SOILS OF THE NORTH APPALACHIAN EXPERIMENTAL WATERSHED

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Agricultural Research Service
and
Soil Conservation Service
UNITED STATES DEPARTMENT OF AGRICULTURE
In cooperation with
Ohio Agricultural Research and Development Center

SOILS OF THE NORTH APPALACHIAN EXPERIMENTAL WATERSHED

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PREFACE

The full value of hydrologic research on experimental watersheds may be realized when the results from measured areas can be interpreted sufficiently to be extended to ungaged watersheds within the problem area. A knowledge of the soils of the experimental area is fundamental to the interpretation and extension processes. This bulletin presents the results of a comprehensive modern soil survey and a description of some of the environmental factors related to soil development in the experimental area.

ACKNOWLEDGMENT

It is a pleasure to acknowledge the contributions of coworkers whose efforts greatly facilitated publication of this soils bulletin. The correlation of these soils into a comprehensive classification system was accomplished through the work of Donald E. McCormack, George M. Schafer, and John D. Rourke, Soil Conservation Service; N. Holowaychuk, Ohio Agricultural Research and Development Center (OARDC); and Richard B. Jones, Division of Lands and Soil, Ohio Department of Natural Resources. Morphological analyses, which were helpful in final correlation, were provided by Dr. Larry P. Wilding, Agronomy Department, OARDC. Dr. Wilding also wrote the clay mineralogy section of this bulletin.

Much of the geologic information resulted from work done by James B. Urban while stationed at Coshocton in the 1960's. Soil samples for this study were collected and prepared for analysis by H. E. Frank and T. E. King. Routine and special physical and chemical analyses were done in the Soil Characterization Laboratory, Agronomy Department, The Ohio State University and OARDC, Columbus, Ohio, under supervision of Dr. George F. Hall and colleagues. Additional chemical characterizations were provided by Dr. D. M. Van Doren, OARDC, Wooster, Ohio.

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SUMMARY

The North Appalachian Experimental Watershed (N.A.E.W.) was established near Coshocton, Ohio, in the late 1930's to study the effect of soils, land management, geology, and climate on waterflow from agricultural land. Watersheds at this site ranging in size from less than 1 acre to nearly 5,000 acres were instrumented for this study.

Climate, vegetation, land management, and geology for the area are described in general terms. The extent of the region of similar characteristics covers hill land of southeastern Ohio, western Pennsylvania, and parts of West Virginia, Kentucky, southern Indiana, and Tennessee.

Soils were mapped soon after the station was established. A modern resurvey of the experimental watersheds was made during 1969–70, and mapping units, according to this survey, were related to those of the survey made 30 years earlier. Each soil series is described, and features are given for each mapping unit. Summaries show the acreage of each mapping unit in each watershed. Location of mapping units appears on a separate map for each single-cover watershed and on the two fold-in maps for mixed-cover watersheds.

Land capability classifications are related to land management and their acreages are summarized for each watershed.

For each soil series estimated engineering properties relating to soil problems involved in the construction and maintenance of roads, airports, pipelines, building foundations, dams, reservoirs, drainage, and waste disposal systems are presented. These are general characteristics estimated according to engineering classification systems in practical use. Listed are some of the important potential uses of these evaluations.

Physical properties of soils that influence their hydrologic performance are presented for sites representative of important soil-cover complexes. These include moisture retention, bulk densities, total porosity, saturated conductivities, and particle size distribution. Supportive chemical data include pH, organic carbon, base saturation, and exchangeable cations.

Soil physical and chemical characteristics for most single-cover watersheds are given to evaluate soil differences from past land management. They also serve to establish "benchmark" data against which the effect of new land management practices on soil conditions can be evaluated. Each site is shown on a single-cover watershed map so that repeat samples can be taken in the future.

This bulletin provides information needed:

1. To analyze past hydrologic data from the research watershed to develop an understanding of watershed flow systems.
2. To provide basic values needed to develop physically based mathematical watershed models for predicting flow at important points in the flow systems,
3. To predict the effect of land management on flow, and
4. To relate the above flow evaluations to the transport of agricultural pollutants and those from disposal of waste on land areas.

Directed to these objectives, this bulletin is also for needs that may appear as greater demands are made for data on water quantity and quality.

INTRODUCTION

This publication presents detailed descriptions of the soils of the North Appalachian Experimental Watershed (N.A.E.W.) near Coshocton, Ohio, (figs. 1 and 2) according to Soil Taxonomy (*35*)[1] the current system of soil classification. The new soil survey and soil descriptions were made in 1969–70 by Glenn E. Kelley, Soil Conservation Service.

Soil survey results in narrative, tabular, and map form are assembled to provide a background for the interpretation of experimental observations and for the analysis and reporting of hydrologic data from the study watersheds. Application of research findings to field problems that have been identified according to earlier soil survey technology will be aided by soil data in this report.

Presented are some of the most important factors that have influenced soil characteristics. Data on climate

[1] Italic numbers in parentheses refer to Literature Cited, p. 66.

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FIGURE 1.—North Appalachian Experimental Watershed, Coshocton, Ohio.

vegetation, land management, and geology provide the reader with an indication of conditions under which soil development occurred. Landscape and soils are related to bedrock in the section on geomorphology. Data on all of these factors and relationships are supplied to help in understanding their roles in watershed hydrology and soil and water management problems. Such understanding must precede practical solutions of the problems.

FIGURE 2.—Location of the North Appalachian Experimental Watershed.

Numerous water problems occur in North Appalachia—problems of excesses, deficiencies, and pollution. Many relate in varying degree to the land and its use. The effect of land use on water quantity and quality is a major research objective of the Coshocton Station.

The research station

The North Appalachian Experimental Watershed was established in the late 1930's by the Research Division, Soil Conservation Service, U.S. Department of Agriculture (USDA), to study the relationship of soil, geology, climate, and land use to waterflow quantity and quality from natural watersheds ranging from 1 acre to over 7 square miles. In January 1954, management of the research station was transferred to Agricultural Research Service, of the then Soil and Water Conservation Research Division.

This experimental watershed station lies at 40° 22′ N and 81° 48′ W, about 10 miles northeast of the city of Coshocton in Coshocton County, Ohio. This site was selected for watershed research because it was typical of 50,000 square miles of land in major land resource areas N-120, N-124, N-125, N-126, and N-127 (2). Over 90 percent of the land in these resource areas lies in western Pennsylvania, southeastern Ohio, and most of West Virginia (fig. 3). In general, the upland valleys are narrow and steep. There is little land flat enough to provide large volumes of

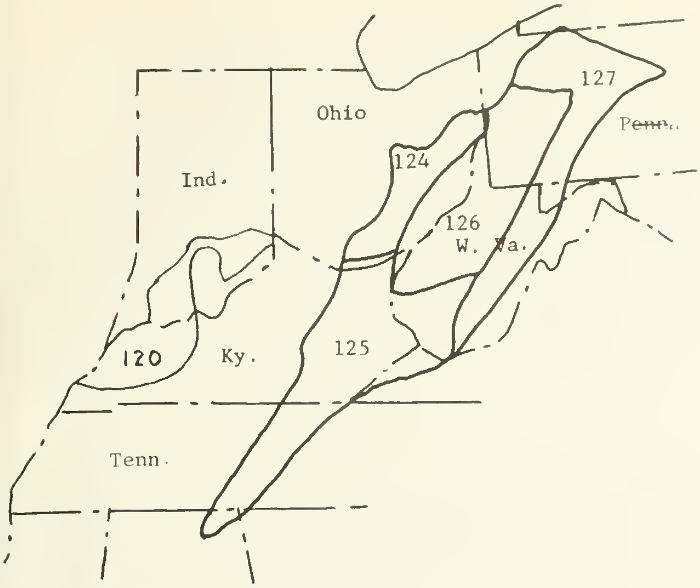

FIGURE 3. Major land resource areas typified by the North Appalachian Experimental Watershed: 120 Kentucky and Indiana sandstone and shale hills and valleys; 124 Western Allegheny Plateau; 125 Cumberland Plateau and Mountains; 126 Central Allegheny Plateau; and 127 Eastern Allegheny Plateau and Mountains. (Map "Land Resource Regions and Major Land Resource areas of the United States" (*2*).)

runoff detention storage. Drainage patterns for surface runoff are well defined.

The watershed research program utilizes 1,047 acres of government-controlled land and 4,500 acres of privately owned land (figs. 4 and 5).

Watersheds that have mainly one cover or crop and that are less than 10 acres are termed "single-cover watersheds." Those of larger size that have more than one cover are termed "mixed-cover watersheds."

Hydrology and soils

Soil characteristics play an important role in the hydrology of agricultural watersheds. An example of the hydrologic role of soils, an updated version of data presented by Dreibelbis and Bender (*9*), is given in figure 6. The two top diagrams of figure 6 are average monthly runoff from two watersheds (109 and 123), treated in like manner in a corn-wheat-meadow-meadow rotation, but each has different soil properties (Rayne and Berks versus Keene soils). Data from 1939 to 1968 were averaged to determine the relationship. The third and fourth diagrams of figure 6 contrast average runoff from two other watersheds (131 and 132) in an uneven-aged stand of hardwoods, likewise having different soil properties (Dekalb versus Coshocton-Rayne soils).

For rotation crops, May through October growing season, runoff totals were not much different—0.79 inch for well-drained soils and 0.69 inch for moderately well drained soils. High evapotranspiration rates in summer made the available storage in the root zone almost equal on both soils. Under summer conditions the infiltration capacities of both soils are about equal. With high-intensity, short-duration summer storms, the similar hydrologic characteristics of the topsoil layers of the two soils result in little difference in runoff amounts.

For the dormant season months, November to April, surface runoff from the moderately well drained area was much higher (1.56 inches) than from the well-drained area (0.42 inch). Water content of the soils often exceeded their holding capacity. During typical low-intensity, long-duration winter storms, the restricted internal drainage of the moderately well drained soil profile resulted in early near-saturation conditions of the topsoil, causing surface runoff. This wet surface condition either did not occur or occurred later on the well-drained area, resulting in significantly less surface runoff.

Although the influence of soil on hydrology is quite striking, soil is only one of several factors that interact to produce a given hydrologic result. Climate obviously is another major determinant. Figure 6 shows that vegetative cover also had a pronounced effect on streamflow. Land use and treatment have been shown to influence water yield and other hydrologic parameters (*14, 24*).

McGuinness and others (*23*) demonstrated the influence of local geology on hydrology. As size of watershed increased, channels incised deeper into the geologic column, intersecting perched water bodies. As watershed size increased from 10 to about 1,000 acres, average annual streamflow increased from 6 to about 12 inches.

The interactions of all the various factors influencing hydrology form a complex pattern. Advances in scientific hydrology in the 1960's introduced flow systems analyses to handle the relevant physical and climatic factors. In constructing mathematical models of watershed flow systems, the model builder simplified interrelationships, not only because of their complexity, but also because of tractability of computation.

England and Onstad (*10*) noted that watershed units of relative homogeneity with respect to soil type, landform, and land use can be identified and related to the hydraulics of overland and subsurface flows. Their concept of *hydrologic response units* that is based on areal and elevational distribution of soils has been incorporated into the USDAHL-70 watershed model (*18*). All current models are characterized by generalizations and simplifying assumptions. As more is learned of how soils and other physical features of natural watersheds affect the water-flow system, notable improvements in simplifying and generalizing will become possible.

The next sections of this report describe some of the factors that would be expected to influence the development and present status of the soils of the research station. Descriptions of the soils are then given, followed by specific information on soil characteristics.

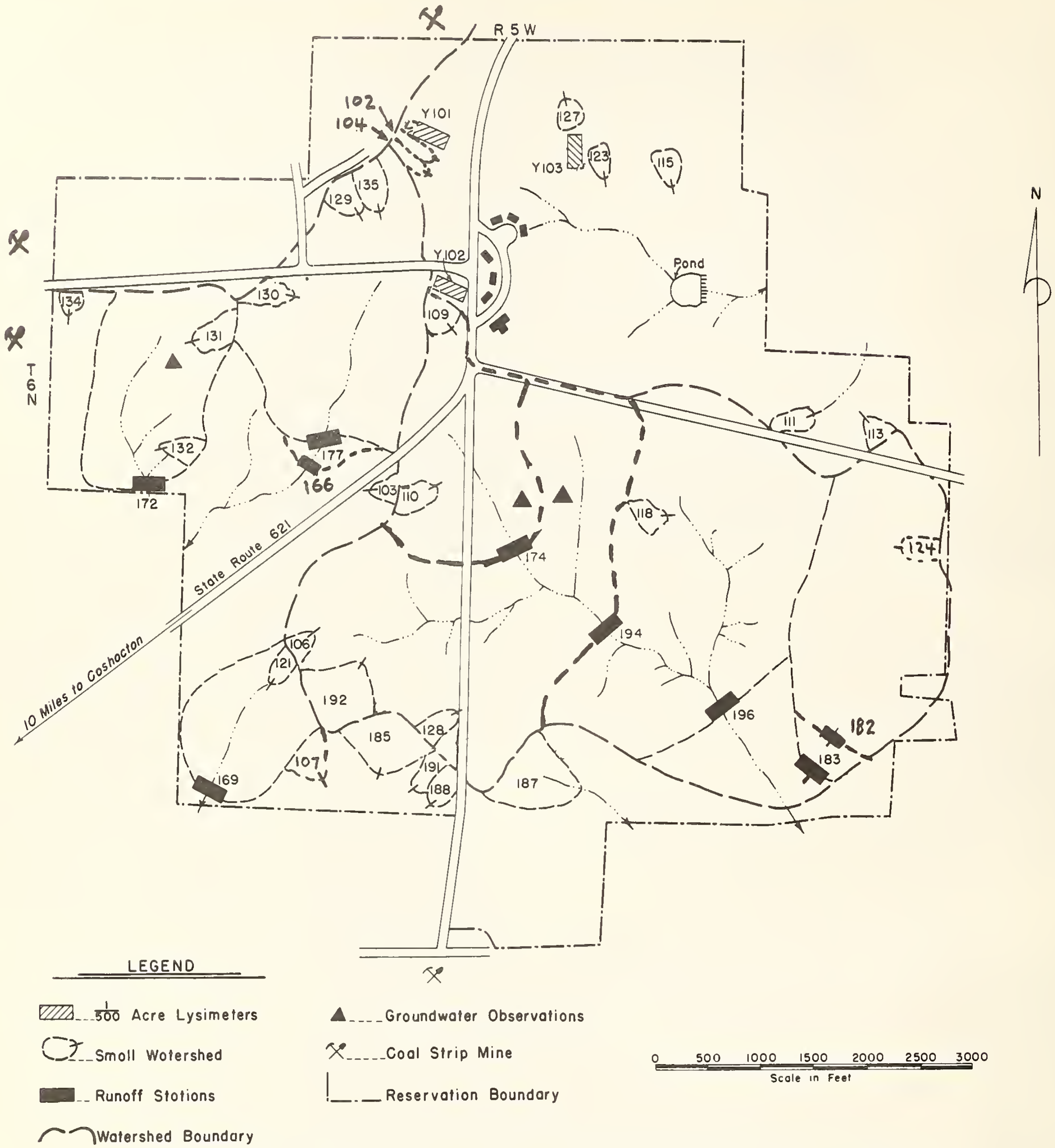

FIGURE 4.—North Appalachian Experimental Watershed, 1,047 acres of government-controlled land.

Climate

The research area is located west of the Appalachian Mountains and is exposed to invasion of cold air from the North and masses of warm, moist air from the South. Precipitation is continental and conforms to the Ohio River Valley pattern. Climate is observed at the central index plot on the station (fig. 7).

Average monthly temperature ranges from 27° F in January to 72° in July (table 1). Average frost-free period is 179 days, April 26 to October 22. Average number of days of frozen soil in winter wheatland is 57 and in meadowland, 43 days. Average depth of maximum annual frost penetration in wheatland (12 inches) and in meadowland (9 inches) is reached in February.

Average monthly precipitation is well distributed throughout the growing season with June and July receiving over 4 inches. Average monthly values from August through February are between 2 and 3 inches, with the October average of 2.16 inches being the lowest. Periods of excess and deficiency occur from year to year. Minimum rainfall for 1 month was 0.17 inch; for a period of 2 months, 0.54 inch; 3 months, 2.18 inches; and 12 months, 27.61 inches. Monthly values have exceeded 10 inches and annual values, 45 inches. Averaging about 19 inches depth a year (2 inches of water), snowfall is not a major source of precipitation in the area.

The greatest amount of rain falling at rates exceeding 1 inch per hour occurs in June and July. Growing-season rainfall is generally of high intensity, short duration, and small areal extent—25 mi^2 or less. Severe, convective summer thunderstorms cause local flooding and account for over 80 percent of the average annual soil erosion as measured on small agricultural watersheds.

Winter-spring precipitation of the cyclonic type is notably of low intensity, long duration (a day or more), and large areal extent (thousands of mi^2). Upstream flooding in this season is usually rare, but downstream floods are common. Soil erosion is minimal in this period.

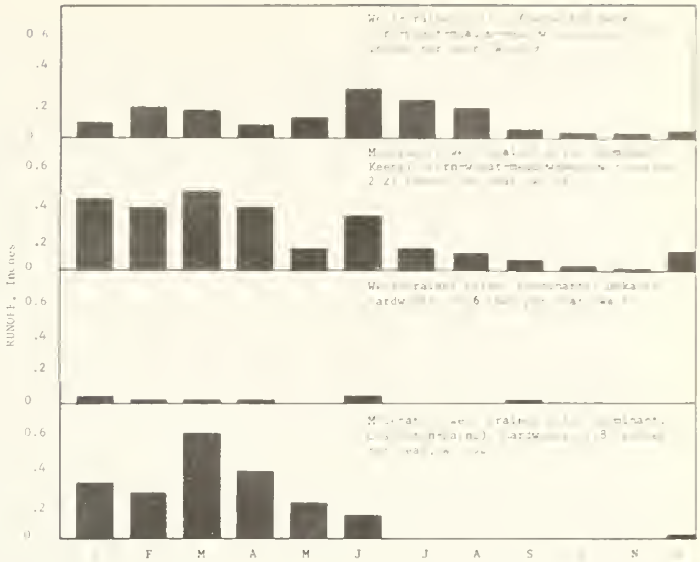

FIGURE 6.—Long-term average effect of soil and cover differences on monthly surface runoff.

Climate must be considered as a prime factor in soil genesis. The soils described in this bulletin reflect the general climatic conditions under which they developed as well as the interactions among climate, soils, geology, and vegetation.

FIGURE 5.—Little Mill Creek watershed.

Vegetation

The North Appalachian Experimental Watershed is located within the Mixed Oak Forests region (*12*) of the unglaciated Allegheny portion of the Appalachian Plateau in east central Ohio. In the 17th century these forests included a variety of primary forest types, of which the most widespread were white oak (*Quercus alba*), black oak (*Q. velutina*), and hickory (*Carya*). The term black oak as used by the early surveyors included not only *Q. velutina* but also red oak (*Q. rubra*) and perhaps scarlet oak (*Q. coccinea*). The term "hickory" included the shagbark (*C. ovata*), bitternut (*C. cordiformis*), pignut (*C. glabra*), and mockernut (*C. tomentosa*) hickories. A white oak-black oak-chestnut (*Castanea dentata*) mixture occurred chiefly on hilltops and extended down south-facing slopes.

Small areas of mixed mesophytic forest probably occurred within the dominantly mixed oak forest where site conditions were more suitable for a greater variety of species. The term "mixed mesophytic" describes a climax association in which no species is dominant. Such areas of undisturbed forest cover in the vicinity of the research area were generally chestnut, various oaks, and yellow poplar (*Liriodendron tulipifera*). Some beech (*Fagus grandifolia*), maple (*Acer*), and hickory were also present. Early descriptions of the area indicated that it was one of

TABLE 1.—*Climatic data averages, North Appalachian Experimental Watershed meteorological station, 1938–70*

Month	Air temperature	Precipitation	Amount of rainfall >1 inch per hour	Days of frozen soil		Maximum depth of frozen soil	
				Wheatland	Meadowland	Wheatland	Meadowland
	°F	*Inches*	*Inches*	*Number*	*Number*	*Inches*	*Inches*
January	27.3	2.83	0.04	22	15	11.0	8
February	29.1	2.36	.05	19	16	12.0	9
March	37.2	3.44	.13	10	5	10.5	5
April	49.0	3.57	.21	------	------	------	------
May	59.4	3.85	.58	------	------	------	------
June	68.5	4.39	1.16	------	------	------	------
July	72.4	4.41	1.27	------	------	------	------
August	71.2	2.93	.72	------	------	------	------
September	64.2	2.59	.38	------	------	------	------
October	53.5	2.16	.14	------	------	------	------
November	40.6	2.41	.05	------	------	------	------
December	30.0	2.22	.02	6	7	9.0	8
Year	50.2	37.16	4.75	57	43	12.0	9

the best developed and most luxuriant of the forest areas in the eastern part of the United States (*4, 22, 39,* and *41*).

Easy access to the region resulted in early exploitation of the original forest by cutting, burning, and clearing for farming. Through the years, intermittent cutting has occurred in the farm woodlots, and no sizable virgin stands remain.

By the late 1930's, less than 25 percent of the research area was in woodland (fig. 8). The rest of the woodlots had been retained for sentimental reasons or because the land was not suited for farming. Practically all the poorly drained bottomlands had a cover of maple, sycamore (*Platanus occidentalis*), elm (*Ulmus*), and several species of

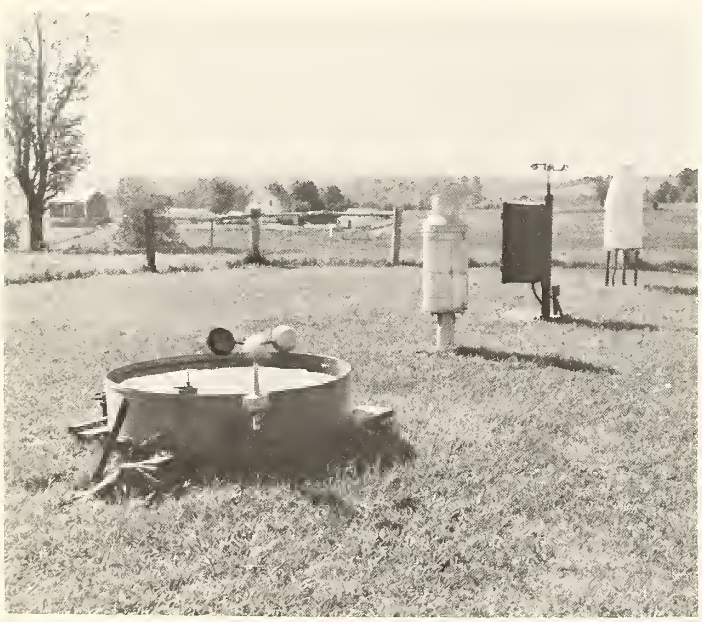

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FIGURE 7.—Evaporation and precipitation gages, central index plot on station.

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FIGURE 8.—Farm woodlot.

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FIGURE 9.—Steep eroded land mostly in poverty oatgrass and broomsedge, 1939.

rushes and grasses. The chestnut-bark disease (chestnut blight) killed most of the chestnuts in the early part of the 20th century. This species has disappeared from the woodlots, and no one tree species has taken its place.

The present woodlot areas have abundant red and white oaks and yellow poplars. Other prominent genera include maples, hickory, beech, ash (*Fraxinus*), and elms. Less numerous, but well distributed, are aspen (*Populus tremuloides* and *P. grandindentata*), butternut (*Juglans cinerea*), blackgum (*Nyssa sylvatica*), redbud (*Cercis canadensis*), sassafras (*Sassafras albidum*), sycamore, staghorn sumac (*Rhus typhina*), and walnut (*Juglans nigra*). Understory growth is generally seedling oaks, yellow poplar, and maples.

Recently abandoned fields are taken over by dogwood (*Cornus florida*), black cherry (*Prunus serotina*), elm and maple seedlings, hophornbeam (*Ostrya virginiana*), hawthorns (*Crataegus*), spicebush (*Lindera benzoin*), and herbaceous plants normally found in the open.

On severely eroded land, poverty oatgrass (*Danthonia spicata*), broomsedge (*Andropogon virginicus*), dewberry (*Rubus flagellaris*), and common cinquefoil (*Potentilla simplex*) are pioneers. Observations show that it normally takes 10 to 15 years or longer for tree species to become established (fig. 9) on severely eroded land even though seed is available from seed trees.

On badly eroded land on the station, too steep to crop or pasture, coniferous trees were planted in 1938–39 (fig. 10). These were mostly red pine (*Pinus resinosa*), white pine (*P. strobus*), and pitch pine (*P. rigida*). Spacing of 6 by 6 feet between seedlings resulted in an early closing of the tree canopy and quick establishment of a protective cover of pine needles on the ground surface. Soil erosion was practically stopped by 1945. The 1958 appearance is shown in figure 11.

In some of the pine-plantation areas, particularly on the north-facing slopes, hardwoods have seeded naturally, overtopping and killing the pines. Yellow poplar appeared most prominent. In other areas, mainly on the south and west slopes, there has been little or no deciduous tree incursion into the pines. Close spacing of pines resulted in stagnation of tree growth by 1950.

Black locust (*Robinia pseudo-acadia*) was also planted on some of the severely eroded lands. These trees grew to fence-post size in 10 years, rapidly covering the surface with a nitrogen-rich leaf litter that halted erosion. Rotation cutting for fence posts was feasible in these plantations because sprout growth after cutting was excellent.

Permanent pasture areas, unless improved by applying lime and superphosphate, have degraded in most areas to drought-tolerant grass species commonly found on low-fertility, acid soils. Two plants, poverty oatgrass and broomsedge, normally characterize these areas. Canada bluegrass (*Poa compressa*) is quite common on pastures that have been occasionally treated with lime and superphosphate.

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FIGURE 10.—Pine trees planted on steep eroded land in 1938–39; view in 1942.

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FIGURE 11.—Pine tree plantation in 1958.

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FIGURE 12.—Land use distribution typified by North Appalachian Experimental Watershed.

At the upper and seemingly highest fertility level that can be maintained economically, Kentucky bluegrass (*Poa pratensis*) is found. This plant normally follows depleted alfalfa (*Medicago sativa*) meadows, but it is also found in old orchards and on alluvial sites which are moderately well drained. This cover predominates on less than 10 percent of the pastured areas.

The forest soils of the entire region indicate that the area was wooded for a long period during prehistoric times.

Land management

Land management in this section covers, in general, the farming practices from the 1930's to 1970. It is discussed in relation to classification units on pages 36 to 43. For each single-crop watershed for its period of study, land management is given in appendix A.

Agriculture of the area represented by the research station (fig. 12) is confined mostly to livestock enterprises—beef, dairy, sheep, and hogs. Grassland, comprising 55 percent of the area, is used for pasture and for hay harvest for on-farm winter feed. Cropland, 15 percent of the area, produces corn, wheat, and oats, most of which is fed to on-farm livestock. Farm woodland covering 26 percent of the area is managed primarily to provide soil stabilization. Some trees are harvested for lumber and pulp. The rest of the area is in miscellaneous use.

In 1938, rotation cropland comprised about 45 percent of the land; pasture, 30 percent; and woodland, 25 percent. About 80 percent of the land had lost from 25 to 75 percent of its topsoil. Rectangular fields were plowed and planted with corn, wheat, or oats without regard for slope or contour. Corn rows were straight and of considerable slope. Fertilizer rates were low. Much of the manure nutrient value was leached from uncovered piles and was lost to streamflow before being applied to cropland. Crop yield trends beginning in the 1940's were striking (table 2). Increases in crop yields were due to applying higher rates of fertilizer and lime, improving methods of utilizing manure that reduced leaching of nutrients, using better varieties of seed, applying insecticides and herbicides, and adapting soil conservation farming practices.

From the early to mid-1940's, conservation farming replaced straight, sloping rows (fig. 13) with contour stripcropping (fig. 14); pastures were improved; and fertilizer was used at higher rates. Before effective conservation

TABLE 2.—*Corn yields, 10-year average, Coshocton County, 1871–1970, and Research Station, 1941–70*

Period	Coshocton County[1]	Research station practices	
		Prevailing[2]	Improved
	Bushels	*Bushels*	*Bushels*
1871–80	36		
1881–90	37		
1891–1900	34		
1901–10	36		
1911–20	37		
1921–30	35		
1931–40	40		
1941–50	51	44	72
1951–60	57	65	9[illegible]
1961–70	86	87	122

[1] Supplied by Cooperative Extension Service, College of Agriculture and Home Economics, The Ohio State University.

[2] See table 3 for definition of practices.

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FIGURE 13.—Poor land use (1936–47)—straight corn rows and untreated pastures.

measures were applied, land slopes in row crops were generally subject to accelerated erosion.

Farming practices on the station for the initial study period through 1970 were divided into two treatment classes

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FIGURE 14.—Conservation farming—contour strips of corn and meadow (midright) and wheat and meadow (foreground).

TABLE 3.—*Features of prevailing and improved farming practices, 1941–70*

Item	Prevailing practice		Improved practice	
	Treatment per acre	Yield level per acre[1]	Treatment per acre	Yield level per acre[1]
Lime to pH of	5.4		6.8	
Crops, rotation:				
Corn:		93 bushels		121 bushels
Manure	4 tons plowed down.		6 tons plowed down.	
Rows	Straight, across slope, sloping.		Contour	
Fertilizer	50 pounds, 5-20-20		180 pounds, 5-20-20	
Wheat:		22.8 bushels		33.5 bushels
Rows	Straight, across slope, sloping.		Contour	
Fertilizer	100 pounds, 5-20-20		180 pounds, 5-20-20	
Manure	None		6 tons top dressed.	
Meadow-1:		2.3 tons		3.4 tons
Fertilizer	None		200 pounds, 0-20-20	
Meadow-2		1.9 tons		3.3 tons
Crops, permanent:				
Meadow	Low fertility	1.5 tons	High fertility	2.5 tons
Pasture[2]	Low fertility		High fertility	
Woodland	Pastured		Not pastured	

[1] Averages for 1966–70.
[2] Controlled grazing by beef and dairy cattle.

(table 3). Prevailing practices included a moderate level of farming management with harvests being about equal to county average (table 2). Improved practice was comparable to that used by the advanced farmer under recommended soil- and water-conservation treatment. Prevailing farming was practiced on watershed land scheduled to remain basically unchanged over the initial period of study. Prevailing practice watersheds served as a base from which to evaluate the effect on hydrology of improved farming and treatment practices on other watersheds.

Preparation of the soil for corn planting was accomplished by plowing, two diskings, and one drag harrowing. Fertilizer was banded beside the seed row in the planting operation. Weed control was accomplished by two or three mechanical cultivations. Since 1960, herbicides have been applied to control weed growth, with an occasional cultivation to breakup soil crusts. Before 1948, the cornstalks were cut and shocked in early October (fig. 13), followed by disking the soil and seeding wheat. Corn was husked and fodder was used in the barn for cattle bedding. Beginning in 1948, corn was harvested in early October with a mechanical picker. Since then, the corn stover has been chopped and left on the soil surface.

Before drilling wheat seed (within 2 weeks following corn harvest), the surface was disked slightly. Fertilizer was applied and timothy seeded along with the wheat in early October. During the winter, the improved-practice wheatland was topdressed with manure. In March, red clover, alfalfa, and more timothy seed were broadcast on the improved-practice watersheds, and timothy, red clover, and alsike clover were seeded on the prevailing-practice areas. After wheat harvest in early July, these meadow seedings provided a vegetative cover. Clipping the new meadow late in July discouraged weed growth.

The following year, hay was harvested in late June and again in early August. After the first harvest, fertilizer was broadcast on the improved-practice watersheds only. Second-year hay harvests were also made in June and August. Lime was broadcast on the second-year meadow to raise the pH to the specified level (table 3). This completed the 4-year crop rotation practices (fig. 14).

Permanent meadow and pasture watersheds were treated to maintain the approximate fertility level of their comparable prevailing- and improved-practice cropped watersheds. Reseedings were made as needed: shallow-rooted plants for the prevailing and deep-rooted ones for the improved watersheds. Hay was harvested on meadow areas twice a year. Controlled grazing was practiced on pastures of both levels of treatment. Overgrazing was not permitted.

Agricultural operations were planned and carried out in a manner typical of general farming practices in the North Appalachian Region. Land use distribution of farmland in the region was illustrated by the Conservation Needs Inventory of 1967 by the Soil Conservation Service and cooperating agencies (*36*). For Coshocton County, land use was 27 percent in crops, 23 percent in pasture, and 45 percent in forest. The major conservation needs on cropland was for increased contour strips, terraces, and diversions on 31 percent of all acres in tillage rotation. Conservation treatment on 46 percent was reported as adequate. On pasture land, 38 percent needed improvement, and 34 percent required brush control and reestablishment in addition to improvement.

Most of the details described in this section of the report are the "current events" chapter in the soils' history. The basic character of the soils was determined during the centuries of forest cover before clearing and cultivation. Then came land management that could affect the soils through erosion control and fertility treatments. Despite 30 years of differential management, measurable differences in physical characteristics of watershed soils because of management treatments were slight and confined to the topsoil layer (*11*). Chemical effects of management were more significant.

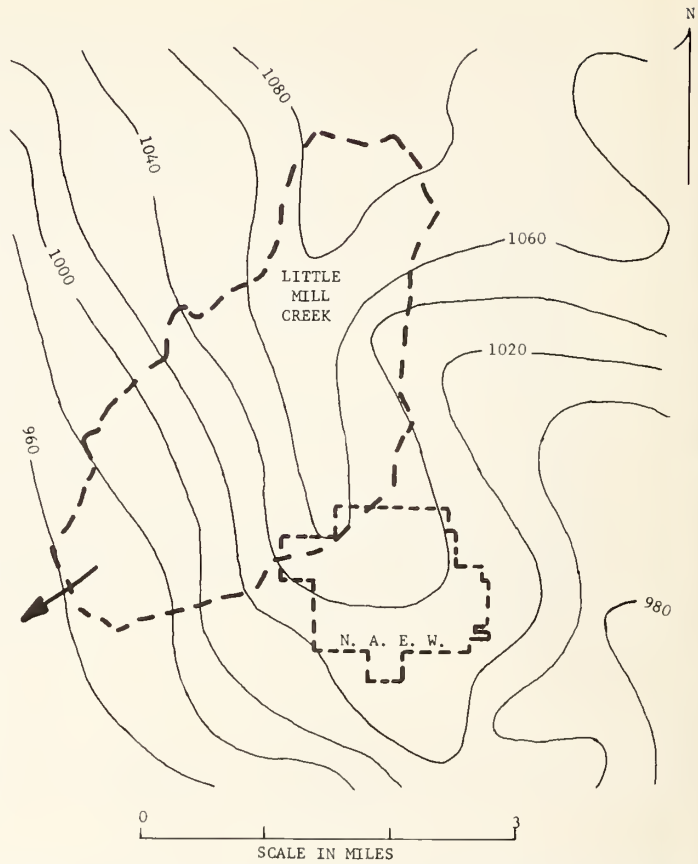

FIGURE 16.—Geologic structure at the North Appalachian Experimental Watershed. Contours show elevation of the base of the Putman Hill limestone. Modified from Lamborn (21).

Geology

Geology of the study area has had a major influence on general topography and soil development. There was no direct effect from glaciation because the ice stopped a few miles north and west of the research station. Although the drainage system was not appreciably modified by glaciation, the major river valleys in the region were filled with outwash material. Drainage was blocked by ice, causing lakes to fill the river valley areas. Silts and clays settled from these lake waters. Present drainage is toward the south and west.

PN-3980

FIGURE 15.—Rock strata, fractured.

Bedrocks that outcrop at the surface are generally sandstone or shale with occasional strata of coal, clay, and limestone. All rocks are of sedimentary origin, deposited as nearly horizontal layers (fig. 15) during late Paleozoic time. By Cretaceous time, consolidation had occurred, and an erosion surface was formed. After uplift raised this surface to form the Allegheny Plateau, rejuvenated streams cut the surface into hills and valleys through the Tertiary Period (*21*).

Bedrock in the area has a general dip to the southeast at an angle of less than 1°. The regional dip is modified by many small synclines and anticlines, many with an amplitude of only 20 to 80 feet and a width of 1,000 to 3,000 feet. The general trends of these undulating structures can be seen in the surface topography.

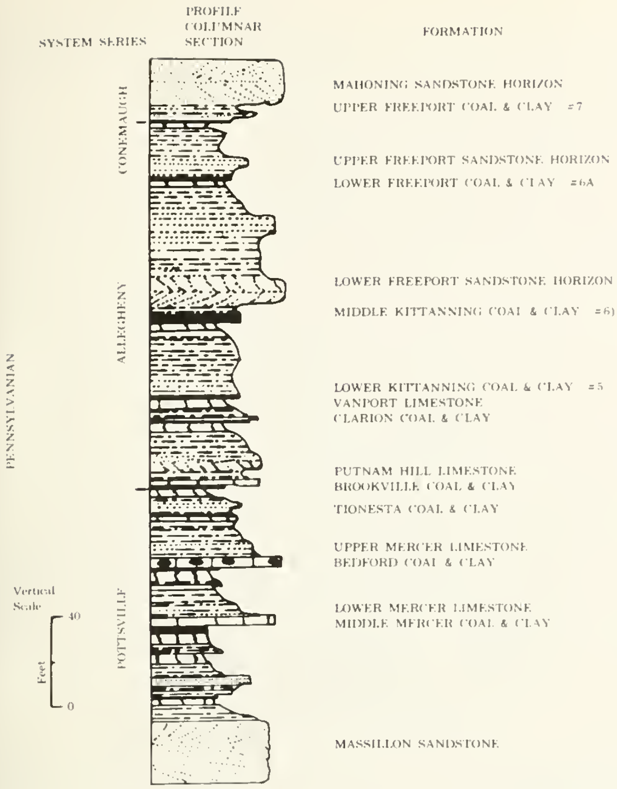

FIGURE 17. – Representative geologic section at the North Appalachian Experimental Watershed.

The most prominent feature of the local geologic structure is the Cambridge arch. This anticline runs generally north and south with the crest sloping gently to the south (fig. 16). The contours show elevation of the base of the Putnam Hill limestone. (Modified from Lamborn *(21)*.)

A representative section of the stratigraphic units underlying the land surface of the N.A.E.W. is given in figure 17.

All layers outcropping in the study area are members of the Pennsylvania System. The Pottsville Series contains more shale and less sandstone and coal than the overlying Allegheny Series. Two of the most important bedrock aquifers are contained in this Series, the Upper Mercer and Lower Mercer limestones. These are underlain by thin coal seams and underclays. Much of the overlying and underlying material is shaly. The lowest member of the Pottsville Series that outcrops in the study area is the massive Massillon sandstone. The bottom reaches of Little Mill Creek are incised in this unit (fig. 18). The average thickness of the Pottsville Series above the Massillon is about 130 feet.

The Allegheny Series consists primarily of sandstone and sandy shale. The coals in this series are important economically and are being actively mined by surface stripping methods in much of Coshocton County. The Vanport and Putnam Hill limestones are both underlain

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FIGURE 18. – Massive Massillon sandstone

by coal and clay. The clay beds support water tables which, especially for the Putnam Hill, are widespread and hydrologically important because they outcrop and contribute significantly to streamflow. The average thickness of the Allegheny Series is about 160 feet.

Remnants of the Conemaugh Series are found on a few ridges and hilltops.

The lateral continuity of many of the formations varies widely over the region and on the experimental watersheds. The rock strata vary mineralogically and chemically.

The position of relatively impermeable clay strata is one of the keys to understanding the subsurface water system. These clay layers are usually found underlying coals and limestones (fig. 17), and they are impermeable enough to support subsurface water bodies in the open fractures of the overlying rock. Although there is little volume of water storage in the aquifers of the Pennsylvania System in the area (*32*), bedrock stratigraphy exerts a strong influence on water yield.

Potter and Baker (*27*) theorized that each underclay supported a perched watertable either wholly or partially separated from each other. Discharge from these water bodies to the surface was through springs, seeps, or as percolation down through the soil mantle to the layer below. The cascading of subsurface waters from one layer to the next tended to build ground-water mounds near the outcrops as illustrated in a sand model (fig. 19). Lateral flow from the mounds would occur in two directions, outward toward the outcrop and back under the hill along the aquifer. Efforts to quantify the relationships numerically with the scanty data then available were not successful.

Urban (*37*) found numerous open rock fractures and joints in the geologic column except in the underclays. The fracture systems were most extensive and interconnected near the outcrop. Further back beneath the hill, fractures were sparse and not connected (fig. 20). The rock strata have little potential for water storage because the porosity of the unfractured stone is quite low. Storage and movement of subsurface water are associated mostly with the

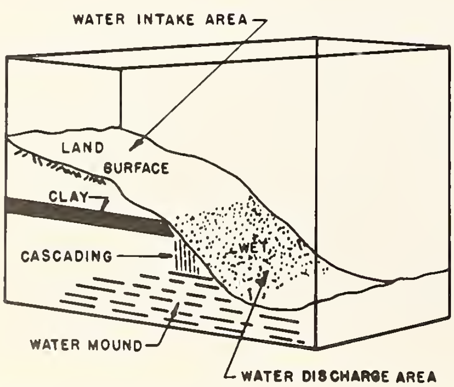

FIGURE 19.—Sand model of cascading ground water.

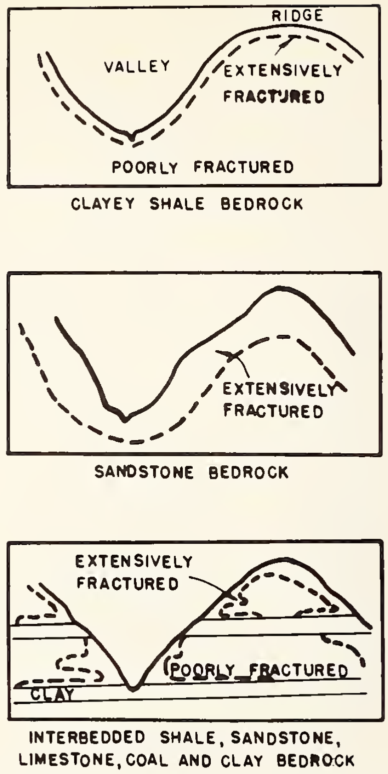

FIGURE 20.—Simplified schematic of zones of extensive open joints (fractures).

limestones, coals, and sandstones that overlie the impermeable clay layers. The active water-storage zone may be described as a shell-like zone of rock fractures of varying depth below ground surface with most storage near the outcrops. The less active ground-water zone lies in the poorly connected rock fractures deep beneath the hills (*37*).

In the late 1930's, 35 ground-water wells were dug on the experimental watersheds and were equipped with automatic water-level recorders. All these were located in the active water-storage zone—not deep beneath the hills. Potter and Baker (*28*) published a series of logs and some water-level data for these wells. In the 1960's, J. B. Urban, station geologist, drilled other wells in both the active and inactive water zones. Logs and water-level records for these wells are on file at the station.

Clay outcrops have also been identified as the mechanism responsible for earth flow (*31, 25*). The clay beds do not extend horizontally to intersect the hill surface, but they thin out and bend downslope as they approach the land surface. Under prolonged wetting, the overlying material may not be able to maintain its shape and position, and soil creep or slumping results.

The quality of water in the Putnam Hill, Upper Mercer, and Lower Mercer aquifers was the subject of an extensive investigation by Caswell (*7*). He found that water in these three aquifers had approximately the same range of chemical characteristics and that they could not be differentiated on the basis of ordinary water-quality tests.

The knowledge now available of geology and subsurface water movement at the N.A.E.W. is extensive. Despite the presence of numerous undulations that change the regional pattern locally, estimates of the probable strength and direction of ground-water movement should now be possible over much of the study area. The real test of this statement will come when refinements are attempted in the subsurface flow components of the watershed mathematical model (*18*).

Surface mining of coal in the ridgetop areas around part of the boundary of Little Mill Creek watershed has drastically changed the land surface (fig. 21). The residual soil has been replaced with a mixture of rock, subsoil, and topsoil, and the area has been mapped as such. Yet to be determined is the effect of this strip-mining operation on the hydrology of watersheds.

PN-3982

FIGURE 21.—Land disturbed by surface mining of coal.

The underlying geologic strata have a pronounced effect on the soils that develop in the mantle over the bedrock. In this area the mantle varies from 0 to about 12 feet and averages about 5 feet in thickness. The relation between the soils, the geology, and the topography of the area is the subject of the next section.

GEOMORPHOLOGY

The soil-bedrock-landscape relationships are complex and a general knowledge of these interactions is important in understanding and using this survey. The most significant factors considered in explaining the variety of soil properties are (1) type, composition, and hardness of bedrock; (2) amount and kind of deposition by wind, water, and gravity; (3) steepness and shape of the landscape and position on the landscape; and (4) the possibility of climatic and drainage changes because of the nearness of the glacier during Pleistocene time. These factors and their interactions are all important in influencing the formation of the soil. With these factors, some general relationships are made in this section.

These relationships as they occur in a typical valley cross section of the Little Mill Creek watershed are shown on figure 22.

The type of bedrock probably exerts the strongest single influence on the shape and slope of the land and on the soil properties in this survey area. Bedrock is characterized by many thin interbedded layers of shale, sandstone, limestone, coal, and clay that are sandwiched between two prominent sandstone beds. The upper sandstone bed (Lower Freeport, elevation 1,200 1,250 feet) caps the highest ridges, whereas the lower bed (Massillon, elevation 800 850 feet) embraces the steep lower slopes and underlies the valley floor (fig. 23).

The resistance to weathering of these two prominent sandstone beds is greater than that of the other bedrock layers, and it is reflected in the shape of the landscape. The landscape associated with the remnants of the Lower Freeport sandstone consists of steep slopes, rounded knobs, and short ridges that occur at the highest elevations; while the Massillon sandstone areas are depicted by escarpmentlike slopes along the valley floor. These landscape segments are bedrock controlled, convex, and mostly mapped as the loamy and channery, moderately deep Dekalb soils. However, the soils on the Massillon sandstone areas, lower slopes, are influenced by an influx of silty colluvial materials. This deposition masks part of the Dekalb soils on this position, forming a mapping complex consisting of the more silty and deeper Rayne soils and the Dekalb soils. Note the distribution of Dekalb and Rayne-Dekalb complex soils in figure 24. Present land use of these sandstone-controlled areas is dominantly wood-

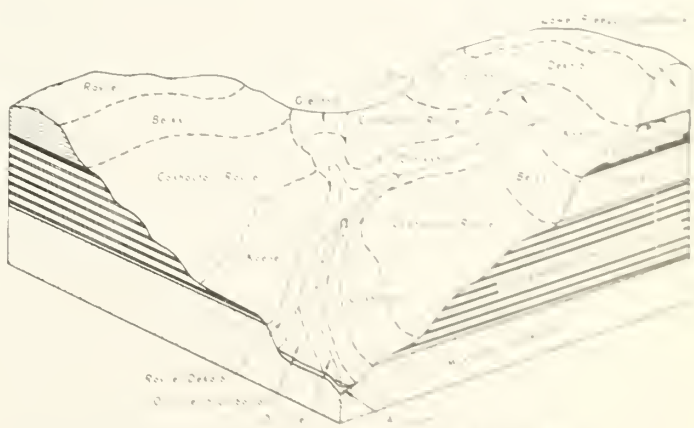

FIGURE 22.—Soil-bedrock-landscape relationships.

Figure 23.—Field view of soil-bedrock-landscape relationships: a. Dekalb soils on sandstone capped ridge; b. Coshocton and Rayne soils on slopes; c. Rayne-Dekalb soils on wooded escarpment of Massillon sandstone; and d. Chagrin soils on the flood plain.

land with some smaller areas used for pasture, meadow, orchards, and cultivated crops.

The landscape between these prominent sandstone beds consists of smoother topography, more gentle slopes, and rounded ridgetops. This unit is extensive in the survey area and comprises most of the tillable land on the hill slopes. This landscape segment is at midslope position, has an overall concave shape, and is supported by thin beds of shale, sandstone, limestone, coal, and clays. Coshocton and Rayne soils dominate these slopes. These soils have bedrock at 4 to 6 feet depth and are medium textured in the upper part. Coshocton is slightly wetter and has a finer textured subsoil than Rayne. The two soils occur in an intricate, and often, banded pattern. They are usually not separated on the soil maps and are classified as Coshocton-Rayne silt loams. Each soil occupies approximately the same proportion of these landscape units.

The microrelief of these units is typically uneven with Coshocton occupying the concave and intermittent bench positions normally underlain by the softer clay shales and coal underclays. Rayne soils occupy the more convex areas underlain by resistant shales, siltstones, and sandstones. The moderately well drained Coshocton soils are the recipient of subsurface seepage waters during the wet seasons. Seepage spots commonly occur in or at the heads of drainageways that cross these landscape units. Wet-season seepage increases winter and spring runoff as shown in figure 6.

Ridgetops and benches that occur within this landscape unit are dominated by Keene, Rayne, and Coshocton soils. They are mostly deep to bedrock, but soft shales may occur between depths from 24 to 40 inches.

Occurring relatively high on the landscape at elevations just below the Lower Freeport sandstone is a bed of silty, and often loamy, shale. The thickness and exposure of this bed are variable. It is most pronounced on ridge or upper slope positions. The landscape is rather sharp and convex. The Berks soils, which are high in shale content and moderately deep to bedrock, occur on these landscape units. The spacial distribution is shown on figure 24.

Silts that are presumed windblown have been deposited in this area. These deposits are most evident on the ridges, benches, and coves. Silt thickness reaches nearly 2 feet on the ridgetops and benches and up to 4 feet in depressional and cove areas. The silts on the benches, showing some stratification, were likely moved by water as well as by wind. The Glenford soils occur on the deeper silt positions. The upper horizons of the Keene and Rayne soils were formed in these silts, as were the A horizons of Coshocton soils in some places.

Deep soils formed in colluvial deposits occur in the coves and benches near the heads of waterways. These deposits are at elevations above the steep Massillon sandstone areas and are from 6 to 10 feet or more in thick-

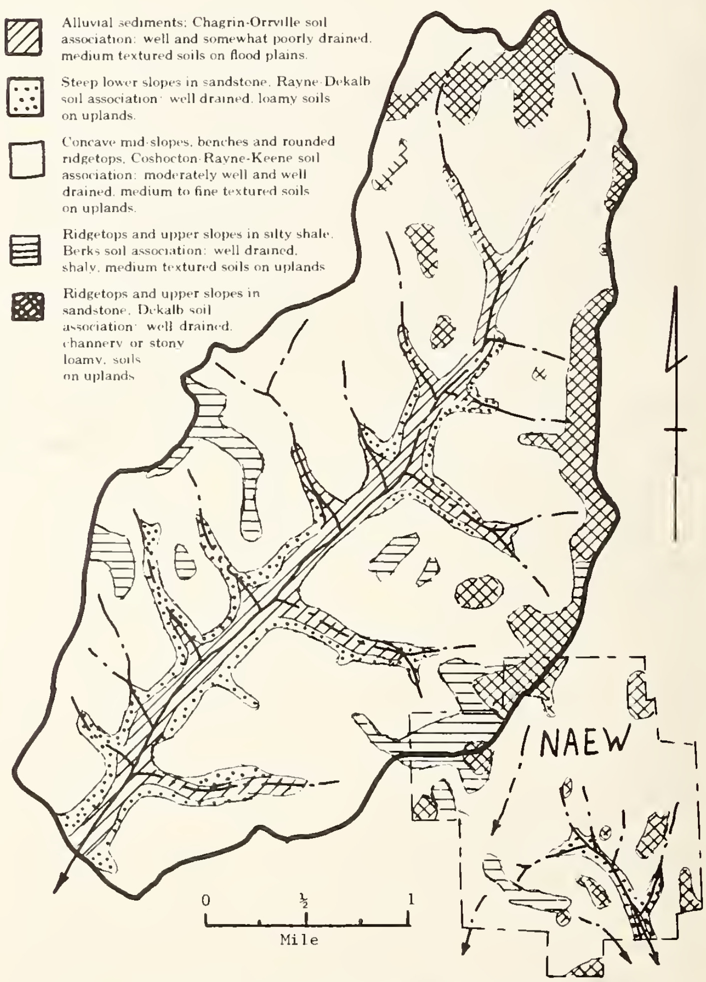

Figure 24.—General landscape and soil distribution map.

ness. Three kinds of soils are mapped on these deposits—Glenford on the deep silty areas, Clarksburg on the channery silt loam areas, and stony colluvial land on the stony areas. These colluvial areas are not generally cultivated but are used extensively for pasture and woodland. They offer deep moist rooting zones for plants. Most units are small and subdivided by deep drainageways.

The final landscape position is the valley floor or flood plain shown in figure 24. Chagrin and Orrville soils occur in the alluvial sediments on these positions. High bottom phases of these soils occur on slightly elevated parts of the flood plain and are subject to less frequent flooding. Most areas are in cropland or pasture.

SOILS

Discussion of the soil survey of the N.A.E.W. is presented in the following sections:

- Soil survey and classification
- Soil descriptions
- Soil acreage
- Soil at lysimeter sites
- Soil use and management
- Soil characterization data

Soil survey and classification

A detailed soil survey was made by Glenn E. Kelley, soil scientist, Soil Conservation Service, Coshocton, Ohio, 1969–70. Assistance in classification and correlation was received from soil scientists and soil specialists from the Ohio Agricultural Research and Development Center, the Ohio Department of Natural Resources, Division of Lands and Soil, and the Soil Conservation Service. Laboratory analyses of the soils were made by the Soil Characterization Laboratory, Department of Agronomy, OARDC.

A previous soil survey was made in the late 1930's. New techniques and criteria were used in the current soil survey (*33, 34, 35*); these provide more detailed and comprehensive information on the soils than the old survey. A general correlation exists between the soil names of the early survey and those in the recent survey (table 4). For example, the current Berks, Dekalb, and Rayne Series were all included in the Muskingum soil series of the survey made in the 1930's.

Boundaries of the individual soils determined in this survey were drawn on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details to help orient the user. Contour lines on 50-foot intervals have been added to the soil maps (fig. 25).

Categories of classification used in this survey are the soil series and the soil phase. Soils that have profiles almost alike make up a soil series. All the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Coshocton and Keene, for example, derived their names from towns in Coshocton County. All the soils in the United States with the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Each soil series is described to indicate its genesis, morphology, geomorphic position, relation to geologic strata, and general location on the experimental watersheds. Also presented are textural characteristics, available moisture capacity, permeability, reaction, and dominant use.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and is in terms familiar to the layman. The second is much more detailed for those who need more thorough and precise information about the soils. Soil color terms are for moist soil unless otherwise stated.

Phases of soil series were used in this survey to distinguish those bottomland soils that occur on slightly elevated positions and that are subject to less frequent flood-

TABLE 4.—*Series, classification, and relation to 1930's soil survey names*

Series[1]	Classification	Old name
Berks	Typic Dystrochrepts; loamy-skeletal, mixed, mesic.	Muskingum.
Chagrin	Dystric Fluventic Eutrochrepts; fine-loamy, mixed, mesic.	Pope and Philo.
Clarksburg	Typic Fragiudalfs; fine-loamy, mixed, mesic.	Muskingum, Coshocton, and Colluvial soils.
Coshocton	Aquultic Hapludalfs; fine-loamy, mixed, mesic.	Coshocton.
Dekalb	Typic Dystrochrepts; loamy-skeletal, mixed, mesic.	Muskingum.
Glenford	Aquic Hapludalfs, fine-silty, mixed, mesic.	Muskingum, Coshocton, and Colluvial soils.
Keene	Aquic Hapludalfs, fine-silty, mixed, mesic.	Keene
Orrville	Aeric Fluvaquents, fine-loamy, mixed, nonacid, mesic.	Atkins and Philo.
Rayne	Typic Hapludults; fine-loamy, mixed, mesic.	Muskingum.

[1] Land types are not included, but areas of stony colluvial land were originally named Muskingum, Coshocton, and Colluvial soils. All strip mining has been done since the original mapping and classification.

ing. These soils were classified as high bottom phases of the Chagrin and Orrville Series.

Each area shown on a soil map is called a mapping unit. It is a kind of soil, a combination of kinds of soil, or a land type that can be shown at the scale of mapping used. This is important for the defined purposes and objectives of the survey. Mapping units are generally designed to reflect significant differences in use and management.

Some mapping units are made up of soils of different series. These are referred to as soil complexes. A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a soil complex contains small areas of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Coshocton-Rayne and Rayne-Dekalb are the two soil complexes mapped in this survey.

Places in the area were surveyed where the soil material is very stony or has been disturbed during coal strip mining operations. These areas were not classified by soil series. They are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names, for example, stony colluvial land, Dekalb soil materials, rolling.

Series and mapping units are described in the following section. Following the name of each mapping unit is such a symbol in parentheses as BrC2. This symbol identifies the mapping unit on the detailed soil map (fig. 25). Listed at the end of each mapping unit description is the capability unit in which the mapping unit has been placed.

Unless it is specifically noted otherwise, the description of the soil series shows the dominant soil in the mapping units of that series. To get full information about any mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series mentioned in the name of the mapping unit.

Soil descriptions

Berks Series

The Berks Series consists of well-drained shaly silt loam soils formed in residuum weathered from silty shale and siltstone bedrock. These soils are on ridgetops and upper slope positions. They occur chiefly near the middle of the Little Mill Creek watershed, and some are found on the western half of the government-controlled land. They have formed in the shale which occurs at elevations just below the Lower Freeport sandstone.

A representative Berks soil in a pasture field has a dark-brown, shaly silt loam plow layer 5 inches thick. Below the plow layer, to a depth of 24 inches, is a yellowish-brown shaly and very shaly silt loam and loam subsoil. Silty shale and siltstone bedrock occur below a depth of 24 inches.

Berks soils have a moderately deep root zone but a low available moisture capacity. Permeability is moderately rapid, and runoff is medium to rapid. Shale fragments throughout the soil are mostly less than 3 inches in diameter. When exposed on the surface, they create a shingling effect and reduce erosion.

Most areas of this soil are being pastured or cropped. Some areas are in woodland or are idle.

The following is a representative profile of Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded, in a pasture on the N.A.E.W., White Eyes Township, NE¼NE¼NW¼ sec. 5:

Horizon	*Description*
Ap	0 to 5 inches, dark-brown (10YR 4/3) shaly silt loam; dark yellowish brown (10YR 4/4) crushed and pale brown (10YR 6/3) dry; weak fine granular structure; friable; many roots; 15 percent shale fragments; neutral; abrupt smooth boundary.
B21	5 to 13 inches, yellowish-brown (10YR 5/6) shaly silt loam; weak medium subangular blocky structure; friable; many roots; 25 percent shale fragments; medium acid; clear smooth boundary.
B22	13 to 19 inches, yellowish-brown (10YR 5/6) shaly loam; weak medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films on the tops of some shale fragments; 50 percent shale and siltstone fragments; very strongly acid; gradual smooth boundary.
B3	19 to 24 inches, yellowish-brown (10YR 5/6) very shaly loam; weak medium subangular blocky structure; friable; few roots; thin very patchy brown (7.5YR 5/4) clay films on the tops of some shale and siltstone fragments; 55 percent shale and siltstone fragments; very strongly acid; gradual smooth boundary.
R	24 inches +, silty shale and siltstone with some fines and occasional clay films extending down cracks.

Solum thickness ranges from 20 to 36 inches. Depth to bedrock ranges from 20 to 40 inches. Shale and siltstone fragments range from 10 to 30 percent in the Ap horizon, from 25 to 60 percent in the B horizon, and from 60 to 80 percent in the C horizon if present. When unlimed, soil reaction is strongly or very strongly acid throughout the solum. The Ap horizon ranges from dark brown (10YR 3/3) to brown (10YR 5/3). The B horizon ranges from yellowish brown (10YR 5/4) to strong brown (7.5YR 5/6). Textures are shaly or very shaly, channery or very channery silt loam or loam. The C horizon, if present, has colors much like the B horizon. Textures are very shaly or very channery loam or silt loam. Bedrock is silty shale or thinly layered siltstone of moderate hardness.

Berks soils are on landscape positions common to Dekalb, Rayne, Coshocton, and Keene soils. Berks soils contain more shale fragments, and they are shallower to bedrock than Rayne, Coshocton, and Keene soils. They also lack the mottled gray clay subsoils common to Coshocton and Keene. Berks soils are more silty and lack the sandstone fragments typical in Dekalb.

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter B, C, D, E, F, or G, shows the slope. Symbols without a slope letter are those of nearly level soils. A final number 2 or 3 in the symbol shows that the soil is moderately eroded or severely eroded.

SYMBOL	NAME
BrC2	Berks shaly silt loam, 6 to 12 percent slopes, moderately eroded
BrD2	Berks shaly silt loam, 12 to 18 percent slopes, moderately eroded
BrE2	Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded
BrE3	Berks shaly silt loam, 18 to 25 percent slopes, severely eroded
BrF2	Berks shaly silt loam, 25 to 35 percent slopes, moderately eroded
Ch	Chagrin silt loam
Ck	Chagrin silt loam, high bottom
ClC	Clarksburg silt loam, 6 to 12 percent slopes
ClD	Clarksburg silt loam, 12 to 18 percent slopes
CoB2	Coshocton silt loam, 2 to 6 percent slopes, moderately eroded
CoC2	Coshocton silt loam, 6 to 12 percent slopes, moderately eroded
CoD2	Coshocton silt loam, 12 to 18 percent slopes, moderately eroded
CrC2	Coshocton-Rayne silt loams, 6 to 12 percent slopes, moderately eroded
CrC3	Coshocton-Rayne silt loams, 6 to 12 percent slopes, severely eroded
CrD2	Coshocton-Rayne silt loams, 12 to 18 percent slopes, moderately eroded
CrD3	Coshocton-Rayne silt loams, 12 to 18 percent slopes, severely eroded
CrE2	Coshocton-Rayne silt loams, 18 to 25 percent slopes, moderately eroded
DkC2	Dekalb channery sandy loam, 6 to 12 percent slopes, moderately eroded
DkD2	Dekalb channery sandy loam, 12 to 18 percent slopes, moderately eroded
DkE2	Dekalb channery sandy loam, 18 to 25 percent slopes, moderately eroded
DkF2	Dekalb channery sandy loam, 25 to 35 percent slopes, moderately eroded
DlC	Dekalb extremely stony sandy loam, 6 to 12 percent slopes
DlD	Dekalb extremely stony sandy loam, 12 to 18 percent slopes
DlE	Dekalb extremely stony sandy loam, 18 to 25 percent slopes
GfC	Glenford silt loam, 6 to 12 percent slopes
KeB	Keene silt loam, 2 to 6 percent slopes
KeC	Keene silt loam, 6 to 12 percent slopes
KeC2	Keene silt loam, 6 to 12 percent slopes, moderately eroded
Or	Orrville silt loam
Os	Orrville silt loam, high bottom
ReB	Rayne silt loam, 2 to 6 percent slopes
ReC2	Rayne silt loam, 6 to 12 percent slopes, moderately eroded
ReD2	Rayne silt loam, 12 to 18 percent slopes, moderately eroded
ReD3	Rayne silt loam, 12 to 18 percent slopes, severely eroded
RfE2	Rayne-Dekalb complex, 18 to 25 percent slopes, moderately eroded
RfF2	Rayne-Dekalb complex, 25 to 35 percent slopes, moderately eroded
ScC	Stony colluvial land, Dekalb soil materials, [illegible]
SsG	Strip mine spoil, sandstone materials, very steep
StC	Strip mine spoil, shale materials, rolling
StE	Strip mine spoil, shale materials, steep
StG	Strip mine spoil, shale materials, very steep
SvE	Strip mine spoil, reclaimed, steep

NORTH APPALACHIAN EXPERIMENTAL WATERSHED AND LITTLE MILL CREEK WATERSHED, COSHOCTON, OHIO — SHEET NUMBER 1

FIGURE 25.—North Appalachian Experimental Watershed soils map.

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Good motor ....
- Poor motor ....

Highway markers

- State or county ....

Buildings ....

- School ....

Cemetery ....

Dams ....

Lysimeter .... Y 101

Meteorological station ....

Mine and quarry ....

Well .... W 102

Weir or Flume 185

BOUNDARIES

Limit of soil survey ....

Minor civil division ....

Watershed ....

Sub-watershed ....

Land survey division corners ...

DRAINAGE

Streams, single-line

- Perennial ....
- Intermittent
  - Crossable with tillage implements ....
  - Not crossable with tillage implements ....

Lakes and ponds

- Perennial .... water w

Spring .... S 83

Wet spot ....

Drainage end ....

RELIEF

Escarpments

- Bedrock ....
- Other ....

Contours, 50-foot interval 900

SOIL SURVEY DATA

Soil boundary

and symbol .... DIC

Rock outcrops ....

U.S. Department of Agriculture, Soil Conservation Service
In Cooperation With
Department of Natural Resources, Division of Lands and Soil
and
Ohio Agricultural Research and Development Center

SOIL LEGEND

The [illegible] capital letter [illegible] the initial [illegible] of the soil [illegible]. A [illegible] F, or G, shows the [illegible]. Symbols without a [illegible] letter [illegible] A final number 2 or 3 in the symbol shows that the [illegible]

SYMBOL	NAME
BrC2	Berks [illegible] silt loam, 6 to 12 percent [illegible]
BrD2	Berks shaly silt loam, 12 to 18 [illegible]
BrE2	Berks shaly silt loam, 18 to 2[illegible]
BrE3	Berks shaly silt loam, 18 to 25 percent [illegible], [illegible] eroded
BrF2	Berks shaly silt loam, 25 to 35 percent [illegible]
Ch	Chagrin silt loam
Ck	Chagrin silt loam, high bottom
ClC	Clarksburg silt loam, 6 to 12 percent [illegible]
ClD	Clarksburg silt loam, 1[illegible] to 18 percent [illegible]
CoB2	Coshocton silt loam, 2 to 6 percent slopes, moderately [illegible]
CoC2	Coshocton silt loam, 6 to 1[illegible] percent [illegible], moderately [illegible]
CoD2	Coshocton silt loam, 12 to 18 percent slopes, moderately [illegible]
CrC2	Coshocton-Rayne silt loams, 6 to 12 percent [illegible]
CrC3	Coshocton-Rayne silt loams, 6 to 12 percent slopes, severely [illegible]
CrD2	Coshocton-Rayne silt loams, 1[illegible] to 18 percent slopes, moderately [illegible]
CrD3	Coshocton-Rayne silt loams, 12 to 18 percent slopes, severely [illegible]
CrE2	Coshocton-Rayne silt loams, 18 to 25 percent slopes, moderately [illegible]
DkC2	Dekalb channery sandy loam, 6 to 12 percent slopes, moderately [illegible]
DkD2	Dekalb channery sandy loam, 12 to 1[illegible] percent slopes, moderately [illegible]
DkE2	Dekalb channery sandy loam, 18 to 25 percent [illegible], moderately [illegible]
DkF2	Dekalb channery sandy loam, 25 to 3[illegible] percent [illegible], moderately [illegible]
DlC	Dekalb extremely stony sandy loam, 6 to 1[illegible] percent [illegible]
DlD	Dekalb extremely stony sandy loam, 1[illegible] to 18 percent [illegible]
DlE	Dekalb extremely stony sandy loam, 18 to [illegible] percent [illegible]
GfC	Glenford silt loam, 6 to 12 percent [illegible]
KeB	Keene silt loam, [illegible] to 6 percent slopes
KeC	Keene silt loam, 6 to 12 percent [illegible]
KeC2	Keene silt loam, 6 to 12 percent [illegible], [illegible]
Or	Orrville silt loam
Os	Orrville silt loam, high bottom
ReB	Rayne silt loam, [illegible] to 6 percent [illegible]
ReC2	Rayne silt loam, 6 to 1[illegible] [illegible]
ReD2	Rayne silt loam, 1[illegible] to 18 [illegible]
ReD3	Rayne silt loam, 1[illegible] to 18 [illegible]
RfE2	Rayne-Dekalb complex, 1[illegible]
RfF2	Rayne-Dekalb complex, [illegible]
ScC	Stony [illegible] land, [illegible]
SsG	Strip mine [illegible]
StC	[illegible]
StE	[illegible]
StG	[illegible]
[illegible]vE	[illegible]

NORTH APPALACHIAN EXPERIMENTAL WATERSHED AND LITTLE MILL CREEK WATERSHED, COSHOCTON, OHIO — SHEET NUMBER 2

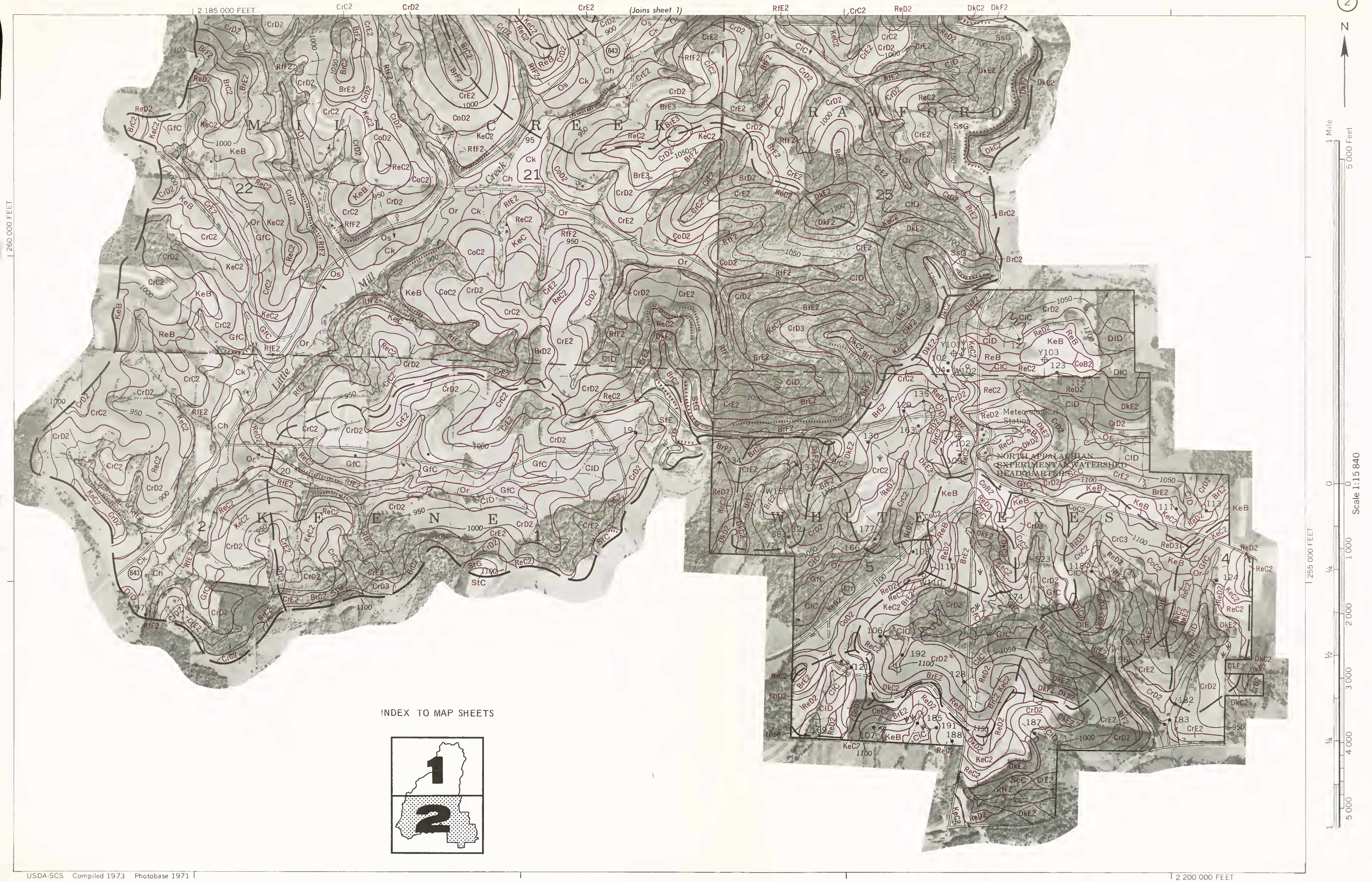

FIGURE 25.—Continued.

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Good motor ....
- Poor motor ....

Highway markers

- State or county ....

Buildings ....

- School ....

Cemetery ....

Dams ....

Lysimeter .... Y 101

Meteorological station ....

Mine and quarry ....

Well .... W 102

Weir or Flume 185

BOUNDARIES

Limit of soil survey ....

Minor civil division ....

Watershed ....

Sub-watershed ....

Land survey division corners ...

DRAINAGE

Streams, single-line

- Perennial ....
- Intermittent
  - Crossable with tillage implements ....
  - Not crossable with tillage implements ....

Lakes and ponds

- Perennial .... water w

Spring .... S 83

Wet spot ....

Drainage end ....

RELIEF

Escarpments

- Bedrock ....
- Other ....

Contours, 50-foot interval 900

SOIL SURVEY DATA

Soil boundary

and symbol .... DIC

Rock outcrops ....

U.S. Department of Agriculture, Soil Conservation Service
In Cooperation With
Department of Natural Resources, Division of Lands and Soil
and
Ohio Agricultural Research and Development Center

Mapping units:

Berks shaly silt loam, 6 to 12 percent slopes, moderately eroded (BrC2). This sloping soil occupies narrow, slightly rounded ridgetops. Most areas of the soil have been cleared of trees and farmed. Its profile differs from the representative profile because it has slightly less shale in its subsoil. Erosion along the edges where the slopes break, has resulted in spots (included in mapping) that have more shaly and lighter colored surface soils. These spots are more droughty and crop yields are lower than areas near the center of the ridges. Also included with this soil in mapping are some slightly eroded woodland areas. Spots of the deeper, less shaly Rayne soil are also present in this soil, as well as spots much like Rayne soil but higher in shale content.

Low available moisture capacity and moderate depth to bedrock limit its uses. (Capability unit IIIe 2.)

Berks shaly silt loam, 12 to 18 percent slopes, moderately eroded (BrD2). This moderately steep soil occupies knobs and slopes on or near ridgetops. Most areas are less than 10 acres and are oblong or long and narrow. The profile of this soil differs from the representative profile because it has slightly less shale in its subsoil.

Included with this soil in mapping are spots of Rayne soils which are deeper, less shaly, and which have slightly more clay in their subsoils. Also, some unnamed soils like Rayne but higher in shale content are included. Primary limitations for farm uses are a low available moisture capacity and a very severe erosion hazard. Moderate depth to bedrock and slope limit nonfarm uses. (Capability unit IVe 2.)

Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded (BrE2). This soil comprises the largest acreage of Berks soils, having steep slopes and occupying positions high on the landscape which receive little colluvial deposition. A profile of this soil is representative for the series. Included with this soil in mapping are spots of Rayne and Rayne-like soils with high shale content. Also included are spots of Dekalb soils and areas that are only slightly eroded and that have darker and thicker surface layers.

Steep slopes, low available moisture capacity, and moderate depth to bedrock limit most uses of this soil to pasture or trees. (Capability unit IVe 2.)

Berks shaly silt loam, 18 to 25 percent slopes, severely eroded (BrE3). This soil lies on upper slopes and knobs on the ridgetops. Because of poor farming practices this soil has been allowed to erode severely. Most of the topsoil has been removed, and considerable shale and subsoil show on the surface. This soil has poor tilth and slightly lower available moisture capacity than the moderately eroded Berks soils. Included with this soil in mapping are spots that are only moderately eroded, near the lower slope edge of the mapping unit.

Past erosion damage, low available moisture capacity, and steep slopes limit the use of this soil for farming. These features, plus a moderate depth to bedrock, are limitations for most nonfarm uses. (Capability unit VIe 2.)

Berks shaly silt loam, 25 to 35 percent slopes, moderately eroded (BrF2). This very steep soil occurs on middle and upper slope positions. Most areas are long and narrow. This soil is largely wooded and includes some slightly eroded areas. Also included in mapping are spots of Rayne soils that are deeper, less shaly, and that contain slightly more clay in their subsoils. A profile of this soil contains slightly more fragments throughout than the profile described as representative.

Both farm and nonfarm uses are limited by very steep slopes and moderate depth to bedrock. (Capability unit VIe 2.)

Chagrin Series

The Chagrin Series consists of medium-textured, well-drained soils that formed in sediments washed from nearby uplands. These soils lie on the flood plains and are subject to periodic flooding for short durations. Records indicate that flooding may be expected, on the average, once a year. High bottom phases of these soils are subject to infrequent flooding.

A representative Chagrin soil that is cultivated has a dark-brown, silt loam plow layer 8 inches thick. Below this to a depth of 25 inches is dark yellowish-brown and dark-brown loam. The substratum from 25 to 60 inches is stratified gravelly alluvium.

Chagrin soils have moderate permeability and a medium to high available moisture capacity. They have a deep root zone. Their water table fluctuates, but it is seldom within 2 feet of the surface.

Chagrin soils are important for farming where they occur in the broader parts of the Little Mill Creek valley.

The following is a representative profile of Chagrin silt loam, in a pasture field, 35 feet north of section line, Mill Creek Township, SE¼SE¼ sec. 20:

Horizon	*Description*
Ap	0 to 8 inches, dark-brown (10YR 4/3) silt loam; weak fine granular structure; friable, many roots; dark-brown (10YR 3/3) coatings on peds, 5 percent pebbles; medium acid; abrupt wavy boundary.
B21	8 to 17 inches, dark yellowish-brown (10YR 4/4) [illegible] loam; weak medium subangular blocky structure; [illegible] common roots; dark brown (10YR 4/3) silt [illegible] some peds, 5 percent pebbles, medium [illegible] boundary.
B22	17 to 25 inches, dark brown (10YR [illegible]) [illegible] medium faint dark yellowish-brown (10YR [illegible]) [illegible] weak medium subangular blocky structure; [illegible] mon roots, 2 percent pebbles; [illegible] boundary.

C1 — 25 to 30 inches, yellowish-brown (10YR 5/4) heavy sandy loam; many fine distinct pale-brown (10YR 6/3) and few fine distinct reddish-brown (5YR 4/4) mottles; massive; friable; few roots; 5 percent pebbles; medium acid; gradual smooth boundary.

C2 — 30 to 60 inches, brown (10YR 5/3) gravelly sandy loam alluvium; massive; friable; few roots; 30 percent pebbles; medium acid.

The solum ranges from 24 to 40 inches in thickness. The reaction ranges from medium to slightly acid throughout the profile. Ap is dark brown (10YR 4/3) or dark grayish brown (10YR 4/2). Structure is weak fine granular to moderate medium granular. The B horizon has colors of 10YR and 7.5YR hues, values from 3 to 5, and chromas of 3 to 4. Dominately silt loam and loam, the texture of the B horizon also includes individual horizons of sandy loam. The structure is weak medium or coarse subangular blocky. Some dark coatings occur on the ped faces. The C horizon consists of stratified alluvial materials with a variety of textures that usually become coarser with depth.

Chagrin soils are adjacent to the high bottom phases of Chagrin and Orrville soils. These soils are on the flood plain with the high bottom phases lying on the slightly higher areas. The lower lying Chagrin has more sand in its subsoil, and it is subject to more frequent flooding than the high bottom phases of Chagrin and Orrville.

Mapping units:

Chagrin silt loam (Ch). This nearly level soil occurs primarily in the main valley of Little Mill Creek though some areas extend up some of the shorter tributaries. Included with this soil in mapping are some wet spots. These spots are typically near the base of the hill slopes. Some small alluvial fans also occur in this soil at the mouth of small tributaries.

Well suited to most crops grown in this area, the physical properties of this soil will support a higher cropping intensity than other soils in the survey area. Flooding is a constant threat, although most frequent flooding is during the winter and spring months. This flooding hazard limits most nonfarm uses. (Capability unit IIw-1.)

Chagrin silt loam, high bottom (Ck). This soil occurs on the landscape as long, narrow segments of the flood plain. With units less than 10 acres in size, this soil usually lies between the slightly lower Orrville and Chagrin soils and the hill slopes. Some areas are separated from the hill slopes by a thin strip of Orrville, high bottom soil.

Chagrin silt loam, high bottom soils in this survey area do not include any major waterways and do not receive as frequent flooding as the nearby Orrville and Chagrin soils. A profile of this soil shows less sand and grayer colors in the lower part of the solum than the profile described as representative for Chagrin.

Included in mapping are spots of Orrville high bottom soil. These spots normally lie adjacent to, and receive runoff from, the hill slopes. Also included with this soil are some areas with slopes ranging up to 4 percent that are situated above present known flood levels. All areas, now cleared of trees, are being farmed. They are important farming soils in the Little Mill Creek valley.

The infrequent flooding hazard of this soil does not create any severe limitations for farming. Some nonfarm uses are limited by this potential flooding threat. (Capability unit I-1.)

Clarksburg Series

The Clarksburg Series consists of deep, medium-textured, moderately well-drained soils that have a fragipan in the lower part of the subsoil. They occupy colluvial slopes in the upper reaches of the watershed. The mapping units are small and dissected by waterways, usually occurring in coves at the head of streams and at the base of steeper slopes. Some Clarksburg soils parallel the smaller streams for a short distance below the coves.

A representative Clarksburg soil has a dark-brown silt loam plow layer 8 inches thick. Below this to a depth of 21 inches is yellowish-brown channery silt loam. Between 21 and 28 inches the subsoil is mottled yellowish-brown channery loam. Between 28 and 61 inches the subsoil is yellowish-brown or dark yellowish-brown very firm and brittle channery loam or silty clay loam fragipan. Sandstone bedrock occurs at a depth of 61 inches.

Clarksburg soils have moderate permeability above the fragipan and slow permeability in the fragipan. They have moderately deep rooting zones and medium to high available moisture capacity. These soils receive seepage and surface water from slopes above and are moist most of the year. A few wet spots and springs occur in these soils. Some large stones or boulders commonly occur on the surface.

These soils, occurring in small units, are often managed with the upland soils, chiefly as pasture or woodland.

The following is a representative profile of Clarksburg silt loam, 12 to 18 percent slopes, in a pasture on the N.A.E.W., 225 feet west of the station's east boundary, White Eyes Township, SE¼NW¼NW¼, sec. 4:

Horizon	*Description*
Ap	0 to 8 inches, dark-brown (10YR 3/3), dark-brown (10YR 4/3) crushed, and pale-brown (10YR 6/3) dried and crushed silt loam; weak fine granular structure; friable; many roots; 10 percent sandstone and shale fragments; neutral abrupt smooth boundary.
A&B	8 to 14 inches, yellowish-brown (10YR 5/4) channery silt loam; weak fine subangular blocky structure; friable; many roots; 20 percent sandstone and shale fragments; neutral; gradual smooth boundary.
B1t	14 to 21 inches, yellowish-brown (10YR 5/4) channery silt loam; weak fine subangular blocky structure; friable; many roots; thin patchy dark yellowish-brown (10YR 4/4) clay films; 20 percent sandstone and shale fragments; medium acid; clear smooth boundary.

B2t — 21 to 28 inches, yellowish-brown (10YR 5/4) channery loam; common fine distinct strong brown (7.5YR 5/6) and few fine distinct pale-brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; common roots; medium continuous brown (7.5YR 5/4) clay films; many dark concretions; 20 percent sandstone and shale fragments; strongly acid; clear wavy boundary.

Bx1t — 28 to 40 inches, yellowish-brown (10YR 5/4) channery loam; common fine distinct light-gray (10YR 7/2) and yellowish-brown (10YR 5/8) mottles; weak very coarse prismatic structure; very firm; brittle; few roots; medium continuous (thick continuous on vertical faces) pale-brown (10YR 6/3) clay films; many dark concretions; 20 percent sandstone and shale fragments; one vertical seam 2 inches wide with light-gray (10YR 7/1) surface colors and strong brown (7.5YR 5/8) underlying colors; strongly acid; gradual smooth boundary.

Bx2t — 40 to 61 inches, dark yellowish-brown (10YR 4/4) channery silty clay loam; common fine distinct light-gray (10YR 6/1) mottles; weak coarse prismatic parting to weak thick platy structure; very firm; brittle; few roots; medium continuous light brownish-gray (10YR 6/2) clay films on ped faces and thick continuous light-gray (10YR 7/2) clay films on vertical seams; many dark concretions; 20 percent sandstone and shale fragments; some flagstones between a depth of 40 and 45 inches; strongly acid increasing to slightly acid at 50 inches.

R — 61 inches +, sandstone bedrock.

Solum thickness ranges from 40 to 65 inches. Depth to the fragipan ranges from 22 to 36 inches. Depth to bedrock is greater than 5 feet. Reaction throughout the soil ranges from strongly acid to slightly acid when not limed. Ap horizons are dark grayish brown (10YR 4/2), dark brown (10YR 4/3, 3/3), and dark yellowish brown (10YR 4/4, 3/4). B1 and Bt horizons are strong brown (7.5YR 5/6) or yellowish brown (10YR 5/4, 5/6). Textures include silt loam, silty clay loam, loam, clay loam, or channery phases of these. Bx horizon colors range from 10YR to 7.5YR in hue, and 4, 5, or 6 in value and chroma and are mottled with gray through reddish brown. The C horizon, if present, ranges from yellowish brown (10YR 5/4) to strong brown (7.5YR 5/6) with gray or brown mottles.

Clarksburg soils are adjacent to the Glenford soils and to stony colluvial land that occurs on similar landscape positions. Clarksburg soils, containing more fragments, are less silty than Glenford soils. They lack the numerous stones that occur in the stony colluvial land. Other nearby soils are Keene, Coshocton, and Rayne.

Mapping units:

Clarksburg silt loam, 6 to 12 percent slopes (ClC). This soil occupies middle and lower slope positions and lies in concave landscape segments near the heads of drainageways. It is irregularly shaped with lobes or fingers that extend up the drainageways for short distances. Because this soil tends to follow the drainageways upslope, it frequently intercepts the residual soil boundaries that run with the contour. This soil lies in the upper third of the Little Mill Creek watershed with only a few units along the stream bottom. Small areas of Glenford soils and stony colluvial land are included with this soil in mapping, as well as small wet spots. The profile of this soil differs from the representative profile because it has slightly less fragments throughout the solum.

Grain and row crop production is limited on this soil because of frequent waterways, seepage spots, and occasional stones. However, it is well suited to pasture and trees. Nonfarm uses are limited by the slope, seepiness, occasional stones, and slow permeability of this soil. (Capability unit IIIe 1.)

Clarksburg silt loam, 12 to 18 percent slopes (ClD). This soil occupies cove positions on middle and lower slopes, chiefly in the upper third of the Little Mill Creek watershed. It is irregular in shape with small lobes extending to near the heads of the drainageways. A profile of this soil is described as representative for the series. A large area of this soil lies in the valley directly east of the N.A.E.W. headquarters. Spots of stony colluvial land and Glenford soils are included with this soil in mapping. Wet spots are also commonly included.

Because of frequent drainageways, seepiness, slope, and occasional stones, farm uses of this soil are limited to woodland and pasture. These limitations along with the slow permeability in the lower part of the subsoil, limit many nonfarm uses. (Capability unit IVe 1.)

Coshocton Series

The Coshocton Series comprises moderately well drained soils that have formed in residuum of interbedded acid shales, siltstone, and coal underclays. These soils occupy narrow irregular ridgetops and moderate to steep side slopes. The largest areas of these soils are moderately steep or steep and are mapped in complex mapping units with Rayne soils. Slope shapes are chiefly concave.

A representative profile that is cultivated has a dark-brown silt loam plow layer 7 inches thick. Below this to a depth of 14 inches, it is yellowish-brown silt loam or light silty clay loam. At 14 to 27 inches the subsoil is mottled yellowish-brown silty clay loam with some vertical structure cracks. Grayish colors line the cracks. From 27 to 58 inches the subsoil is yellowish-brown shaly loam or shaly silty clay loam. Below a depth of 58 inches is fractured shale bedrock.

Coshocton soils have slow permeability and medium available moisture capacity. The rooting zone is deep, although somewhat restricted in the lower layers of subsoil with roots concentrating in the vertical cracks. Wet-weather seepage spots are common in this soil. In dry weather surface cracks will open to 1 inch wide.

Nearly all areas of Coshocton soil have been cleared and farmed. The Coshocton-Rayne complex comprises nearly 50 percent of the cropland in the Little Mill Creek watershed. These areas are being farmed in crop rotations with contour stripcropping being used extensively.

The following is a representative profile of Coshocton silt loam, 6 to 12 percent slopes, moderately eroded, in a cultivated field 170 feet south of Township Road 171d, and 50 feet west of farm lane on the N.A.E.W., White Eyes Township, SW¼NW¼ sec. 4:

Horizon	*Description*
Ap	0 to 7 inches, dark-brown (10YR 4/3) silt loam; weak medium granular structure; friable; many roots; 5 percent shale fragments; medium acid; abrupt smooth boundary.
B1	7 to 10 inches, yellowish-brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; friable; common roots; 5 percent shale fragments; strongly acid; clear smooth boundary.
B21t	10 to 14 inches, yellowish-brown (10YR 5/4) silty clay loam; weak fine and medium subangular blocky structure; friable; common roots; thin patchy light yellowish-brown (10YR 6/4) clay films on vertical and horizontal ped faces; 10 percent shale fragments mainly less than 3 inches in diameter; very strongly acid; clear smooth boundary.
B22t	14 to 17 inches, yellowish-brown (10YR 5/4) shaly silty clay loam; many fine distinct strong brown (7.5YR 5/6) and common fine distinct light brownish-gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; few roots; thin patchy light yellowish-brown (10YR 6/4) clay films on vertical and horizontal ped faces; 15 percent shale fragments less than 6 inches in diameter; very strongly acid; clear smooth boundary.
IIB23tg	17 to 27 inches, yellowish-brown (10YR 5/4) silty clay loam; common fine distinct yellowish-brown (10YR 5/8) and few fine distinct light brownish-gray (2.5Y 6/2) mottles; moderate medium and coarse prismatic structure parting to weak coarse subangular blocky structure; firm; few roots; moderate continuous light brownish-gray (2.5Y 6/2) coatings on major vertical prismatic faces; thin patchy light yellowish-brown (10YR 6/4) to grayish-brown (10YR 5/2) clay films on vertical and horizontal ped faces within prisms; many dark concretions; 10 percent shale fragments less than 6 inches in diameter; very strongly acid; abrupt wavy boundary.
IIIB3	27 to 46 inches, yellowish-brown (10YR 5/4) shaly loam; few fine distinct light brownish-gray (2.5Y 6/2) and yellowish-brown (10YR 5/8) mottles; weak thick platy structure parting to weak fine subangular blocky structure; very firm; few roots; thin very patchy light yellowish-brown (10YR 6/4) clay films on vertical ped faces; many dark concretions; 20 percent shale fragments less than 6 inches in diameter; very strongly acid; clear wavy boundary.
IIIC	46 to 58 inches, yellowish-brown (10YR 5/4) shaly silty clay loam; common medium distinct light brownish-gray (2.5Y 6/2) and few fine faint yellowish-brown (10YR 5/8) mottles; massive; 30 percent shale fragments less than 6 inches in diameter; very strongly acid.
IIIR	58 inches +, fractured shale with thin beds of sandstone.

The solum ranges in thickness from 28 to 60 inches. Depth to bedrock ranges from 40 inches to 72 inches or more. Reaction of the solum, unless limed, is strongly acid to extremely acid. The Ap horizon is dark grayish brown (10YR 4/2), dark brown (10YR 4/3), or dark yellowish brown (10YR 4/4). The upper Bt horizon has hues of 10YR or 7.5YR, values of 4 or 5, and chromas of 4 to 6. Textures are heavy silt loam, clay loam, or light silty clay loam. The lower Bt horizon colors range from 7.5YR to 2.5Y with values of 4 to 6 and chromas of 2 to 6. Textures are silty clay loam, silty clay, or clay loam.

Coshocton soils are most commonly adjacent to Rayne, Dekalb, Berks, or Keene soils. They have grayer subsoil colors and more clay in the lower part of the subsoil than Rayne, Dekalb, and Berks soils and have less silt in the upper soil layers than Keene soils.

Mapping units:

Coshocton silt loam, 2 to 6 percent slopes, moderately eroded (CoB2). This gently sloping soil lies on ridgetops. Its profile differs from the profile described as representative for the series because it has more silt in the upper layers. Some small areas of the more silty Keene soils and less clayey Rayne soils are included with this soil in mapping.

Erosion is the primary limitation for farm uses; some care is needed to maintain the soil tilth. The fine textures in the lower part of the subsoil and slow permeability are limitations for some nonfarm uses. (Capability unit IIe-1.)

Coshocton silt loam, 6 to 12 percent slopes, moderately eroded. (CoC2.) This sloping soil occupies rounded ridgetops and lower slope bench positions. A profile of this soil is described as representative for the series. The most extensive units of this soil are on the ridge east of N.A.E.W. headquarters and on lower slope (benchlike) positions approximately 50 feet above Little Mill Creek flood plain in the lower third of the watershed. Most mapping units are irregular in shape and 5 to 10 acres in size. Included in mapping are spots of the more silty Keene soils and less clayey Rayne soils.

Limitations for farm uses are primarily erosion with wet weather seepage being a special problem on the lower slope positions. Seepage, slow permeability, slope, and clayey subsoils are limitations for some nonfarm uses. (Capability unit IIIe-1.)

Coshocton silt loam, 12 to 18 percent slopes, moderately eroded (CoD2). This soil occurs chiefly on lower slope (benchlike) positions approximately 50 to 75 feet above the Little Mill Creek flood plain in the lower third of the watershed. These mapping units are U-shaped and wrap around the base of the point slopes. Seepage during wet weather is common from this soil, and many areas are dissected by waterways.

A profile of this soil has more shale and sandstone fragments in the upper horizons than the representative profile. Small areas of the less clayey Rayne soils are included with this soil in mapping.

Wet-weather seepage and a very severe erosion hazard are limitations for farm uses. Nonfarm uses are limited by the clayey subsoil, slope, and seepiness of this soil. (Capability unit IVe-1.)

Coshocton-Rayne silt loams, 6 to 12 percent slopes, moderately eroded (CrC2). These soils typically occupy rounded, uneven ridgetops and less commonly occupy benches and lower slopes. These uneven ridges are bedrock controlled, and slight changes in elevation reflect changes in bedrock. This results in changes in soil types within short distances. Coshocton and Rayne are the dominant soils with each occupying 30 to 60 percent of the area. Other soils included in mapping are the more silty Keene soils and the more shaly Berks soils. Profiles of these soils are similar to those described as representative for the series.

Most areas of this mapping unit are being used for rotation cropland. On ridge positions cultivation is with the length of ridge. These ridge units are small and are often managed in the same manner as the steeper and longer slopes below. Slope and depth to bedrock are limitations for many nonfarm uses. (Capability unit IIIe-1.)

Coshocton-Rayne silt loams, 6 to 12 percent slopes, severely eroded (CrC3). These sloping soils lie on rounded ridgetop positions. Coshocton and Rayne soils occur in an intricate pattern with each occupying 30 to 60 percent of the area.

All areas have been cleared and farmed. Erosion has been severe, with most of the original surface soil lost. The profiles of these soils have lighter colored and more shaly surface soils than the representative profiles for the Coshocton and Rayne soils. They have slightly reduced available moisture capacity. The surface soil texture of the Coshocton soils contains slightly more clay, and dry-weather cracking is more pronounced than on the moderately eroded soils. Small areas of the more shaly Berks soils are the most common inclusion in mapping.

The effects of past erosion and the hazard of future erosion are limitations for most farm uses and some nonfarm uses. (Capability unit IVe-1.)

Coshocton-Rayne silt loams, 12 to 18 percent slopes, moderately eroded (CrD2). These soils are the most extensive in the survey area. The size and shape of the mapping unit on the landscape is quite variable, but typically it is long, irregular, and U-shaped. Some units are more than 1 mile in length and ¼ mile in width. Width is greatest on the points of the slopes and least in the ravines. This mapping unit is most common on the lower half of the slopes, but some areas extend to the ridgetops.

Thin alternating bedrock strata of siltstone, silty shales, soft clay shales, coal, and coal underclays underlie this mapping unit and create an intricate pattern of soils. Coshocton and Rayne soils each occupy approximately 30 to 60 percent of the area. Other soils total less than 30 percent of the area.

The microrelief of this mapping unit is typically uneven with intermittent benches. The concave and bench positions are chiefly occupied by Coshocton soils. Bedrock strata underlying these positions are dominantly clay shale, coal, and coal underclay. Seep spots are commonly associated with these positions. These seeps will saturate large spots in the spring (mostly before leafing) and often feed drainageways that dissect this soil.

Rayne soils occupy the convex parts of the slopes. The proportion of Rayne is highest on the upslope side of most areas of this mapping unit. The bedrock is mostly siltstone and silty shales.

Spots of the more silty Keene soils and soils that are finer textured and more limy than Coshocton soils are included in mapping. Also included are some severely eroded spots. Profiles of these soils are similar to those described as representative for the series.

Important are these cropland soils on the hill land. They lend themselves well to contour stripcropping. Long contour strips that are interrupted only by farm boundaries or deeply incised drainageways can be used on the larger areas. A very severe erosion hazard limits farming practices. The moderately steep slopes limit many nonfarm uses. (Capability unit IVe-1.)

Coshocton-Rayne silt loams, 12 to 18 percent slopes, severely eroded (CrD3). This mapping unit comprises small areas less than 10 acres that have been or are being eroded. Much of the topsoil has been removed, and some areas contain gullies. The tilth and available moisture supplying capacity have been reduced. The landscape position is middle and upper slope.

Coshocton and Rayne soils in this mapping unit form an intricate pattern over thinly bedded and alternating layers of soft and moderately hard bedrock. Each soil occupies 30 to 60 percent of the area. Coshocton soils occupy the slightly concave positions underlain by soft bedrock. These slightly wet areas are subject to wet-weather seepage. The Rayne soils are on the more convex positions underlain by moderately hard bedrock.

Surface soil of this mapping unit contains more shale fragments than the representative profiles described for the Coshocton and for the Rayne Series. Some spots of the more shaly Berks soils and areas that are more limy than either Coshocton or Rayne soils are included in mapping. Also included are some spots that are only moderately eroded.

The hazard of further erosion and the effects of past erosion limit farm uses. Past erosion and moderately steep slopes are limitations for many nonfarm uses. (Capability unit VIe-1.)

Coshocton-Rayne silt loams, 18 to 25 percent slopes, moderately eroded (CrE2). These soils are among the most prominent soils on the hill slopes. They occupy mostly middle and upper slope positions. Most areas, relatively large, comprise long meandering segments of land that follow the contour. Some areas reach lengths of 1 mile or more.

Coshocton and Rayne soils dominate this mapping unit. Each soil comprises 30 to 60 percent of the area, and other soils total less than 30 percent of the area. Small areas of the more shaly Berks soils and spots that are more limy than either Coshocton or Rayne soils are included in this mapping unit. Also included are many severely eroded spots, where most erosion cuts have healed, but the scars remain. Profiles of these soils are slightly shallower to rock and more shaly than those described as representative for the series.

Bedrock underlying this mapping unit consists of clay shales, coal, and coal underclays associated with the Coshocton soils. These bedrock strata are interbedded with siltstone and silty shales associated with Rayne soils to form an intricate pattern of soils on these hill slope positions.

Wet-weather springs and seepage are associated with the Coshocton parts of this mapping unit. Seepage spots will often occur in a line across the slope at similar elevations. These seeps will saturate large spots in the spring and often will feed drainageways that dissect this mapping unit.

Present land use is divided among cropland, pasture, and woodland. Several large areas are idle and are reverting to woodland. These soils are still important for small grain and row crops, although some areas have been converted to pasture or woodland. Erosion presents a very severe hazard in using these soils for cultivated crops. Contour stripcropping is used extensively. The steep slopes and very severe erosion hazard limit many nonfarm uses. (Capability unit VIe–1.)

Dekalb Series

The Dekalb Series comprises well-drained channery sandy loam and extremely stony sandy loam soils formed in residuum weathered from sandstone bedrock. The most extensive areas of these soils are formed in residuum of Lower Freeport sandstone and are at elevations above 1,175 feet. These areas occupy the highest parts of the landscape and consist of narrow ridges, knobs, and moderately steep to very steep side slopes. Less extensive areas of Dekalb lie on the ends of lower elevation ridges. Other areas are in mapping complexes with Rayne soils on the steep slopes and on escarpments where the hill slopes border the Little Mill Creek flood plain. The latter areas are underlain by the Massillon sandstone.

A representative Dekalb soil in a wooded area has a very dark grayish-brown, very friable surface layer 2 inches thick that is a channery sandy loam. Below this layer, from 2 to 6 inches, is light yellowish-brown channery sandy loam. The subsoil from 6 to 34 inches is light yellowish-brown and yellowish-brown channery loamy sand and sandy loam. Sandstone bedrock is at a depth of 34 inches.

The content of sandstones greater than 10 inches in diameter in the Dekalb soils is quite variable, but most areas need to be cleared of stones before they can be farmed. Some areas contain excessive amounts of stones and boulders, making it impractical to clear them for farming.

Dekalb soils have high infiltration rates and rapid permeabilities. They have low available moisture capacities and moderately deep rooting zones.

Dekalb soils in this survey area are used mostly for woodland. Some ridgetops are still being farmed, but many areas that were once cleared of trees are reverting to woodland.

The following is a representative profile in an area of Dekalb channery sandy loam, 25 to 35 percent slopes, moderately eroded, in a woods on the N.A.E.W., White Eyes Township, SW¼NE¼NW¼ sec. 5:

Horizon	*Description*
01	3 to 1 inch, deciduous leaf litter.
02	1 to 0 inch, decomposed organic material.
A1	0 to 2 inches, very dark grayish-brown (10YR 3/2) channery sandy loam; moderate fine granular structure; very friable; many roots; 20 percent sandstone fragments less than 6 inches in diameter; extremely acid; clear smooth boundary.
A2	2 to 6 inches, light yellowish-brown (10YR 6/4) channery sandy loam; fingers of dark grayish brown (10YR 4/2) and streaks of yellowish brown (10YR 5/6); weak fine and medium subangular blocky structure; very friable; many roots; 35 percent sandstone fragments less than 6 inches in diameter; very strongly acid; clear smooth boundary.
B1	6 to 14 inches, light yellowish-brown (10YR 6/4) channery loamy sand; weak medium and fine, subangular blocky structure; very friable; many roots; 35 percent sandstone fragments less than 6 inches in diameter; extremely acid; gradual boundary.
B2	14 to 24 inches, yellowish-brown (10YR 5/4) channery sandy loam; weak medium subangular blocky structure; friable; common roots; faint evidence of clay bridging in lower part of horizon; 32 percent sandstone fragments less than 6 inches in diameter; extremely acid; gradual boundary.
B3	24 to 34 inches, yellowish-brown (10YR 5/4) channery sandy loam with pockets of sand; weak coarse subangular blocky structure; friable; common roots; thin very patchy pale-brown (10YR 6/3) clay films bridging sand grains and on tops and sides of channers and flagstones; 40 percent sandstone fragments less than 10 inches in diameter; extremely acid; gradual boundary.
R	34 inches +, fractured and partially disintegrated coarse-grained sandstone; few roots; very strongly acid.

Solum thickness ranges from 20 to 35 inches, and bedrock is at a depth of 20 to 40 inches. Sandstone fragments, 1 to 10 inches in diameter, range from 10 to 60 percent in the solum and usually increase with depth. Unless limed, the reaction ranges from strongly acid to extremely acid throughout the solum. The A1 horizon is very dark grayish brown (10YR 3/2) or dark brown (10YR 3/3). Colors of the A2 horizon are yellowish brown (10YR 5/4), pale brown (10YR 6/3), and light yellowish brown (10YR 6/4). Plowed layers are dark brown (10YR 4/3) or dark yellowish brown (10YR 4/4). Texture of the A horizons is channery or stony sandy loam. Color of the B horizons is light yellowish brown (10YR 6/4) or yellowish brown (10YR 5/4, 5/6). Textures are channery or very channery and include loam or sandy loam but may range to loamy sand in some layers. Structure is weak to moderate subangular blocky. The B horizon of most profiles has some clay bridges between the sand grains and a few thin discontinuous silt and clay films. A C horizon, if present, has colors of brown (10YR 5/3) to yellowish brown (10YR 5/6), and textures of channery or flaggy sandy loam or loamy sand. Underlying bedrock is gray to brown sandstone of varying hardness and is usually fractured.

Dekalb soils are on landscape positions common to Berks, Rayne, Coshocton, and Keene soils. Dekalb is higher in sand and sandstone fragment content than these soils and, except for Berks, is shallower to bedrock.

Mapping units:

Dekalb channery sandy loam, 6 to 12 percent slopes, moderately eroded (DkC2). This sloping soil occupies slightly rounded ridgetops. It commonly occurs on the tops of knobs and elongated humps along the north and east rims of the watershed divide. Other scattered areas are on ridgetops that lie at lower elevations than the major Dekalb ridges. A majority of the areas of this soil have been cleared and farmed, but some areas are now idle. Many stones have been removed from the fields.

Where this soil has been cleared and farmed, its profile has a lighter colored surface soil than the representative profile. Some spots of the more silty and shaly Berks soils are included in this mapping unit. Also included with this soil are some areas that contain relatively few sandstone fragments and that have slightly more clay in their subsoils.

The erosion hazard, presence of many sandstone fragments, and low available moisture capacity are the major limitations for farm uses. In addition, the moderate depth to sandstone bedrock must be considered for uses involving excavation. (Capability unit IIIe-2.)

Dekalb channery sandy loam, 12 to 18 percent slopes, moderately eroded (DkD2). This moderately steep soil occupies slopes near the tops of ridges and knobs and humps on the ridges. Parts of these areas have been farmed and have a lighter colored and thinner surface soil than the profile described as representative for the series. Some stony spots occur in this soil, especially in the wooded areas. Also, narrow bands of the finer textured Coshocton soils and spots of the more silty and shaly Berks soils are present in some areas. Included with this soil in mapping are some areas that contain relatively few sandstone fragments and that have slightly more clay in their subsoils. Also included are some slightly eroded areas which are mostly wooded.

Limitations for farm uses are low available moisture capacity, high sandstone fragment content, a few stones, and a very severe erosion hazard. Soil uses requiring excavation will be hampered by the sandstone bedrock within a depth of 40 inches. (Capability unit IVe-2.)

Dekalb channery sandy loam, 18 to 25 percent slopes, moderately eroded (DkE2). This steep soil most commonly occupies upper slope positions and knobs on the ridgetops. Large areas of this soil occur in positions transitional between the very steep Dekalb soils above and the less sloping Coshocton-Rayne soils below. The soils on these transitional areas are underlain by clay shale, coal, underclay, and sandstone. These spots hold more moisture for plant growth. The coal under these areas makes them subject to strip mining, and many areas of this soil have already been disturbed by mining. Included with this soil in mapping are areas that are less channery and more silty than most Dekalb soils. Also included are some wooded areas that are only slightly eroded.

A very severe erosion hazard, sandstone fragments, stones, and low available moisture capacity limit this soil for farming. Nonfarm uses of this soil are limited by steep slopes, presence of stones and fragments, and moderate depth to sandstone bedrock. (Capability unit IVe-2.)

Dekalb channery sandy loam, 25 to 35 percent slopes, moderately eroded (DkF2). Most areas of this very steep soil are long and narrow and extend along the sides of the sandstone-capped ridges. Some areas are bounded on their lower sides by strip mine high walls.

Some stony spots and some small areas that are more silty or more sandy than the representative profile of Dekalb are included with this soil, as well as some areas that are eroded only slightly. A slightly eroded profile included within an area of this soil is described as representative for the series. Most areas are being used for woodland. Both farm and nonfarm uses are limited by the very steep slopes, and the moderately deep sandstone bedrock of this soil. (Capability unit VIe-2.)

Dekalb extremely stony sandy loam, 6 to 12 percent slopes (DIC). This soil occupies sandstone-capped ridgetops. There are many large sandstones covering 3 to 15 percent of the surface, and they are mixed through the soil profile. Most of these stones and boulders are not attached to the bedrock, and they range in size from 1 to 10 feet in diameter. Most areas of this soil are near the ends of ridges that lie at lower elevations than the major Dekalb ridges. A profile of this soil differs from the representative Dekalb profile by being more stony and slightly more droughty.

All areas of this soil are wooded. The stones and boulders, and the moderate depth to bedrock are the most limiting factors in the use of this soil. (Capability unit VIs-1.)

Dekalb extremely stony sandy loam, 12 to 18 percent slopes (D1D). This moderately steep soil lies adjacent to the ridgetops. Stones and boulders ranging from 1 to 10 feet in diameter are distributed over 3 to 15 percent of the surface and are mixed through the soil. Its profile is more stony and droughty than the profile described as representative for the series. Included with this soil in mapping is a large fractured sandstone outcrop that protrudes from the Little Mill Creek flood plain. Some soil occurs between the rocks of this outcrop.

Areas of this soil are being used for woodland, because most other uses are limited by its stoniness. (Capability unit VIs-1.)

Dekalb extremely stony sandy loam, 18 to 25 percent slopes (D1E). This steep soil occupies slopes below Dekalb and stony Dekalb ridges. Stones and boulders, ranging from 1 to 10 feet in diameter, cover 3 to 15 percent of the surface. This soil has a profile that is more stony and droughty than the profile described as representative for the series. Most areas are presently in woodland.

Stoniness and steep slopes present severe limitations for most uses. (Capability unit VIIs-1.)

Glenford Series

The Glenford Series consists of deep, silty soils that are moderately well drained. They occupy high terraces, coves, benches, saddles, and other protected areas where silty materials have accumulated. These transported materials are thought to be deposited by wind and water. Glenford soils occur only in small areas and on scattered terrace remnants in this survey area.

A representative Glenford soil has a dark-brown silt loam plow layer 6 inches thick. Below this to a depth of 40 inches, it has a yellowish-brown silt loam subsoil that grades to silty clay loam below 40 inches. Stratified silt loam and silty clay loam materials are between 57 and 72 inches.

Glenford soils have moderately slow permeability. They have a deep root zone and high available moisture capacity. These soils receive seepage and surface water from slopes above and are moist most of the year. Locally, Glenford soils are used chiefly for pasture, but some small areas are farmed with adjoining soil areas in rotation cropland. Glenford soils are well suited to most farm crops grown in this area.

The following is a representative profile of Glenford silt loam, 6 to 12 percent slope, in a pasture on the N.A.E.W., 200 yards east of Township Road 190a, White Eyes Township, SE¼ sec. 5:

Horizon	*Description*
Ap	0 to 6 inches, dark-brown (10YR 4/3) silt loam; weak fine granular structure; friable; many roots; very strongly acid; abrupt smooth boundary.
B1	6 to 12 inches, yellowish-brown (10YR 5/6) silt loam; weak fine subangular blocky structure; friable; common roots; thin continuous yellowish-brown (10YR 5/4) silt coatings; very strongly acid; clear smooth boundary.
B21t	12 to 17 inches, yellowish-brown (10YR 5/6) silt loam; moderate fine and medium subangular blocky structure; friable; common roots; thin patchy yellowish-brown (10YR 5/4) clay films; very strongly acid; clear smooth boundary.
B22t	17 to 25 inches, yellowish-brown (10YR 5/6) silt loam; common fine distinct grayish-brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few roots; thin patchy yellowish-brown (10YR 5/4) and light yellowish-brown (10YR 6/4) clay films; very strongly acid; clear smooth boundary.
B23t	25 to 40 inches, yellowish-brown (10YR 5/6) silt loam, fine distinct light-gray (10YR 6/1) mottles; weak medium prismatic structure parting to weak thick platy structure; firm; few roots; thin continuous grayish-brown (2.5Y 5/2) clay films; common fine dark concretions; strongly acid; gradual smooth boundary.
B3	40 to 57 inches, yellowish-brown (10YR 5/6) silty clay loam; light brownish-gray (10YR 6/2) ped surface colors and common fine distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to weak thick platy structure; firm; thin very patchy yellowish-brown (10YR 5/4) clay films; strongly acid; gradual boundary.
C	57 to 72 inches, stratified silt loam and silty clay loam materials; slightly acid increasing to neutral at 72 inches.

Solum thickness ranges from 40 to 60 inches. Unlimed, the reaction is very strongly acid to medium acid in the solum. Reaction increases with depth in the C horizon to slightly acid or neutral. Carbonates are lacking within a depth of 72 inches. The Ap horizon is dark grayish brown (10YR 4/2) to dark yellowish brown (10YR 4/4). The B horizons have a color range with hues of 10YR or 7.5YR, values of 4 or 5, and chromas of 3 to 6. Texture of the B horizons is silt loam or silty clay loam. Structure is subangular blocky or prismatic. The C horizons are stratified. Silt loam and silty clay loam textures are dominant, but strata of loam or light silty clay are present in some profiles.

Glenford soils are adjacent to the Clarksburg soils and stony colluvial land that occur on similar landscape positions. Glenford soils lack the fragipan and contain less sand and stone fragments than the Clarksburg soils. They lack the stones characteristic of stony colluvial land. Keene, Coshocton, and Rayne soils are nearby on the hillslopes. Glenford lacks the finer textures that are present in the lower part of the subsoil of the Keene soils and it also lacks the shale fragments that are in the Coshocton and Rayne soils.

Mapping unit:

Glenford silt loam, 6 to 12 percent slopes (GfC). This sloping soil most commonly occupies high terrace and bench positions 20 to 60 feet in elevation above the streams. Some areas also occur in coves and saddles high on the landscape. Positions favorable for this soil are concave and are the recipient of silty deposits from wind and water. Areas of this soil are small in size, less than 10 acres, and long and narrow. Some are curved in a half-moon shape. Most areas have been dissected by waterways.

Included with this soil in mapping are spots containing stone fragments that have colluviated from the slopes above. Also included are spots that have been moderately eroded. Spots with bedrock at depths of 4 to 6 feet are likely in the areas in high landscape positions.

This soil is used for pasture and some rotation cropland. The small size, shape of units, slight seepage and wetness hazard, and moderate erosion hazard limit its use for some farm crops. Some nonfarm uses are limited by the erosion hazard, the slope, and slight wetness. (Capability unit IIIe-1.)

Keene Series

The Keene Series consists of moderately well drained soils with silt loam upper horizons and plastic, finer-textured lower horizons. They are formed in residuum of soft, acid, thin-bedded clay shale and siltstone capped by approximately 2 feet of silty material presumed of loessial origin. These soils occupy gently sloping and sloping ridgetops, benches, and lower concave slopes. These are relatively stable landscape positions.

A representative Keene soil that is cultivated has a dark grayish-brown, silt loam plow layer that is 9 inches thick. Below the plow layer to a depth of 20 inches is friable yellowish-brown silt loam and silty clay loam. The lower part of the subsoil from 20 to 39 inches is mottled yellowish-brown silty clay loam and silty clay. Below 39 inches it grades through a mottled gray shaly silty clay loam to siltstone bedrock at a depth of 62 inches.

Keene soils have a medium to high available moisture capacity. The rooting zone is deep although somewhat restrictive in the lower part of the subsoil where roots concentrate in the vertical cracks. Slow permeability in the lower part of the subsoil creates a perched water table at depths between 15 to 30 inches for short periods in the spring.

Nearly all areas of Keene soils have been cleared and cultivated. Most are farmed in crop rotation or used for pasture.

The following is a representative profile of Keene silt loam, 2 to 6 percent slopes, in a cultivated field 70 feet west of lysimeter battery Y103 on the N.A.E.W., Crawford Township, SE¼SE¼SE¼ sec. 25:

Horizon	*Description*
Ap	0 to 9 inches, dark grayish-brown (10YR 4/2) silt loam; weak fine subangular blocky structure; friable; many roots; 2 percent shale fragments; medium acid; abrupt smooth boundary.
A2	9 to 12 inches, yellowish-brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; friable; many roots; very porous; very strongly acid; clear smooth boundary.
B1t	12 to 15 inches, yellowish-brown (10YR 5/6) silt loam; weak fine and medium subangular blocky structure; friable; common roots; many small pores in ped interiors; thin very patchy yellowish-brown (10YR 5/4) clay films on vertical and horizontal ped faces; very strongly acid; clear smooth boundary.
B21t	15 to 20 inches, yellowish-brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common roots; thin patchy dark yellowish-brown (10YR 4/4) clay films on vertical and horizontal ped faces; very strongly acid; clear smooth boundary.
IIB22t	20 to 25 inches, yellowish-brown (10YR 5/6) silty clay loam; many medium distinct light brownish-gray (10YR 6/2) and pale-brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; common roots; thin patchy dark yellowish-brown (10YR 4/4) clay films on vertical and horizontal ped faces; 5 percent shale fragments less than 6 inches in diameter; very strongly acid; clear smooth boundary.
IIB23tg	25 to 39 inches, mixed yellowish-brown (10YR 5/4) and gray (5Y 6/1) silty clay; many medium prominent strong brown (7.5YR 5/8) and common fine distinct light brownish-gray (10YR 6/2) mottles; moderate medium prismatic structure parting to moderate medium angular blocky structure; firm; few roots; moderate patchy pale-brown (10YR 6/3) clay films on vertical and horizontal ped faces; 10 percent shale fragments less than 6 inches in diameter; very strongly acid; gradual smooth boundary.
IIB3g	39 to 52 inches, gray (10YR 6/1) shaly silty clay loam; few fine prominent strong brown (7.5YR 5/8) mottles; weak medium angular and subangular blocky structure; very firm; thin patchy pale-brown (10YR 6/3) clay films on vertical ped faces; 25 percent shale fragments less than 6 inches in diameter; very strongly acid; gradual smooth boundary.
IICg	52 to 62 inches, gray (10YR 5/1) shaly silty clay loam with streaks of yellowish-brown (10YR 5/8) partially weathered shale; massive; 35 percent shale fragments less than 6 inches in diameter; very strongly acid; abrupt smooth boundary.
IIR	62 inches +, siltstone bedrock.

The solum ranges from 30 to 60 inches in thickness. Depth to bedrock is 3½ to 7 feet or more. Unless limed, the reaction is strongly acid to extremely acid throughout the solum and slightly acid to extremely acid in the C horizon. Percent of coarse fragments in the solum ranges from 0 to 30. The Ap horizons are dark grayish brown, dark brown or grayish brown (10YR, 4/2, 4/3, or 5/2). The upper part of the Bt horizon is yellowish brown (10YR 5/4 or 5/6) or strong brown (7.5YR 5/6) and has silt loam or light silty clay loam texture. The lower part of the Bt horizon is heavy silty clay loam or silty clay. Matrix colors range in hue from 7.5YR to 5Y, values from 4 to 6, and chromas from 2 to 6. Structure is prismatic that parts to subangular and angular blocky. The C horizon colors include gray, brown, yellow, and olive with variable textures that are dominantly shaly silty clay loam or silty clay.

Keene soils are most commonly adjacent to Rayne, Dekalb, Berks, and Coshocton soils. Because Keene soils have more silt in the upper 2 feet, they are generally deeper to rock than adjoining soils. Keene soils also have more clay and have grayer colors in the lower part of the subsoil than Rayne, Dekalb, and Berks soils.

Mapping units:

Keene silt loam, 2 to 6 percent slopes (KeB). This gently sloping soil occupies smooth segments of long uneven ridgetops. These segments commonly include saddles between sandstone knobs along the watershed divide, as well as gently sloping portions of the lateral ridges that descend and finger into the valley in a stairstep fashion.

This soil is usually bounded by steeper soils that are shallower to rock and higher in shale and stone content. Small areas of these thinner soils and Coshocton soils are included with this soil in mapping. A profile of this soil is described as representative for the series.

A slight erosion and wetness hazard are the primary farming limitations. Slow permeability and high plasticity of the lower part of the subsoil are limitations for some nonfarm uses. (Capability unit IIe–1.)

Keene silt loam, 6 to 12 percent slopes (KeC). This soil occupies broad, rounded ridgetops, protected coves, and lower concave slopes that have received some deposition from the higher adjacent slopes. Most areas have been cleared and farmed. Past erosion has been slight. The surface layer of this soil has slightly more shale fragments than the surface layer of the representative profile.

Where this soil joins Rayne, Coshocton, and Berks soils, there are inclusions of spots slightly more shaly and thinner to rock.

A moderate erosion hazard and slight wetness hazard are the primary limitations to the use of this soil for farming. Slow permeability, poor workability of subsoil, and seepage limit nonfarm uses. (Capability unit IIIe–1.)

Keene silt loam, 6 to 12 percent slopes, moderately eroded (KeC2). This sloping soil occupies rounded ridgetops, benches, and lower slopes. Most areas have been cleared and farmed, and erosion damage is quite variable. The surface soil is thinner, lighter colored, more shaly, and it has weaker structure than the representative profile. This results in reduced soil tilth and slightly lower available water capacity. Some severely eroded spots, often near the slope breaks, have less than 14 inches of silty material over the clayey subsoil. Seepage is usually associated with these eroded spots. Spring-fed drainageways commonly originate from this soil.

Small areas of the more shaly and less silty Coshocton soils and the less clayey Rayne soils are included with this soil in mapping.

A severe erosion hazard and reduced soil tilth are the primary limitations for most farm uses. Seepage and soil slippage present occasional hazards. Slow permeability, slope, and the clayey subsoils limit nonfarm uses. (Capability unit IIIe–1.)

Orrville Series

The Orrville series consists of medium-textured, somewhat poorly drained soils on flood plains. They are formed in sediments eroded from the nearby hills. Records indicate that flooding may be expected on the average of once a year. High bottom phases of these soils lie on slightly elevated positions that are subject to less frequent flooding. Orrville soils occur in nearly all of the tributaries to Little Mill Creek and in some large sections of the main valley.

A representative Orrville soil that is cultivated has a very dark grayish-brown, silt loam plow layer 9 inches thick. Below this to a depth of 30 inches is mottled dark grayish-brown, dark-brown, and grayish-brown silt loam or loam. Below 30 inches is gravelly stratified alluvium.

Orrville soils have moderate permeability and a seasonally high water table. They are slow to dry out in the spring unless they are artificially drained. The rooting zone of these soils is deep when the water table is low, and they have a medium to high available moisture capacity.

The Orrville series comprises more than half of the flood plain areas. Locally it is used primarily for pasture with some cropland in the broader areas.

The following is a representative profile of Orrville silt loam, 0 to 2 percent slopes, in a pasture 70 yards east of State Route 643 in Mill Creek Township, SW¼SE¼SE¼ sec. 20:

Horizon	*Description*
Ap	0 to 9 inches, very dark grayish-brown (10YR 3/2); crushed dark grayish-brown (10YR 4/2) silt loam; weak fine granular structure; friable; many roots; dark-brown (10YR 3/3) coatings on peds; 2 percent pebbles; medium acid; abrupt smooth boundary.
B1	9 to 13 inches, dark grayish-brown (10YR 4/2) silt loam; common fine faint brown (10YR 5/3) mottles in ped interiors; moderate fine subangular blocky structure; friable; many roots; 2 percent dark concretions; 2 percent pebbles; strongly acid; clear smooth boundary.
B21	13 to 17 inches, dark-brown (10YR 4/3) silt loam; many large distinct grayish-brown (10YR 5/2) and common fine distinct yellowish-brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common roots; dark grayish-brown (10YR 4/2) coating on peds; 10 percent dark concretions; 5 to 10 percent pebbles; strongly acid; clear smooth boundary.

B22	17 to 26 inches, grayish-brown (10YR 5/2) silt loam; many fine distinct yellowish-brown (10YR 5/6) and common medium distinct dark-brown (10YR 4/3) mottles; weak medium subangular blocky structure; friable; common roots; 5 percent dark concretions; 5 percent pebbles; strongly acid; clear wavy boundary.
B3	26 to 30 inches, 60 percent of mass is grayish-brown (10YR 5/2) ped surfaces, 40 percent is dark yellowish-brown (10YR 4/4) and yellowish-brown (10YR 5/6)-ped interiors; gravelly loam; weak medium subangular blocky structure; friable; few roots; 5 percent dark concretions; 15 percent gravel; medium acid; clear smooth boundary.
C	30 to 60 inches +, grayish-brown (10YR 5/2) gravelly sandy loam; common fine distinct yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) mottles; massive, friable; few roots; 30 percent gravel; medium acid.

Solum thickness is 24 to 40 inches. Bedrock is mostly below a depth of 10 feet, but it may occur as shallow as 5 to 6 feet in some narrow valleys. Reaction ranges from slightly acid to strongly acid throughout the solum. The crushed color of the A1 or Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2). Most surface layers have slightly darker colors on ped surfaces than ped interiors. The B horizon has base colors with hues of 10YR or 2.5Y, values of 4 to 6, and chromas of 1 to 4. Texture of the B horizon is silt loam or loam; coarse fragments range from 0 to about 15 percent in the solum. Below 30 inches, the soil contains strata with a variety of textures, including gravelly layers in most profiles.

Orrville soils are adjacent to the well-drained Chagrin soils on the flood plains. Also on the flood plains, but at a slightly higher elevation, are the high bottom phases of the Chagrin and Orrville soils. The lower lying Orrville soils contain more sand in their subsoils than the high bottom phases of the Orrville and Chagrin soils.

Mapping units:

Orrville silt loam (Or). This soil occurs primarily on flood plains of Little Mill Creek tributaries and occupies some large parts of the main valley floor. Several areas of this soil occur in the valleys on the N.A.E.W. station. This soil is seasonally wet because of hillside seepage and runoff that spreads on to the flood plain. The water table is also affected by the water level in the nearby stream. Artificial drainage is needed; however, some areas do not have suitable tile drainage outlets.

Included in mapping are narrow bands of the well-drained Chagrin soils along the stream channels in the broader areas of this soil. Some small areas of wetter soils occur in the small tributaries in the upper reaches of the watershed, and these are included with this soil as well as a few small alluvial fans.

The flooding hazard and seasonally high water table limit the farm and nonfarm uses of this soil. (Capability unit IIw-1.)

Orrville silt loam, high bottom (Os). This soil occupies long narrow segments of landscape that lie on slightly elevated segments of the valley floor along the base of the hill slopes and on the opposite side from the stream channel. Most segments of this soil are separated from the slightly lower positioned Chagrin and Orrville soils by a strip of Chagrin high bottom soil. Orrville high bottom soil receives much runoff and seepage water from the adjacent slopes. This soil is lower in sand content and is subject to less frequent flooding than the normal Orrville soils. Some spots near the hill slopes contain more coarse fragments than typical for the Orrville Series.

The seasonally high water table and flooding hazard of this soil limit many farm and nonfarm uses. Production of most farm crops requires artificial drainage. (Capability unit IIw-1.)

Rayne Series

The Rayne Series consists of silty, well-drained soils formed in residuum from acid silty shale, siltstone, or fine-grained sandstone. Some areas are capped by silts that are up to 15 inches thick. These soils occupy narrow ridgetops, benches, and hillsides. These soils commonly are gently sloping to moderately steep, but they include steep and very steep areas on lower landscape positions. The hard underlying bedrock materials usually form convex landscape segments.

Rayne soils frequently occur in complex with Coshocton soils on sloping to steep areas. They also occur in complex with Dekalb soils on the steep and very steep areas that border the Little Mill Creek flood plain.

A representative Rayne soil that is cultivated has a dark-brown silt loam plow layer 9 inches thick and has a dark yellowish-brown silt loam and shaly loam subsoil to a depth of 27 inches. The lower part of the subsoil and the substratum from 27 to 55 inches is yellowish-brown shaly or very shaly silt loam. Silty shale bedrock is at a depth of 55 inches.

These soils have moderate permeability, deep rooting zones, and medium available moisture capacity.

Local Rayne soils are used primarily for rotation crops or pasture. Some steep areas are wooded.

Following is a representative profile of Rayne silt loam, 6 to 12 percent slopes, moderately eroded, in a meadow crop field on the N.A.E.W., White Eyes Township SE¼NW¼NE¼ sec. 5:

Horizon	*Description*
Ap	0 to 9 inches, dark brown (10YR 4/3) silt loam; weak fine granular structure; friable, many roots; 5 percent shale fragments up to 3 inches in diameter; slightly acid; abrupt smooth boundary.

B21t — 9 to 17 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate fine and medium subangular blocky structure; friable; common roots; thin patchy yellowish-brown (10YR 5/4) clay films; 8 percent shale fragments less than 3 inches in diameter; medium acid; gradual smooth boundary.

B22t — 17 to 27 inches, dark yellowish-brown (10YR 4/4) shaly loam; weak fine and medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 20 percent shale fragments less than 3 inches in diameter; very strongly acid; gradual wavy boundary.

B3t — 27 to 40 inches, yellowish-brown (10YR 5/4) shaly silt loam; some platiness from shale weathering in place which parts to weak coarse and medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 40 percent shale fragments up to 3 inches in diameter; very strongly acid; gradual wavy boundary.

C — 40 to 55 inches, yellowish-brown (10YR 5/4) very shaly silt loam; streaks of light brownish gray (2.5Y 6/2); massive; few roots; thin patchy dark-brown (7.5YR 4/4) clay films on shale faces; 60 percent shale fragments (increases to 80 percent at a depth of 50 inches) less than 3 inches in diameter; shale interiors are yellowish brown (10YR 5/8); very strongly acid; gradual wavy boundary.

R — 55 inches +, silty shale bedrock.

Depth to bedrock ranges from 40 to 72 inches. Weathered shales frequently occur above a depth of 40 inches. A few sandstone and shale fragments are common throughout and usually increase in content with depth. Unless limed, the reaction is strongly acid or very strongly acid throughout the solum. The Ap horizon colors are dark brown (10YR 4/3) to dark yellowish brown (10YR 4/4).

B2 horizon colors are yellowish brown (10YR 5/4 or 5/6), dark yellowish brown (10YR 4/4), or strong brown (7.5YR 5/6). Texture of the B horizon typically is heavy silt loam but includes light silty clay loam and heavy loam or shaly phases of these. Clay films are thin, and they vary from patchy to nearly continuous on ped faces. Structure is weak or moderate, fine or medium subangular blocky. A B3 or C horizon usually occurs in this soil with textures of silt loam, light silty clay loam, loam, or clay loam that are shaly, very shaly, or channery. Colors are brown, yellowish brown, or grayish brown.

Rayne soils are adjacent to Coshocton, Keene, Berks, and Dekalb soils. Rayne soils, lacking the gray colors, have less clay in their lower horizons than Coshocton and Keene soils. They contain less coarse fragments, and they are deeper to bedrock than Dekalb and Berks soils.

Mapping units:

Rayne silt loam, 2 to 6 percent slopes (ReB). This gently sloping soil, occupying ridgetops, is typically joined by Keene and Coshocton soils on the ridgetops, and by Berks soils on the slope breaks below the ridge. Inclusions of small areas of these adjoining soils are in this mapping unit. Some areas, underlain by a thin bed of sandstone, have loamy textures in the lower part of the solum. The profile of this soil has more silt and less coarse fragments in the upper layers than the profile described as representative for the series.

Occurring in small areas, this soil is normally farmed with nearby Keene and Coshocton soils. Few limitations exist for either farm or nonfarm uses, although the underlying rock strata may be difficult to excavate. (Capability unit IIe–1.)

Rayne silt loam, 6 to 12 percent slopes, moderately eroded (ReC2). This sloping soil occupies narrow, rounded ridgetops and benches throughout the survey area. A profile of this soil is representative for the series. Most areas of the soil are less than 5 acres. This soil is adjacent to Berks, Coshocton, and Keene, and it includes spots of these soils. A few areas adjacent to Dekalb soils may be underlain by loamy textures and sandstone bedrock below a depth of 2 feet.

A severe erosion hazard limits most farm uses of this soil. The underlying bedrock and slope may limit some nonfarm uses. (Capability unit IIIe–1.)

Rayne silt loam, 12 to 18 percent slopes, moderately eroded (ReD2). This soil occupies upper slopes and knob positions, and in some areas it occurs at middle slope on benches. Units occurring on benches and upper slopes are long and narrow. This soil is adjacent to Berks and Coshocton soils, and it usually has inclusions of them. The profile of this soil contains less silt and more coarse fragments than the profile described as representative for the series.

The moderately steep slopes that create a very severe erosion hazard limit the farm uses of this soil. Moderately steep slopes and underlying bedrock limit many nonfarm uses. (Capability unit IVe–1.)

Rayne silt loam, 12 to 18 percent slopes, severely eroded (ReD3). This soil occupies upper slopes or ridgetop landscape positions. Most areas are small and irregularly shaped. This soil has been subjected to poor farming practices and most of the surface soil has been removed by erosion. The profile of this soil has a thinner and lighter colored surface than the profile described as representative. It also has more shale fragments throughout and has a slightly lower available moisture capacity.

Past erosion damage and hazard of further erosion limit many farm uses of this soil. These features, plus underlying bedrock and moderately steep slopes, limit most nonfarm uses. (Capability unit VIe–1.)

Rayne-Dekalb complex, 18 to 25 percent slopes, moderately eroded (RfE2). This mapping unit consists of steep areas of Rayne and Dekalb soils occurring in a mixed pattern on lower landscape positions. It lies between the flood plain below and the less sloping upland soils above (fig. 24). Areas are mostly less than 500 feet in width, but extend up to a mile in length. This mapping unit is frequently dissected by drainageways.

Bedrock is exposed in the deeper cuts and on slope points. The Massillon sandstone is the principal underlying bedrock (fig. 22).

Composition of this mapping unit is quite variable, but ranges are estimated as follows: Rayne, 40 to 70 percent, and Dekalb, 15 to 45 percent. Rayne and Dekalb soils have profiles deeper to bedrock than those described as representative for the series.

The more silty material in which the Rayne soils are formed is considered to be deposits of soil creep from nearby slopes. Some wind and water deposition may also be present. Rayne soils are more extensive along the tributaries of Little Mill Creek than along the creek itself.

Primary inclusions with this soil in mapping are areas that are either deeper to bedrock or higher in silt content than either Rayne or Dekalb soils. These areas are in coves and ravines where good tree growth can be expected. Spots with silt loam surface soil texture are included in the Dekalb areas which have slightly higher available moisture capacity than Dekalb.

Most areas are used for pasture or woodland. The steep slopes limit most farm and nonfarm uses. (Capability unit IVe-1.)

Rayne-Dekalb complex, 25 to 35 percent slopes, moderately eroded (RfF2). This very steep, escarpmentlike mapping unit consists of Rayne and Dekalb soils occurring in an intricate pattern. It occurs at the base of long moderately steep to steep slopes and borders the flood plains. Dekalb soils occur on the more exposed areas, such as slope points, and Rayne soils commonly occupy the cove and ravine areas. Composition of this mapping unit is quite variable, but ranges are estimated: Rayne, 40 to 70 percent and Dekalb, 15 to 45 percent.

Soil areas are long and narrow with some areas reaching a mile in length. Most areas are dissected by drainageways that have incised deeply and have left bedrock escarpments and overhangs. Occasionally bedrock will also protrude on the points of the slope. The Massillon sandstone is the principal underlying bedrock (fig. 22).

Rayne and Dekalb soils have profiles similar to those described as representative for the series. Spots that are deeper to bedrock than either Rayne or Dekalb are included in mapping, mainly in cove areas. These soils are used for woodland and pasture. Well suited to trees, good growth can be expected in the cove and ravine areas. The very steep slopes limit most other farm and nonfarm uses. (Capability unit VIe-1.)

Stony colluvial land

This land has stones and boulders on the surface that are as much as 6 feet in diameter and that are mixed throughout the soil. One area of this land on the N.A.E.W. was evaluated by examination of six backhoe pits. This study indicated that stones and stone fragments comprise an average of 50 to 60 percent of the volume in the top 30 inches of soil material. Coarse material is dominately sandstone, and soil texture is silt loam and loam. Below 30 inches, stone content decreases abruptly to interbedded clays, silts, coal seams, coal underclays, and soft shale beds.

The upper 30 inches appear to be colluvial deposition, and the layers below, although mostly intact, indicate some evidence of colluvial movement. Depth to hard bedrock is greater than 8 feet. A seasonal water table occurs at a depth from 3 to 6 feet. Reaction is very strongly acid in the upper layers and in medium acid to neutral below 5 feet.

Mapping unit:

Stony colluvial land, Dekalb soil materials, rolling (ScC). This stony land occupies cove and bench positions high in the watershed. It commonly lies at the heads of drainageways and at the base of sandstone-dominated slopes. The areas are less than 10 acres and irregularly shaped. This land has concave slopes that range from 6 to 18 percent. It receives seepage and surface water from the slopes above, and it is moist most of the year. Most farm uses of this land are limited; however, good tree growth can be expected. (Capability unit VIs-1.)

Strip mine spoil

Approximately 2.5 percent of the area in the Little Mill Creek watershed has been strip mined for coal. All mining has occurred within the past 20 years, and several mines are still active. Although several seams of coal occur in this area, only one has been mined. This is the Middle Kittanning coal, or number 6 seam, which is the thickest and highest coal vein in the watershed. No strip mining has occurred on the N.A.E.W. lands.

The spoils are composed mostly of broken acid shale, siltstone, and sandstone bedrock mixed with lesser amounts of soil material and unconsolidated clays. They are divided into two groups—areas dominated by sandstone materials and areas dominated by shale materials. All areas are extremely to strongly acid (pH 3.6 to 5.5), and most areas contain spots of pH less than 3.5, which are toxic to plants. The amount of grading of the spoils after mining has been quite variable, ranging from little to complete regrading. One area was reshaped to its original contour, and the original soil was replaced on the surface. The gradient classes include undulating, steep, and very steep.

Mapping units:

Strip mine spoil, sandstone materials, very steep (SsG). These spoils occur along the east side of Little Mill Creek watershed north of the N.A.E.W. They extend along the base of sandstone-capped ridgetops, and they are separated from the ridge and upper slope soils by a prominent highwall. The overburden in this area was too great to permit complete removal of the coal. Small pools of water stand in the open pits below the highwalls.

Sandstone dominates the spoils that have loam or sandy loam textures. All areas are acid and include large spots toxic to plants. Most areas have been planted to trees, but establishment of vegetative cover has been spotty because of the toxic areas. Spots that are bare of vegetation have eroded severely. Slopes are uneven, and they average greater than 25 percent. Most of them have stony or very stony surfaces. Establishing trees is the main concern of management. (Capability unit VIIs–2.)

Strip mine spoil, shale materials, rolling (StC). These spoils occur on ridgetops along the southeast and north boundaries of Little Mill Creek watershed. The coal vein has been completely removed, and the spoils leveled to 6 to 12 percent slopes. The spoils are dominated by shales and have silt loam, silty clay loam, and clay loam textures. Parts of these areas are toxic to plants. Runoff is rapid, and the hazard of erosion is severe. Stones on the surface limit tillage of these spoils, but some nontoxic areas can be treated for hay or pasture. (Capability unit VIs–2.)

Strip mine spoil, shale materials, steep (StE). This consists of one large moderately steep to steep area occurring west of the N.A.E.W. on the east boundary of Little Mill Creek watershed. These spoils are dominated by siltstone and shale and are low in sand content. The surface is rough, irregular, and very stony. Overloading of spoils on the slope has triggered large soil slips. Masses of spoil have slid on to adjoining undisturbed land. Part of the area is extremely acid and toxic to plants. Slopes range from 12 to 25 percent. Runoff is rapid but intercepted by rills and pockets in the rough surface; erosion is a very severe hazard. Establishment of a vegetative cover is the primary management concern. (Capability unit VIIs–2.)

Strip mine spoil, shale materials, very steep (StG). These are very steep spoils occurring near the ridgetops along the watershed divide. The spoils, dominated by shales, have many sandstones and siltstones on the surface. The surface is uneven and the slopes average greater than 25 percent. Parts of these areas are extremely acid and are toxic to plants. Runoff is rapid and the erosion hazard is very severe. In most areas there is a high wall. Controlling erosion and establishing trees are the main concerns in managing these strip-mined areas. (Capability unit VIIs–2.)

Strip-mine spoil, reclaimed, steep (SvE). This comprises one unit of soil along the northwest boundary of the Little Mill Creek watershed. It is a moderately steep to steep knob which has been reclaimed for farming. This soil contains many shale fragments but these do not hinder tillage operations. The surface layer is a mixture of the original surface soil and subsoil materials. Included are some very shaly spots that are more droughty. Slopes are 12 to 25 percent. This soil is suited to small grain and meadow. Careful management is needed. (Capability unit VIs–2.)

Soil acreage

Total survey area

The area of each of the 42 mapping units is given in table 5. Total area mapped was 5,555 acres. The five units of largest size that comprise half the acreage mapped are:

CrD2, 1,332 acres,
CrE2, 569 acres,
RfF2, 354 acres,
CrC2, 261 acres, and
ReD2, 258 acres.

The 10 largest mapping units make up 70 percent of the area mapped. There are 6 units of 12 acres or less.

TABLE 5.—*Acreage of soils mapping units*

Mapping units	Acres	Description
BrC2	53	Berks shaly silt loam, 6 to 12 percent slopes, moderately eroded.
BrD2	17	Berks shaly silt loam, 12 to 18 percent slopes, moderately eroded.
BrE2	149	Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded.
BrE3	25	Berks shaly silt loam, 18 to 25 percent slopes, severely eroded.
BrF2	86	Berks shaly silt loam, 25 to 35 percent slopes, moderately eroded.
Ch	85	Chagrin silt loam.
Ck	37	Chagrin silt loam, high bottom.
ClC	113	Clarksburg silt loam, 6 to 12 percent slopes.
ClD	178	Clarksburg silt loam, 12 to 18 percent slopes.
CoB2	5	Coshocton silt loam, 2 to 6 percent slopes, moderately eroded.
CoC2	57	Coshocton silt loam, 6 to 12 percent slopes, moderately eroded.
CoD2	83	Coshocton silt loam, 12 to 18 percent slopes, moderately eroded.
CrC2	261	Coshocton-Rayne silt loams, 6 to 12 percent slopes, moderately eroded.
CrC3	17	Coshocton-Rayne silt loams, 6 to 12 percent slopes, severely eroded.
CrD2	1,332	Coshocton-Rayne silt loams, 12 to 18 percent slopes, moderately eroded.
CrD3	11	Coshocton-Rayne silt loams, 12 to 18 percent slopes, severely eroded.
CrE2	569	Coshocton-Rayne silt loams, 18 to 25 percent slopes, moderately eroded.
DkC2	103	Dekalb channery sandy loam, 6 to 12 percent slopes, moderately eroded.
DkD2	106	Dekalb channery sandy loam, 12 to 18 percent slopes, moderately eroded.

TABLE 5.—*Acreage of soils mapping units*—Continued

Mapping units	Acres	Description
DkE2	170	Dekalb channery sandy loam, 18 to 25 percent slopes, moderately eroded.
DkF2	81	Dekalb channery sandy loam, 25 to 35 percent slopes, moderately eroded.
DlC	13	Dekalb extremely stony sandy loam, 6 to 12 percent slopes.
DlD	6	Dekalb extremely stony sandy loam, 12 to 18 percent slopes.
DlE	26	Dekalb extremely stony sandy loam, 18 to 25 percent slopes.
GfC	90	Glenford silt loam, 6 to 12 percent slopes.
KeB	112	Keene silt loam, 2 to 6 pereent slopes.
KeC	59	Keene silt loam, 6 to 12 percent slopes.
KeC2	239	Keene silt loam, 6 to 12 percent slopes, moderately eroded.
Or	250	Orrville silt loam.
Os	19	Orrville silt loam, high bottom.
ReB	42	Rayne silt loam, 2 to 6 percent slopes.
ReC2	200	Rayne silt loam, 6 to 12 percent slopes, moderately eroded.
ReD2	258	Rayne silt loam, 12 to 18 percent slopes, moderately eroded.
ReD3	10	Rayne silt loam, 12 to 18 percent slopes, severely eroded.
RfE2	148	Rayne-Dekalb complex, 18 to 25 pereent slopes, moderately eroded.
RfF2	354	Rayne-Dekalb complex, 25 to 35 pereent slopes, moderately eroded.
ScC	55	Stony eolluvial land, Dekalb soil materials, rolling.
SsG	67	Strip mine spoil, sandstone materials, very steep.
StC	12	Strip mine spoil, shale materials, rolling.
StE	20	Strip mine spoil, shale materials, steep.
StG	33	Strip mine spoil, shale materials, very steep.
SvE	4	Strip mine spoil, reclaimed, steep.
Total	5,555	

Mixed-cover watersheds on government land

Acreage of each soil in each of the complex watersheds on the government land (fig. 4) of the N.A.E.W. (table 6) is an important factor in the interpretation and analyses of the hydrologic data. These watersheds range from 29 to 303 acres in size. Of further value is the location of these soils within each watershed, as shown on the soil maps (fig. 25).

Single-cover watersheds on government land

Acreage of each soil in each of the single-cover watersheds on the government land (table 7) will be of considerable value to the users of hydrologic data from these watersheds. Of further value is the location of these soils shown on individual topographic maps (app. A, figs. 32 to 58) and the accompanying descriptive material. Descriptive materials include important physical and chemical characteristics of each soil sampled. Sampling sites are shown on the maps.

Mixed-cover watersheds in the Little Mill Creek basin

Acreage of each soil in each watershed in Little Mill Creek (fig. 5) is given in table 8. Watershed 19, 22.6 acres, contains 15.1 acres of steep, shale-dominated, strip-mine spoils. Strip mining operations were finished in this watershed in 1966.

Watershed 19 is a part of 20 (fig. 5). In addition to the steep strip-mine spoil in 19, there are 3.2 acres of very steep spoil and 4.3 acres of rolling spoil in watershed 20.

About half of the Little Mill Creek watersheds of 292 to 4,580 acres is comprised of the Coshocton-Rayne and Rayne soils. Of these, the Coshocton-Rayne on 12 to 18 percent slopes, moderately eroded, makes up over one quarter of the watershed areas. There appears to be considerable similarity in the soils of at least half these watershed areas.

The location of each soil in each watershed is shown on the soil maps (fig. 25).

Soils at lysimeter sites

The Coshocton lysimeters were planned to obtain data on the various water-cycle factors under different seasonal, vegetal, land use, and soil-type conditions. Since 1944, hydrologic data from three different sites have been summarized by Harrold and Dreibelbis (*15, 16*). Location of these sites, Y101 (four lysimeters), Y102 (three lysimeters), and Y103 (four lysimeters), are shown in figure 4. At each site one lysimeter of 65 tons gross weight is equipped with mechanical scales sensitive to 5-pound weight (water storage) change. Each lysimeter has a surface area of 0.002 acre (6.22 by 14 feet) and depth of 8 feet. The entire natural plant rooting depth has been encased because bedrock lies at a depth of about 5 feet.

Soil blocks were enclosed by building concrete casings in location on the ground surface and by lowering them into the soil profile after removing the soil beneath the cutting edge of the casing, then allowing them to sink to the 8-foot depth (fig. 26). Finally, perforated steel percolation pans were forced into the shale or sandstone bedrock at the bottom edge of the casing to complete the isolation of the soil monolith. Construction and recording features of the lysimeters along with cropping history and hydrologic data have been presented by Harrold and Dreibelbis (*15, 16*). An artist's concept of lysimeter features appears in figure 27. The 1958 bulletin presents data on mechanical and chemical characteristics of the soil along with descriptions of the soil profiles at each of the three sites.

All soil management practices on the lysimeters were made by hand, attempting to simulate those performed by farm machinery on adjacent watersheds. Vegetation on lysimeters of 23 percent slope at site Y101 was permanent grass or grass-legume mixtures. Cropping of lysimeters on slopes of 13 percent (Y102) and 6 percent (Y103) followed a 4-year rotation of corn, wheat, and 2 years of meadow.

Since 1959, data on soil water storage changes were obtained with the neutron probe at depths from 1 to 7 feet and with electrical resistance blocks in the 0- to 1-foot depth. Except for soil tillage on lysimeters of Y102 and Y103, no soil has been manually disturbed or removed from the lysimeter profiles. The other exception is the augering removal of soil from inside the 1½-inch diameter access tube for the nuclear soil-water probe as it was driven into the bedrock at 5- to 7-foot depths—one tube per lysimeter. Profile descriptions follow:

Y101

This lysimeter is located in a Dekalb (DkE2) mapping unit on a 23-percent slope having an eastern aspect. The area had been cleared and cropped by early settlers; but, since the 1930's, land use has been restricted to pasture and meadow.

Soil within the lysimeter has less sand and more silt throughout the solum than allowable in the Dekalb Series. Silt loam textures in the upper 16 inches overlie loams in the lower part of the solum. The original A1 horizon has been mixed by cultivation with any A2 which may have been present, resulting in an Ap horizon of 7 to 8 inches clearly distinguishable from the underlying B1. This profile is well drained, and it probably has a higher available moisture capacity than the typical Dekalb profile.

Profile site 1023 (app. A, table 17) was sampled 100 feet southwest of the Y101 site, and it is comparable to the lysimeter solum. Below 30 inches, the lysimeter soils are well described by the representative Dekalb profile.

Watershed 104, adjacent to Y101, is also in pasture grass-legume vegetation.

TABLE 6.—*Soils by mapping units in mixed-cover watersheds on government land, 1970*

Mapping unit symbol	Acres of soil mapping unit in watershed number[1]										
	166	169	172	174	177	182	183	185	187	194	196
BrC2	1.1	0.6	1.5	0	1.1	0	0	0	0	0.6	0.7
BrD2	4.3	0	0	1.1	3.9	0	0	0	.8	1.1	1.1
BrE2	9.1	6.3	9.7	2.5	9.1	0	0	1.0	0	16.7	16.7
BrF2	2.1	0	14.9	0	2.1	0	0	0	0	0	0
Ch	0	0	0	0	0	0	0	0	0	0	2.4
ClC	0	2.1	0	1.3	0	0	0	.6	0	8.2	10.9
ClD	.2	7.3	0	0	.2	6.3	6.3	0	1.6	0	0
CoB2	0	0	0	3.4	0	0	0	0	0	3.8	3.8
CoC2	.1	0	0	.6	.1	0	0	1.1	0	5.7	21.6
CoD2	0	6.8	0	0	0	0	0	0	0	0	2.7
CrC2	14.7	0	0	0	14.3	0	0	0	0	2.4	2.4
CrC3	0	0	0	0	0	.4	.4	0	0	0	12.3
CrD2	13.5	0	2.2	10.9	13.5	12.7	15.0	0	2.6	56.0	56.0
CrD3	0	0	0	.5	0	0	0	0	0	2.6	2.6
CrE2	0	0	8.2	0	0	4.0	4.0	0	0	0	10.7
DkC2	1.3	.9	.3	.5	1.3	1.8	1.8	.1	0	2.6	5.0
DkD2	0	0	1.3	0	0	0	0	0	.2	.1	.1
DkE2	9.7	0	2.1	3.6	9.7	9.1	9.1	0	0	3.5	12.5
DkF2	.6	0	2.2	0	.6	0	0	0	0	1.0	5.0
DlC	0	0	0	0	0	0	0	0	0	0	1.2
DlE	0	0	0	0	0	1.3	1.3	0	0	0	7.1
GfC	0	0	0	.8	0	6.6	6.6	0	0	15.4	15.4
KeB	3.2	0	0	6.8	3.2	1.6	1.6	0	0	7.4	10.9
KeC	0	0	0	5.4	0	0	0	0	0	5.2	5.2
KeC2	1.3	.4	0	0	1.3	6.1	6.1	0	0	9.0	10.1
Or	3.8	0	0	0	3.1	1.4	1.4	0	0	0	.9
ReB	0	0	0	.4	0	0	0	1.0	0	2.1	2.1
ReC2	0	.6	1.2	1.7	0	6.7	6.7	.1	0	3.1	7.0
ReD2	14.2	4.0	0	5.5	12.1	2.8	2.8	3.5	2.0	12.1	25.3
ReD3	0	0	0	4.5	0	.7	.7	0	0	5.5	8.4
RfF2	0	0	0	3.3	0	8.1	10.4	0	0	20.1	34.1
SsD	0	0	0	0	0	0	0	0	0	2.8	9.4
Total	79.2	29.0	43.6	52.8	75.6	69.6	74.2	7.4	7.2	187.0	303.0

[1] Watersheds located on figure 4.

TABLE 7.—*Soils by mapping units in single-cover watersheds, 1970*[1]

Watershed		Mapping unit											
Number	*Acres*	*Symbol*	*Acres*	*Symbol*	*Acres*	*Symbol*	*Acres*	*Symbol*	*Acres*	*Symbol*	*Acres*	*Symbol*	*Acres*
102	1.3	ReD2	0.4	DkE2	0.9								
103	.6	ReB	.1	ReD2	.1	CoC2	0.4						
104	1.3	ReD2	.2	DkE2	1.1								
106	1.6	ReC2	.5	BrE2	1.1								
107	2.6	ReD2	.5	CoD2	1.1	BrE2	.8	KeC2	0.2				
109	1.7	ReC2	1.1	BrC2	.1	BrD2	.5						
110	1.3	ReB	.1	ReD2	.6	KeC2	.6						
111	1.2	CoC2	.5	KeB	.1	KeC2	.6						
113	1.4	ReD2	.4	ClD	.1	KeB	.4	KeC2	.5				
115	1.6	ReB	.2	ReC2	.6	CoB2	.6	KeB	.2				
118	2.0	ClC	.3	CoC2	1.7								
121	1.4	ReC2	.2	ClD	.1	BrE2	1.1						
123	1.4	ReC2	.3	KeB	1.1								
124	1.2	ReC2	.1	ReD2	.3	ClC	.1	CoC2	.2	GfC	0.3	KeC2	0.2
127	1.6	ClC	.1	KeB	.5	CrD2	1.0						
128	2.2	ReB	.6	BrE2	1.0	CrC3	.6						
129	2.7	ReD2	.4	BrE2	2.3								
130	1.6	ReC2	.1	BrE2	.6	DkE2	.5	CrE2	.4				
131	2.2	BrF2	.4	DkE2	.4	DkF2	.8	CrE2	.6				
132	.6	BrE2	.1	BrF2	.1	CrD2	.4						
134	.9	ReD2	.2	BrC2	.1	BrF2	.6						
135	2.7	ReD2	.6	BrE2	.4	DkC2	.6	KeB	.5	CrC2	.6		
188	2.0	ReB	.3	ReC2	1.3	GfC	.4						
191	1.0	ReB	.2	ReC2	.7	GfC	.1						
192	7.6	ReB	.1	ReC2	.7	BrE2	2.0	DkC2	.9	CrD2	2.0	ClC	1.9

[1] Watersheds located on figure 4.

Y102

Located on the boundary between mapping units BrD2 above and ReD2 below, this lysimeter battery has soil characteristics that lie near the range limits of Berks and Rayne. The surface has a 13-percent eastern slope and lies on a smooth landscape well suited for farming.

This soil is well drained, but it has more silt and less stone than does the Berks soil upslope. The lower part of the solum contains many siltstone and shale fragments, increasing with depth to the fractured shale bedrock at 40+ inches. A thin silt cap, prominent on the Rayne immediately downslope, makes the Ap and upper B horizons nonskeletal. Slightly heavier silt loam textures below the surface give the profile a moderate water-holding capacity, more like the Rayne than the Berks profile.

Profile site 1092 (app. A, table 20) describes the Rayne solum just downslope of lysimeter site Y102 whereas profile site 1091, upslope, is the skeletal Berks profile. The lysimeter solum has characteristics midway between these two. Depth to hard bedrock is greater than in the typical Berks profile, but it is at the shallow end of the range for Rayne.

Watershed 109, adjacent to Y102, is in a 4-year crop rotation.

PN-[illegible]

FIGURE 26.—Concrete casing for lysimeter, weighted [illegible] in partly excavated [illegible]

TABLE 8.—*Soils by mapping units in mixed-cover watersheds in Little Mill Creek watershed, 1970*

Mapping unit symbol	Acres of soil mapping unit in watershed number —[1]									
	5	10	11	19	20	91	92	94	95	97
BrC2	0	0	4.7	1.3	6.6	0	0	0	11.4	46.9
BrD2	0	0	0	0	.5	0	0	0	1.5	11.3
BrE2	0	3.3	2.1	0	0	10.8	20.5	20.5	31.2	86.9
BrE3	0	0	0	0	0	0	0	0	10.5	25.4
BrF2	0	0	15.8	0	0	0	0	0	21.1	62.3
Ch	2.5	0	0	0	0	0	14.2	14.2	35.7	76.4
Ck	0	0	0	0	0	0	0	0	10.5	36.8
ClC	21.8	0	0	0	0	30.3	65.9	77.7	80.2	80.2
ClD	0	0	9.0	.3	21.7	0	6.6	42.8	77.6	130.3
CoC2	4.5	0	0	0	0	0	4.5	4.5	4.5	28.2
CoD2	0	0	0	0	0	0	0	0	14.7	70.4
CrC2	3.5	7.1	.5	0	20.9	31.4	38.4	59.0	81.9	240.0
CrD2	72.3	77.7	84.3	5.9	131.8	76.6	250.7	416.0	720.0	1181.2
CrD3	0	0	0	0	2.1	0	0	0	0	8.8
CrE2	10.4	3.8	45.9	0	72.8	0	11.9	53.8	221.7	513.6
DkC2	21.3	1.1	1.0	0	0	10.8	38.7	63.5	77.0	86.3
DkD2	49.5	0	0	0	0	15.9	70.0	89.1	96.3	96.3
DkE2	14.8	0	0	0	0	10.3	30.7	57.6	90.8	112.4
DkF2	0	0	0	0	0	3.6	3.6	18.1	37.1	70.1
DlC	0	0	0	0	0	0	1.0	5.2	5.2	5.2
DlD	0	0	0	0	0	0	0	0	0	1.0
DlE	1.0	0	0	0	0	0	10.7	17.4	17.4	17.4
GfC	5.0	.3	0	0	22.0	0	10.0	10.0	14.0	60.2
KeB	15.8	.5	.5	0	0	17.0	34.8	43.6	46.6	78.1
KeC	14.8	0	13.2	0	0	10.3	25.1	29.3	42.4	53.8
KeC2	2.0	10.9	2.6	0	10.7	14.9	51.5	72.2	111.0	203.1
Or	10.9	3.8	9.0	0	16.6	6.7	29.8	79.4	131.1	236.4
Os	0	0	0	0	0	0	0	0	9.4	19.2
ReB	13.9	0	0.5	0	0	0	13.9	23.2	24.2	30.9
ReC2	29.7	13.6	17.4	0	16.6	1.0	46.5	62.5	108.0	157.1
ReD2	9.4	0	38.0	0	0	45.2	67.9	80.3	128.0	138.3
ReE2	0	0	0	0	27.8	0	0	21.7	36.8	147.7
RfF2	14.8	0	38.5	0	0	0	17.9	58.7	129.2	297.8
ScC	0	0	9.0	0	0	8.2	22.5	28.7	37.6	37.6
SsG	0	0	0	0	0	0	1.5	31.5	67.6	67.6
StC	7.9	0	0	0	4.3	0	7.9	7.9	7.9	12.2
StE	0	0	0	15.1	15.1	0	0	0	0	20.2
StG	18.8	0	0	0	3.2	0	18.8	24.5	24.5	32.9
SvE	4.5	0	0	0	0	0	4.5	4.5	4.5	4.5
Total	349.1	122.1	292.0	22.6	372.7	293.0	920.0	1517.4	2569.1	4585.0

[1] Watersheds located on figure 5.

Y103

The soil at this lysimeter site in a Keene (KeB) mapping unit is well described by the representative Keene profile, which was taken within 100 feet of this site. Slopes are 6 percent with a southern aspect and are near the crest of a broad, nearly flat ridge.

Profile site 1231 (app. A, table 27) describes the solum which overlies shale bedrock at approximately 6 to 7 feet.

Watershed 123, adjacent to Y103, is in a 4-year crop rotation.

Soil use and management

Land capability classification and management by capability units

Capability classification is the grouping of soils to show, in a general way, their suitability for most kinds of farming. It is a practical classification based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment. The soils are classified according to degree and kind of permanent limitation, but without consideration of major and generally expensive

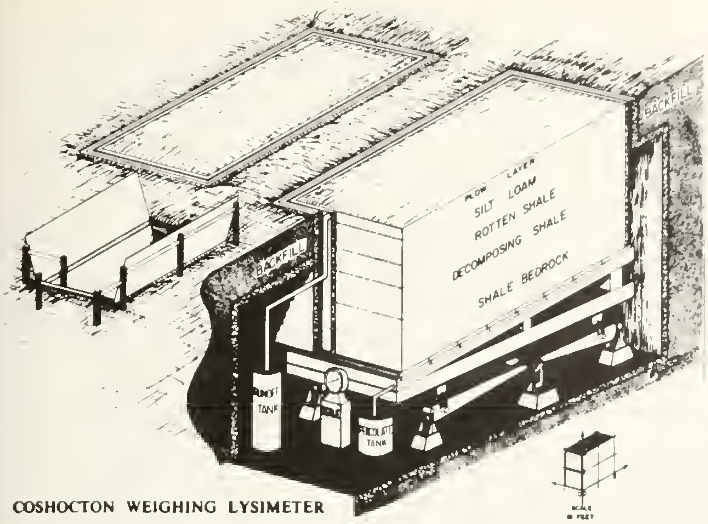

FIGURE 27. Sketch of lysimeter features.

landforming that would change the slope, depth, or other characteristics of the soils, and without consideration of possible major reclamation projects.

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

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

- Class I. Soils have few limitations that restrict their use.
- Class II. Soils have some limitations that reduce the choice of plants or require moderate conservation practices.
- Class III. Soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV. Soils have very severe limitations that restrict the choice of plants or that require careful management, or both.
- Class V. Soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife food and cover.
- Class VI. Soils have severe limitations that make them generally unsuited to cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.
- Class VII. Soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodland, or wildlife.
- Class VIII. Soils and landforms have limitations that preclude their use for commercial plant production and that restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

Capability subclasses are soil groups within one class; they are designated by adding a small letter e, w, or s, to the class numeral, for example, IIe. The letter e shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); and s shows that the soil is limited mainly because it is shallow, droughty, or stony.

Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. 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, IIIe-2. 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. The Arabic numeral specifically identifies the capability unit within each subclass.

The capability unit for agricultural use of each mapping unit in the research area is shown in table 9. Chagrin silt loam, high bottom phase is the only soil in capability class I. There are only 36.8 acres of this soil, all lying below gage 94 in Little Mill Creek (table 8). There are six series having mapping units in capability class II. Two of these, Orrville and Chagrin, involving 334 acres, are in high flood hazard positions. There are 19.2 acres of Orrville silt loam, high bottom phase, which occur in a low flood hazard position. Other series in class II are Rayne, Coshocton, and Keene with 2 to 6 percent slopes (table 9).

TABLE 9.—*Land capability units for agricultural use by soil mapping unit*

Mapping unit symbol	Land capability unit	Mapping unit symbol	Land capability unit
BrC2	IIIe-2	DlC	VIs-1
BrD2	IVe-2	DlD	VIs-1
BrE2	IVe-2	DlE	VIIs-1
BrE3	VIe-2	GfC	IIIe-1
BrF2	VIe-2	KeB	IIe-1
Ch	IIw high flood hazard	KeC	IIIe-1
Ck	I-1 low flood hazard	KeC2	IIIe-1
ClC	IIIe-1	Or	IIw high flood hazard
ClD	IVe-1	Os	IIw low flood hazard
CoB2	IIe-1	ReB	IIe-1
CoC2	IIIe-1	ReC2	IIIe-1
CoD2	IVe-1	ReD2	IVe-1
CrC2	IIIe-1	ReD3	VIe-1
CrC3	IVe-1	RiF2	IVe-1
CrD2	IVe-1	RiF2	VIe-1
CrD3	VIe-1	SeC	VIs-1
CrE2	VIe-1	*Mined land*	
DkC2	IIIe-2	SsG	VIIs-2
DkD2	IVe-2	StC	VIs-2
DkE2	IVe-2	StE	VIIs-2
DkF2	VIe-2	StG	VIIs-2
		SvF	VIs-2

Total acreage of capability class II is 492 acres, or 9 percent of the area mapped.

Class III capability involves nine mapping units that total 1,175 acres, or 22 percent of the entire area. Class IV capability includes 10 mapping units of 2,457 acres, or 45 percent of the area. Classes II, III, and IV cover about three-fourths of the area.

There is no class V land in the area. Class VI capability includes 12 mapping units of which 2 are mined land of 16 acres. Class VI land totals 1,226 acres, or 22 percent of the total area.

Class VII land, 146 acres, comprises 3 percent of the Little Mill Creek watershed. Of this, 138 acres are strip mine spoils.

No class VIII land occurs in the area.

Management by capability units: Land capability units in the experimental watershed areas are described, and land management for each is discussed. Certain soil features that limit agricultural use are explained as well as erosion hazards and drainage problems. Other features noted influence cropping patterns of specific capability units.

Capability unit I-1

This unit includes only Chagrin silt loam, high bottom phase, which occurs on slightly elevated areas of the flood plain (fig. 28). This is a deep, nearly level, moderately well drained soil that is subject to very infrequent flooding. Some areas are on elevations above the highest known flood levels.

Soil in this unit has a silt loam surface layer that is friable and easily worked. The subsoil, dominantly silt loam, does not restrict the growth of roots or the movement of water. A seasonal water table may rise into the lower subsoil during wet periods.

The available moisture capacity is high; seldom is the moisture supply inadequate for field crops. Artificial drainage is not needed except in wet spots which will drain effectively with tile.

Because this soil is nearly level, water erosion is not a hazard. It is naturally medium to strongly acid in the root zone of most crops, and it benefits from applications of lime.

The potential productivity of this soil is high, and it is well suited to all the field crops commonly grown in the

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FIGURE 28.—Flood plain includes capability units I-1 and IIw-1. Chagrin and Orrville soils occupy these positions.

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FIGURE 29. Field view of capability units of IIe 1, IIIe 1, and IVe 2 landscape. Keene and Rayne soils are in capability units IIe 1 and IIIe 1 on lower lying ridge in background, and Dekalb soils are in capability unit IVe 2 in meadow on high ridge in foreground.

area. This soil can be used intensively or even continuously for row crops if fertility and organic-matter content are maintained.

Capability unit IIe-1

This unit consists of deep, gently sloping, moderately well or well-drained soils of the Coshocton, Keene, and Rayne Series. These are upland soils that occur on ridgetop and bench positions (fig. 29).

Surface layers of these soils have silt loam textures; they are friable and easily worked. The upper part of the subsoil is silt loam or silty clay loam. Lower parts of Coshocton and Keene subsoils include silty clay texture which restricts the growth of roots to the vertical structure cracks commonly occurring in this part of the profile. Soft shale bedrock occurs at depths of 3½ to 7 feet.

The available moisture capacity is medium to high. The moisture supply is adequate for crops in most years. In dry years some moisture deficiencies may be evident, especially on the Rayne soils.

Seepage spots that require some artificial drainage occur in the Coshocton and Keene soils on bench positions; however, tile drains function well.

Erosion hazard is the chief land use limitation, and erosion control practices are needed. Rotations that include sod crops are commonly used on these soils.

These soils are naturally acid throughout, and additions of lime are normally required. These soils are productive if the fertility and organic matter content are maintained. They are well suited to all field crops commonly grown, including meadow and pasture. These soils on ridgetop positions are also well suited for orchards.

Capability unit IIw-1

This unit consists of deep, nearly level, well-drained to somewhat poorly drained soils of the Chagrin and Orrville Series. These soils are on flood plains (fig. 28) and are subject to occasional flooding for short periods. Orrville silt loam, high bottom phase occupies slightly higher positions and it is subject to infrequent flooding. However, these high bottom soils receive surface water from the adjoining hill slopes. Also, some ponding in low areas may occur for short periods after heavy rains. Flooding of the soils in this unit is principally in the winter and early spring months.

These soils have silt loam surface layers and loam or silt loam subsurface layers. Tilth is good—the surface layer is friable and is easy to work. Thin layers of sand and gravel are common below a depth of 3 feet. There are no layers that restrict the growth of roots within a depth of 4 feet.

The water table in Orrville soils is high during part of the year. Tile drains are effective, but suitable outlets are not always available. Shallow surface ditches to remove surface water concentrations from low areas are sometimes needed.

Soils in this unit are not as acid as the soils on uplands, but most areas require additions of lime. Row crops can be grown continuously if drainage is adequate and fertility and organic-matter content are maintained. Oats and wheat sometimes are stunted because of the high water table or are damaged by floods early in the spring. Alfalfa can be heaved during winter and sometimes maybe damaged by floods. Old stream channels and ditches from side streams dissect these soils and limit field size.

The soils in this unit are well suited to Ladino clover and Kentucky bluegrass. Row crops and pasture are the principal uses being made of these soils.

Capability unit IIIe-1

This unit consists of sloping, well-drained to moderately well drained soils of the Clarksburg, Coshocton, Glenford, Keene, and Rayne Series. They are on ridgetops, benches, and side slopes (fig. 29). These soils have silt loam surface horizons and silt loam, silty clay loam, or silty clay subsoils. Bedrock is at a depth of 3½ to 7 feet, but it may be much deeper in some areas of Glenford and Clarksburg soils.

These soils are all deep to bedrock, but the fine textures in the lower part of the subsoil of Keene and Coshocton and the fragipan in Clarksburg soils cause some limitations in the depth of root growth. These layers also restrict the downward movement of water. Available moisture capacity of these soils is medium to high. Moisture supply is seldom inadequate for crops except in Coshocton and Rayne soils during dry years.

Wetness is a problem only in small seep spots. These can be intercepted and drained with tile, although the slope may make this difficult in some areas.

Erosion is a severe hazard on soils of this unit, and erosion control conservation practices are needed for erosion control. Contour stripcropping with a rotation of corn, small grain, and meadow is used to control erosion in most areas. These naturally acid soils need lime.

Soils in this unit are suited to most field crops commonly grown in the area. Various hay and pasture crops are also suitable.

Capability unit IIIe-2

This unit consists of sloping, moderately deep, well-drained soils of the Berks and Dekalb Series occurring dominantly on ridgetop positions. These soils have silt loam or sandy loam surface layers and silt loam to loamy sand subsoils. Most textures are shaly or channery. Silty shale or sandstone bedrock is at depths of 20 to 40 inches.

These soils have moderately rapid to rapid permeability and low available moisture capacity. Periods of moisture deficiency for crops occur during average and dry years. Rooting depth is limited by bedrock.

Erosion is a severe hazard on these soils. Organic matter in the surface soils is low, and further loss of the surface soil by erosion is critical in maintaining the productivity of these soils. Contour stripcropping with crop rotations effectively controls erosion.

Stones near the surface of these soils, especially the Dekalb Series, hinder plowing in some areas. These soils are very acid, and quick crop response can be expected from lime and fertilizer applications.

The severe erosion hazard and droughtiness of these soils limit their use for row crops. However, the recent use of no-till corn has been at least partially effective in overcoming these limitations. These soils are well suited for small grains, meadows, pasture crops, and, because of their ridgetop position and dryness, orchards.

Capability unit IVe-1

This unit consists of deep, sloping to steep, well-drained or moderately well-drained soils of the Clarksburg, Coshocton, and Rayne series. These soils occur on side slopes and benches and they have silt loam surface textures. Most of these soils are moderately eroded, and one is severely eroded.

These soils have moderate to slow permeability. The growth of roots is restricted by fine textures in the Coshocton subsoils where roots are channeled into the vertical structure cracks. A fragipan in the Clarksburg soils also limits the depth of root growth.

A considerable amount of water runs off and the erosion hazard is very severe. Erosion control measures for cropland are essential. These soils are suited to row cropping when they are farmed in contour strips and in rotation with meadow crops. Most Clarksburg areas are small and dissected by deep ravines, making the use of contour strips very difficult.

The available moisture capacity is medium in most places. Natural drainage is adequate, except for some seeps and springs that are difficult to drain because of the steepness of slope.

The Coshocton and Rayne soils in this unit comprise a large part of the cropland soils on the hill land. Contour stripcropping is being used extensively with rotations of corn, small grain, and meadow (fig. 30). These soils are also well suited to pasture and meadow crops.

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FIGURE 30.—Contour strips on capability unit IVe-1 land. Coshocton and Rayne soils are in the background. Note the wooded sandstone knob (Dekalb soils) on horizon.

Capability unit IVe-2

This unit consists of moderately deep, moderately steep to steep, well-drained soils of the Berks and Dekalb Series. These soils occur on ridge knobs, benches, and side slopes (fig. 29). They are shaly or channery soils with silt loam or sandy loam surface layers and silt loam to loamy sand subsoils. Silty shale or sandstone bedrock is at depths of 20 to 40 inches.

The soils in this unit are strongly acid with moderately deep root zones and low available moisture capacities.

A very severe hazard of erosion is the major limitation to use of these soils, but droughtiness is also a concern. Periods of moisture deficiency for crops occur during average and dry years. Practices that return large amounts of crop residue to the soil, along with the maintenance of high fertility, will help overcome the droughtiness limitation. Crop response to fertilizer is good. Contour stripcropping effectively controls erosion on these soils.

The soils in this unit are not as well suited to corn or other row crops as they are to small grain, meadow, and pasture crops. However, good corn yields have been obtained during most years using no-till methods. Tillage is hindered by stones in some areas. When these soils occur on ridge knob positions, they offer good locations for orchards.

Capability unit VIe-1

This unit consists of deep, moderately steep to very steep, moderately well or well-drained soils of the Coshocton and Rayne Series. They occur on side slopes and benches. The moderately steep soils in this unit are severely eroded. The surface layers are silt loam, and the subsoils are silt loam to silty clay loam with some silty clay texture in the Coshocton subsoil.

The silty clay texture in Coshocton and the soft shale bedrock in Rayne present some root growth limitations within a depth of 3 feet. These soils have a medium available moisture capacity, and crop moisture will be deficient during dry years.

These soils have a very severe erosion hazard. The use of row crops should be limited to long rotations with close-growing crops. Contour stripcropping is effective in controlling erosion. Erosion damage has been moderate to severe. Good fertility and crop residue management is needed.

Some seeps and springs occur in these soils which are difficult to drain with tile because of the steepness of slope.

Coshocton-Rayne silt loams in this unit comprise some large areas of rotation cropland on which contour stripcropping is used extensively. These soils are also well suited to pasture and meadow crops.

Capability unit VIe-2

This unit consists of moderately deep, steep to very steep, well-drained soils of the Berks and Dekalb Series. On upper slopes and ridge knob positions (fig. 31), these soils are moderately deep over silty shale or sandstone bedrock. Textures throughout the soil are mostly shaly or channery and range from silt loam to loamy sand. The steep slopes in this unit are severely eroded.

Soils in this unit have a moderately rapid to rapid permeability and low available moisture capacity. Moisture deficiencies for crop growth can be expected during average or dry years.

These soils are not well suited to small grain or row crops because of steep slopes and droughtiness. Also, tillage may be hampered by stones near the surface, especially on Dekalb soils. These soils are well suited to pasture, woodland, and some meadow crops on the less sloping areas.

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FIGURE 31.—Pasture on Berks soils, capability unit VIe-2.

The erosion hazard is very severe and tillage should be kept to a minimum. Past erosion has been moderate to severe. These soils are acid, and a quick crop response can be expected from lime and fertilizer applications.

Meadow, pasture (fig. 31), and woodland are the dominant land uses. Tree species should be selected that are adapted to dry sites. Ridge knob positions are suitable for orchards.

Capability unit VIs-1

This unit consists of moderately deep to deep, sloping to moderately steep, well-drained soils of the Dekalb Series and Stony colluvial land. These soils predominantly occupy ridgetop and cove bench positions. They have many stones and boulders (sandstone) ranging from 1 to 10 feet in diameter on the surface and mixed through the soil. Textures are silt loam to sandy loam throughout.

Stones present severe limitations in the use of these soils. The operation of farm machinery is restricted to small areas among the stones. Also, the stones dilute the volume of soil, reduce the rooting zone, and lower the available moisture capacity.

Dekalb soils in this group are moderately deep to sandstone bedrock and are located on ridgetops and upper slopes which are dry sites. The Stony colluvial soils are in cove positions and are the recipient of surface and subsurface water that keeps them moist most of the year. Also, they are deep to solid bedrock.

These soils are limited to pasture or woodland, but the use of machinery to maintain pasture and to harvest trees is restricted. Overgrazing should be prevented to control erosion. The moisture relationships of these soils should be judged at each site to select the best tree species for planting.

Capability unit VIs-2

This unit consists of strip-mine spoils on rolling and steep areas (fig. 21). These spoils are dominantly broken shale materials that have been excavated during mining operations. They contain many rock fragments, but they have enough fine material at the surface to support vegetation. These spoils have been graded to various degrees. One area has had the original soil materials replaced on the surface, while other areas have had only minimum grading. These spoils are acid, and most areas contain toxic spots.

The strip-mine spoil in this unit has moderate to rapid permeability and medium to low available moisture capacity. The depth of the root zone varies.

The poor physical condition of the spoil material is the major limitation to the use of these spoils. They are droughty during dry periods, and erosion is a hazard on the steeper slopes. Tillage of these spoils is very difficult because of the stony and rough surface.

These strip-mine spoils are not suited to crops requiring tillage operations. Some areas may be useful as meadows where hay harvesting equipment can be used. Other areas are best suited to pasture or woodland. If these areas are pastured, an adequate plant cover should be maintained for erosion control. Plants tolerant to extremely acid conditions should be selected to obtain cover on the toxic spots.

Capability unit VIIs-1

This unit consists of only steep Dekalb, extremely stony sandy loam. This moderately deep, well-drained soil occurs on upper slope positions. Many sandstones ranging from 1 to 10 feet in diameter are located on the surface and are mixed through the soil. Textures are loam to sandy loam throughout.

The high landscape position, loamy textures, and quantity of stone diluting the soil mass make this a very dry soil. The available moisture capacity is low, even though the rooting zone is moderately deep over bedrock.

This soil is best suited for woodland, but the use of logging machinery is restricted. Pine and hardwood species tolerant to dry sites are best adapted to these soils.

Capability unit VIIs-2

This unit consists of strip-mine spoils on steep and very steep areas (fig. 21). These spoils consist of acid sandstone, siltstone, and shale materials that have been excavated during mining operations. They are stony to very stony and have low to very low available moisture capacity. Most areas contain toxic spots.

These spoils are either ungraded or smoothed only on the tops of the spoil piles. Slopes are mostly greater than 25 percent with the exception of one very stony area having slopes of 12 to 25 percent.

Poor physical condition, steep slopes, and stoniness limit the use of these spoils. Erosion is a severe hazard on the steeper slopes. The spoil material in this unit is suited only to trees; black locust is desirable.

Engineering uses of the soils

Certain physical and chemical properties of these soils are of special importance to engineers. Their characteristics relate to soils problems involved in the construction and maintenance of roads, pipelines, building foundations, water storage and erosion control structures, and drainage and waste disposal systems. Some properties important to the engineer (table 10) are permeability, shrink-swell characteristics, grain size, Unified and AASHO classifications, pH, and corrosion potential. Depths to water table and to bedrock are also important.

The data in table 10 do not eliminate the need for sampling and testing at the site of specific engineering works, particularly where heavy loads are to be supported and where the excavations are deeper than the depths of layers reported in this publication.

The wide range in characteristics of some mapping units precludes precise predictions of the physical properties and expected engineering performance. Furthermore, many soils have not been subjected to detailed soil mechanics tests. For many of them the only physical test data available are mechanical analyses, made according to U.S. Department of Agriculture standards, of soil profiles that occur somewhere within the range of characteristics of a soil series. Nevertheless, by using the information in table 10 an engineer can plan detailed investigations at proposed construction sites.

Some terms used by the soil scientist may be unfamiliar to the engineer, and some of them have special meanings in soil science. These terms, as well as other special terms that are used in this report, are defined in the Glossary.

Soil properties significant to engineering: Several estimated soil properties significant in engineering are given in table 10. These estimates are made for typical soil profiles, by layers sufficiently dissimilar to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other areas. The following are explanations of some of the columns in table 10:

Depth to bedrock is the distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary.

Soil texture is described in the standard terms used by the USDA. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, such an appropriate modifier is added as "gravelly loamy sand." Most terms used in USDA textural classification are defined in the Glossary.

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*38*) used by the SCS engineers, Department of Defense, and others, and the American Association of State Highway Officials (AASHO) system (*1*).

In the Unified classification, the soils are grouped on the basis of their texture and plasticity and their performance as material for engineering structures. In this system, two letters are used to designate each of 15 possible classes. The letters G, S, C, M, and O stand for gravel, sand, clay, silt, and organic soils, respectively, and W, P, L, and H refer to well graded, poorly graded, low liquid limit, and high liquid limit, respectively. In this system, SM and GM are sands and gravels that include fines of silt; ML and CL are silts and clays that have a low liquid limit; and MH and CH are silts and clays that have a high liquid limit.

The AASHO system is used to classify soils according to those properties that effect 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, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of soil characteristics observed in the field, particularly structure and texture. The estimates do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available moisture capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

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

Shrink-swell potential is the relative change in volume expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils may cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material of this rating.

Corrosivity, as used in table 10, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of *uncoated steel* is related to such soil properties as drainage, texture, total acidity, and electrical conductivity of the soil material. Ratings of soils for corrosivity for concrete are based mainly on soil texture and acidity. Installations that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of low means that there is a low probability of soil-induced corrosion damage. A rating of high means that there is a high probability of damage, so that protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

TABLE 10.—*Estimated soil prop-*

Soil series and mapping unit	Depth to		Depth from surface	Classification			Coarse fraction >3 inches
	Bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*Inches*				*Percent*
Berks (BrC2, BrD2, BrE2, BrE3, BrF2).	2-3½		0-5	Shaly silt loam	ML	A-4	0-10
		>4	5-19	Shaly silt loam or shaly loam	ML	A-4	0-10
			19-24	Very shaly loam or very shaly silt loam.	GM, ML	A-2, A-4	5-20
			24+	Silty shale and siltstone bedrock			
Chagrin[1] (Ch, Ck)	>5	>3	0-8	Silt loam	ML	A-4	
			8-25	Loam or silt loam	ML	A-4	
			25-60	Sandy loam, loam, or gravelly sandy loam.	SM, ML	A-2, A-4	0-15
Clarksburg (ClC, ClD)	>5	1½-3	0-14	Silt loam or channery silt loam	ML	A-4	0-10
			14-28	Channery silt loam or channery loam.	CL, ML	A-4, A-6	0-10
			28-61	Channery loam or channery silty clay loam.	ML, CL	A-4, A-6	5-20
Coshocton[2] (CoB2, CoC2, CoD2, CrC2, CrC3, CrD2, CrD3, CrE2)	3½-6	1½-3	0-7	Silt loam	ML	A-4	0-5
			7-14	Silt loam or silty clay loam	CL, ML	A-6	0-5
			14-27	Shaly silty clay loam or silty clay	CL, CH	A-6, A-7	0-10
			27-58	Shaly silty clay loam or shaly loam.	CL	A-6	0-15
			58-60+	Shale bedrock			
Dekalb (DkC2, DkD2, DkE2, DkF2, DlC, DlD, DlE)	2-3½	>4	0-6	Channery sandy loam or stony sandy loam.	ML, SM	A-2, A-4	10-25
			6-34	Channery sandy loam or channery loam.	SM, GM	A-2, A-4	15-35
			34+	Sandstone bedrock			
Glenford	>5	1½-3	0-12	Silt loam	ML	A-4	
			12-57	Silt loam or silty clay loam	CL, ML	A-6	
			57-72	Stratified silt loam and silty clay loam.	CL, ML	A-4, A-6	
Keene (KeB, KeC, KeC2)	3½-7	1½-3	0-12	Silt loam	ML	A-4	
			12-20	Silt loam or silty clay loam	ML, CL	A-6	0-2
			20-39	Silty clay loam or silty clay	CL, CH	A-6, A-7	0-10
			39-62	Shaly silty clay loam or silty clay	CL	A-6, A-7	5-15
Orrville[1] (Or, Os)	>5	½-1½	0-9	Silt loam	ML	A-4	
			9-30	Silt loam or loam	ML	A-4	
			30-60	Gravelly sandy loam	SM, ML	A-2, A-4	0-15

erties significant to engineering

Particles <3 inches passing sieve: Number 4 (4.7 millimeter)	Number 10 (2.0 millimeter)	Number 40 (0.42 millimeter)	Number 200 (0.074 millimeter)	Permeability	Available moisture capacity	Reaction	Shrink-swell potential	Corrosivity: Uncoated steel	Corrosivity: Concrete
Percent	*Percent*	*Percent*	*Percent*	*Inches per hour*	*Inches per hour*	*pH*			
70–90	65–85	55–80	50–70	2.0–6.0	0.14–0.18	4.5–7.3	Low	Low	Moderate to high.
65–85	55–75	50–70	50–65	2.0–6.0	.10– .14	4.5–6.0	Low	Low	Moderate to high.
40–70	35–65	30–60	25–55	2.0–6.0	.06– .10	4.5–5.5	Low	Low	Moderate to high.
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100	95–100	80–95	65–85	0.6–2.0	.17– .21	5.6–7.3	Low	Low	Low to moderate.
100	95–100	75–90	60–75	.6–2.0	.14– .18	5.6–6.5	Low	Low	Low to moderate.
80–100	75–95	50–70	35–65	.6–6.0	.10– .18	5.6–6.5	Low	Moderate	Low to moderate.
85–100	70–95	70–90	65–85	.6–2.0	.16– .20	5.1–7.3	Low	Moderate	Moderate.
80–100	70–85	65–85	60–80	.6–2.0	.13– .17	5.1–6.5	Low to moderate	Moderate	Moderate.
75–90	60–80	55–75	50–70	.06–0.2	.06– .10	5.1–6.5	Low	High	Moderate.
85–95	80–95	70–90	60–85	.6–2.0	.16– .20	5.1–7.3	Low	Moderate	Moderate.
85–95	80–95	70–90	60–85	.2– .6	.14– .18	4.1–5.5	Moderate	High	High.
80–95	75–90	70–85	65–80	.06– .2	.08– .12	4.1–5.5	Moderate	High	High.
70–80	55–75	45–70	40–65	.06– .6	.08– .12	4.1–5.5	Moderate	High	High.
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60–85	55–75	35–65	30–60	6.0–12.0	.10– .14	4.6–7.3	Low	Low	High.
50–85	45–70	35–60	30–50	6.0–12.0	.06– .12	4.0–5.5	Low	Low	High.
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100	100	90–100	85–95	.6–2.0	.16– .20	4.5–7.3	Low	Moderate	Moderate to high.
100	100	90–100	80–95	.2– .6	.14– .18	4.5–6.0	Low to moderate	Moderate	Moderate to high.
100	90–100	70–95	60–90	.2– .6	.13– .17	6.1–7.3	Low to moderate	Moderate	Low.
100	95–100	85–100	80–90	.6–2.0	.16– .20	4.0–7.3	Low	Moderate	High.
100	95–100	85–100	80–90	.2– .6	.13– .17	4.0–5.5	Moderate	High	High.
85–100	80–90	75–85	70–85	.06– .2	.08– .12	4.0–5.5	Moderate to high	High	High.
65–85	60–80	55–75	50–70	.06– .6	.08– .12	4.0–6.5	Moderate	High	Moderate to high.
100	95–100	80–95	65–85	.6–2.0	.16– .20	5.6–7.3	Low	High	Low to moderate.
100	95–100	80–90	60–75	.6–2.0	.12– .18	5.1–6.5	Low	High	Low to moderate.
80–100	70–95	40–70	30–60	.6–6.0	.08– .14	5.1–6.5	Low	High	Low to moderate.

TABLE 10.—*Estimated soil properties*

Soil series and mapping unit	Depth to Bedrock	Depth to Seasonal high water table	Depth from surface	Classification: USDA texture	Classification: Unified	Classification: AASHO	Coarse fraction >3 inches
	Feet	*Feet*	*Inches*				*Percent*
Rayne[3] (ReB, ReC2, ReD2, ReD3, RfE2, RfF2)	3½–6	>4	0–9	Silt loam	ML	A-4	0–5
			9–17	Silt loam	ML, CL	A-4, A-6	0–10
			17–40	Shaly silt loam or shaly loam	ML, CL	A-4, A-6	5–15
			40–55	Very shaly silt loam or very shaly loam.	GM	A-2	5–20
			55+	Silty shale bedrock			

[1] These soils are subject to flooding.
[2] For the Rayne part of CrC2, CrC3, CrD2, CrD3, and CrE2 mapping units, refer to Rayne Series.
[3] For the Dekalb part of mapping units RfE2 and RfF2, refer to Dekalb Series.

Soil characterization data

This section includes physical and chemical characteristics of soils on single-cover watersheds, important hydrologic characteristics of profiles of major soils, and clay mineralogy of six selected soil profiles and underclays.

Single-cover watershed soils

Soil characteristics of single-cover watersheds—those less than 8 acres—were surveyed in great detail. Maps of each watershed (app. A, figs. 32–58) show contours, soil mapping units, and location of profile sampling sites. Description of the watershed according to slope, land use, and soil, along with a description of the soil profile down through the B horizon, appears on the page facing each map (app. A, tables 17–36).

In 1970, soil core samples were taken in the top 24- or 30-inch depth of 18 watersheds in crop rotation, permanent meadow, or pasture. In general, core sites were located at the upper, middle, and lower end of each watershed. Sampling sites were selected so that the soil characteristics could be related to land management practices. If the same mapping unit was found in the upper areas of watersheds of contrasting land use, core sites were located therein. Data from them would show the effect of land management.

Sampling sites were not selected to represent specific soil series. Several of the profile descriptions indicate soil properties outside the range of the soil series mapped at the site. Such profiles are considered mapping inclusions.

These data, taken in 1970, also will provide soil physical and chemical evaluations as benchmarks which can define the effects of changes in management over a period of years.

Soil samples were taken from each core to represent the topsoil, the plowsole layer, and the B horizon. Physical and chemical characteristics of the soil at each core site were evaluated from these samples.

Physical characteristics of single-cover watershed soils at core sampling sites are presented in table 11. These data were obtained from laboratory analyses made by the Agronomy Departments of The Ohio State University and Ohio Agricultural Research and Development Center, and by the Coshocton Station as follows:

1. Water holding capacity
   a. At 0.1, 0.33 and 1.0 bar tension evaluated at the Coshocton Station using method No. 29 (*29*), and
   b. At 6.0 and 15.0 bar tension evaluated by The Ohio State University using method No. 31 (*29*).
2. Particle size distribution done at The Ohio State University using their modification of the pipette method (*20*).
3. Aggregate mean weight diameter evaluated by the Ohio Agricultural Research and Development Center
   a. By the wet method (*40*), and
   b. By the dry method (*8*).
4. Aggregate stability index evaluated by the Ohio Agricultural Research and Development Center using the method described by DeBoodt (*8*).

Chemical characteristics of single-cover watershed soils at core sampling sites are presented in table 12. These data were obtained from laboratory analyses made by the Ohio Agricultural Research and Development Center as follows:

1. Values of pH were determined by glass electrode using 1:1 soil to water ratio.
2. Exchangeable magnesium, calcium, and potassium were displaced with neutral normal ammonium acetate (*30*).
3. Potassium and sodium were then evaluated by flame photometry, while magnesium and calcium were determined by methods outlined by Barrows and Simpson (*3*).
4. Total phosphorus was determined by the method described by Bray and Kurtz (*5*).

significant to engineering—Continued

Particles <3 inches passing sieve: Number 4 (4.7 millimeter)	Number 10 (2.0 millimeter)	Number 40 (0.42 millimeter)	Number 200 (0.074 millimeter)	Permeability	Available moisture capacity	Reaction	Shrink-swell potential	Corrosivity: Uncoated steel	Corrosivity: Concrete
Percent	*Percent*	*Percent*	*Percent*	*Inches per hour*	*Inches per hour*	*pH*			
85–95	75–95	70–90	65–80	.6–2.0	.16– .20	5.6–7.3	Low	Low	Moderate.
85–95	75–90	65–85	60–75	.6–2.0	.13– .17	4.5–6.5	Low	Low	Moderate to high.
60–80	55–75	50–70	50–65	.6–2.0	.08– .12	4.5–5.5	Low	Low	High.
30–50	25–40	20–35	15–30	2.0–6.0	.06– .10	4.5–5.5	Low	Low	High.

5. Cation-exchange capacity (CEC) is the sum of exchangeable hydrogen, magnesium, calcium, and potassium, expressed as milliequivalents per 100 grams of dry soil.
6. Organic matter was determined by multiplying the organic carbon content from the Walkely-Black method (*26*) by 1.72.

Soil characteristics that affect hydrology

Additional physical characteristics from which the hydrologic response of the major soil profiles can be determined are presented in appendix B. In 1965, eight locations, shown in figure 59, were selected as part of an ARS watershed sampling plan throughout the Nation (*17*). Selection of these sites was based on the soil classification system in use at that time. Current concepts and series classification would place the profile described at some of these sites outside of its current series range. At each location the profiles were described and sampled in duplicate for laboratory analyses. Profile descriptions, plus supporting physical and chemical data, are also reported in appendix B, tables 37–52.

Mositure retentions were determined at 0.1, 0.3, 0.6, 3.0, and 15 bars tension by the methods of Richards (*29*). Since interest in this study centered on specific profiles representing specific watersheds, samples were neither crushed nor sieved.

Moist (0.3 bar tension) and oven-dry bulk densities were determined by liquid displacement of saran-coated, fist-sized fragments (*19*). Total porosity was then calculated by assuming specific gravities equal to 2.65 for all soil material in both moist and dry conditions.

Saturated vertical conductivities were determined on duplicate 1-inch slabs trimmed from undisturbed fist-sized fragments. These slabs, mounted in 3-inch diameter rings, were subjected to a constant, positive waterhead, following overnight saturation to determine saturated conductivity for each horizon sampled.

Additional samples were collected for further characterization by the Agronomy Department at The Ohio State University. Particle size distribution was determined from these samples by the techniques of Kilmer and Alexander (*20*). A description of the pH and organic carbon determinations is given on page 46. The determination for exchangeable cations included H, Ca, Mg, and K. The percent base saturation excludes hydrogen.

Data in Appendix B are presented in a form readily utilized for deterministic hydrology modeling. Combined with rainfall and runoff records, they may be useful in determining the influence of soils on watershed hydrologic performance. In consolidating relevant information about the watershed soils, the descriptions and tables in appendix B are reproduced with minor changes from an earlier publication by Holtan and associates (*17*).

Clay mineralogy[2]

Six profiles, representative of major soils of the N.A.E.W. and with a wide range in texture, parent material, base status, and argillic horizon development, were examined to determine the crystalline components of the total clay fraction (table 13). Each profile was sampled at or near the site of the representative profile for that series. Analysis was performed in the Agronomy Department of The Ohio State University and was reported in an unpublished manuscript "Clay Mineralogy" by L. P. Wilding and L. R. Drees, November 1971.

Profile descriptions, particle size distributions, and chemical analyses of these six profiles are given in the appendixes. For the Berks, Clarksburg, Dekalb, and Keene profiles, the information is given in appendix C, tables 53–56. Data for the Coshocton and Rayne profiles appear in appendix B, tables 37 and 52, because hydrologic characteristics at these sites are also included.

Clay mineralogy was determined by X-ray diffraction analysis of the total clay (<2 microns) fraction plated on porous ceramic plates.

Definition and Identification of Clay Minerals

The clays were identified from diffraction patterns for

[2] This section written by Dr. L. P. Wilding, professor, Department of Agronomy, The Ohio State University, Columbus, Ohio.

TABLE 11.—*Physical characteristics of soils at*

Site and horizon	Depth	Water-holding capacity 0.1 bar	0.33 bar	1.0 bar	6.0 bar	15.0 bar	Particle size distribution: Fine clay <0.2 micron	Coarse clay 2 to 0.2 micron	Total clay <2 micron	Very fine silt 2 to 5 micron
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1021:										
Ap2	2–5	36.1	33.0	26.6	11.6	11.2	3.9	14.7	18.6	14.4
B1	8–11	34.5	28.5	22.5	13.6	12.9	9.4	18.0	27.4	13.4
IIB22t	22–25	36.0	29.2	24.7	15.0	14.4	13.2	18.5	31.7	12.7
1022:										
Ap2	2–5	34.9	30.3	24.1	9.6	8.1	3.2	15.2	18.4	12.4
B1	7–10	32.3	26.5	19.9	11.2	10.8	7.1	16.2	23.3	10.0
B22t	21–24	39.3	33.3	29.6	10.7	10.4	6.5	17.1	23.6	9.3
1023:										
Ap2	2–5	31.5	27.7	22.6	13.0	11.3	2.6	15.1	17.7	12.7
B21	7–10	30.1	24.4	19.6	9.5	8.4	4.5	15.9	20.4	10.1
IIB22	19–22	32.8	27.3	20.9	7.1	6.9	4.0	10.6	14.6	6.7
1031:										
Ap	2–5	30.4	26.8	22.2	14.2	12.9	4.4	15.2	19.6	5.0
B21t	8–11	36.6	31.1	24.9	16.5	15.8	11.3	19.1	30.4	6.0
B22t	22–25	51.1	42.3	37.6	14.1	12.1	7.0	19.7	26.7	5.0
1032:										
Ap	2–5	31.1	28.6	24.7	18.0	15.0	5.4	19.8	25.2	5.0
B21t	7–10	37.8	32.5	27.8	15.2	15.5	9.3	21.5	30.8	6.0
B22t	20–23	34.7	31.3	28.0	15.4	13.5	6.5	18.4	24.9	5.0
1033:										
Ap	2–5	35.4	32.1	26.7	16.6	15.9	2.2	21.9	24.1	15.8
B21t	9–12	33.3	29.7	26.1	17.0	16.1	11.3	22.0	33.3	11.9
B22t	16–19	31.8	29.3	26.7	17.2	13.9	12.2	18.9	31.1	13.0
1061:										
Ap	2–5	30.3	26.3	20.9	10.3	7.1	4.1	13.5	17.6	5.0
B1	7–10	32.8	27.8	20.2	12.5	10.0	9.5	13.7	23.2	4.0
B22t	26–29	30.4	23.7	17.8	10.8	9.5	8.2	11.0	19.2	3.0
1062:										
Ap	2–5	26.0	22.5	18.0	10.5	8.9	2.7	11.8	14.5	5.0
B1	8–11	35.2	29.2	22.4	9.0	7.9	6.2	10.1	16.3	1.0
B2	16–19	28.8	23.0	16.1	7.8	6.5	5.2	7.2	12.4	2.0
1063:										
Ap	2–5	27.6	23.9	19.0	9.6	7.4	4.3	11.4	15.7	4.0
B21t	11–14	30.3	26.1	20.4	9.6	7.8	6.5	10.9	17.4	4.0
B22t	21–24	24.9	18.4	15.2	9.7	6.1	4.0	9.0	13.0	1.0
1064:										
Ap	2–5	30.9	26.2	19.4	9.2	8.4	4.5	13.0	17.5	5.3
B1	9–12	27.7	23.3	17.0	8.6	8.1	8.6	8.7	17.3	6.2
B21t	17–20	27.0	21.9	19.0	7.6	6.8	6.2	8.5	14.7	6.1
1091:										
Ap	2–5	27.9	24.9	20.1	9.3	8.3	3.4	14.6	18.0	6.7
B21	8–11	24.5	20.4	15.9	8.0	7.6	4.9	10.7	15.6	5.8
B22	18–21	34.2	27.8	25.2	9.5	8.8	4.6	12.9	17.5	7.7
1092:										
Ap	2–5	30.9	28.5	24.5	13.1	10.1	2.6	12.1	14.7	5.0
B1	7–10	29.5	25.0	19.7	12.7	9.6	5.8	15.3	21.1	5.0
B22t	25–28	28.6	24.2	20.4	12.5	9.7	9.1	11.6	20.7	5.0
1093:										
Ap	2–5	28.8	25.6	20.6	11.7	8.6	2.1	13.4	15.5	5.0
B1	6–9	30.0	25.5	20.0	11.8	8.7	4.8	13.8	18.6	5.0
B22t	24–27	27.1	23.7	20.0	12.1	9.4	5.7	13.9	19.6	4.0
1101:										
Ap	2–5	29.7	27.2	23.4	12.3	8.0	2.5	14.9	17.4	5.0
B21t	8–11	32.7	27.9	22.2	13.8	10.2	7.8	17.1	24.9	5.0
B22t	20–23	45.3	41.2	37.9	16.0	11.9	6.3	22.2	28.5	6.0

sampling sites in single-cover watersheds

Particle size distribution									Aggregates		
Fine silt 2 to 20 micron	Coarse silt 20 to 50 micron	Total silt 2 to 50 micron	Very fine sand .05 to 0.1 millimeters	Fine sand 0.1 to .25 millimeters	Medium sand .25 to .5 millimeters	Coarse sand 0.5 to 1.0 millimeters	Very coarse sand 1.0 to 2.0 millimeters	Total sand .05 to 2.0 millimeters	Mean weight diameter		Stability index
									Wet	Dry	
Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Millimeters*	*Millimeters*	*Millimeters*
51.1	11.8	62.9	5.7	4.5	2.4	3.2	2.7	18.5	2.78	2.64	2.14
49.5	12.8	62.3	3.8	2.3	1.3	1.8	1.1	10.3			
42.5	9.0	51.5	7.9	4.7	1.5	1.7	1.0	16.8			
44.3	12.8	57.1	7.5	5.3	2.9	4.8	4.0	24.5	3.79	3.50	1.27
39.6	15.2	54.8	8.4	4.9	2.0	3.5	3.1	21.9			
33.0	15.4	48.4	14.2	6.4	1.6	2.9	2.9	28.0			
40.1	12.6	52.7	9.5	8.9	3.2	3.9	4.1	29.6	2.96	3.28	1.50
38.5	13.8	52.3	7.6	7.4	2.8	3.7	5.8	27.3			
25.7	12.1	37.8	8.8	17.4	10.0	7.2	4.2	47.6			
57.2	15.2	72.4	2.4	1.3	.8	1.9	1.6	8.0	3.08	2.37	2.40
53.2	11.5	64.7	1.6	.4	.3	.9	1.7	4.9			
62.6	5.7	68.3	.9	.3	.3	1.3	2.2	5.0			
56.5	10.2	66.7	2.4	1.5	.9	1.9	1.4	8.1	3.56	2.73	2.05
58.5	7.4	65.9	.8	.4	.3	.9	.9	3.3			
62.5	6.9	69.4	.9	.6	.5	1.5	2.2	5.7			
53.6	13.6	67.2	3.0	1.2	.8	1.7	2.0	8.7	2.69	2.31	2.46
42.6	16.2	58.8	5.4	.8	.3	.8	.6	7.9			
47.7	14.2	61.9	3.7	.5	.3	.9	1.6	7.0			
40.1	15.7	55.8	13.5	10.4	.9	1.0	.8	26.6	.92	1.23	3.54
28.6	12.7	41.3	19.8	12.3	1.0	1.3	1.1	35.5			
16.7	10.4	27.1	25.8	24.6	1.9	1.1	.3	53.7			
37.6	13.9	51.5	15.1	14.1	1.7	1.7	1.4	34.0	2.34	2.04	2.73
21.0	10.0	31.0	22.4	24.0	4.1	1.5	.7	52.7			
15.2	7.4	22.6	20.2	33.6	7.6	2.6	1.0	65.0			
27.1	14.0	41.1	20.4	16.6	2.1	1.9	2.2	43.2	2.60	2.28	2.50
25.8	13.6	39.4	19.0	18.3	2.7	1.7	1.5	43.2			
15.6	10.2	25.8	25.7	27.2	4.9	2.5	.9	61.2			
29.3	13.9	43.2	18.5	13.7	2.2	2.2	2.7	39.3	1.88	1.76	3.02
21.0	11.0	32.0	25.0	19.3	2.8	1.8	1.8	50.7			
18.6	10.4	29.0	27.0	23.1	3.5	1.7	1.0	56.3			
31.8	13.9	45.7	12.8	17.2	3.0	1.8	1.5	36.3	1.16	1.01	3.77
19.5	8.6	28.1	20.1	27.2	5.7	2.2	1.1	56.3			
27.1	15.8	42.9	22.5	10.5	2.7	2.2	1.7	39.6			
46.4	16.1	62.5	6.9	9.1	1.8	2.6	2.4	22.8	1.81	1.83	2.95
42.8	18.9	61.7	6.3	5.7	1.6	2.1	1.5	17.2			
33.0	20.8	53.8	8.0	10.1	2.5	2.8	2.1	25.5			
44.2	15.1	59.3	8.6	8.7	2.2	3.2	2.5	25.2	1.17	1.30	3.48
37.6	15.4	53.0	9.4	10.5	2.6	3.1	2.8	28.4			
29.2	12.9	42.1	21.3	11.4	1.8	2.0	1.8	38.3			
57.9	18.4	76.3	2.2	1.4	.9	1.2	.6	6.3	3.47	2.76	2.02
55.3	16.2	71.5	1.4	.6	.4	.7	.5	3.6			
58.6	6.3	64.9	.8	.7	.6	2.2	2.3	6.6			

TABLE 11.—*Physical characteristics of soils at*

Site and horizon	Depth	Water-holding capacity 0.1 bar	0.33 bar	1.0 bar	6.0 bar	15.0 bar	Particle size distribution: Fine clay <0.2 micron	Coarse clay 2 to 0.2 micron	Total clay <2 micron	Very fine silt 2 to 5 micron
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1102:										
Ap	2–5	33.7	30.4	25.5	15.7	11.1	5.0	18.7	23.7	5.0
B21t	8–11	40.5	35.3	30.2	18.5	13.2	8.5	22.7	31.2	6.0
B22t	16–19	45.6	38.4	32.4	15.9	12.9	6.1	20.3	26.4	5.0
1103:										
Ap	2–5	31.8	28.3	23.9	14.2	10.0	6.8	15.2	22.0	13.5
B21t	8–11	31.6	26.9	20.8	14.0	10.7	9.5	14.2	23.7	10.4
B22t	16–19	32.2	27.8	24.2	14.5	14.0	10.7	18.5	29.2	12.3
1111:										
Ap	2–5	28.1	24.8	20.2	11.8	10.1	2.2	14.9	17.1	5.0
B21t	9–12	30.0	24.8	19.6	14.7	12.7	8.7	18.3	27.0	7.0
IIB22t	22–25	30.4	24.0	21.0	15.8	14.2	10.6	18.8	29.4	7.0
1112:										
Ap	2–5	32.4	26.2	23.4	18.2	13.3	4.3	17.6	21.9	5.0
B1	7–10	30.6	27.9	23.2	19.5	17.4	9.8	22.2	32.0	6.0
IIB22t	19–22	37.5	32.1	27.9	9.4	17.6	11.2	23.3	34.5	6.0
1113:										
Ap	2–5	30.0	27.1	23.4	15.8	11.3	4.4	18.8	23.2	11.4
B21t	9–12	29.9	25.7	22.1	16.4	11.9	6.6	21.1	27.7	10.7
IIB22t	17–20	31.3	27.2	23.2	16.5	12.7	6.2	22.2	28.4	14.3
1131:										
Ap	2–5	28.5	26.1	21.0	11.3	10.8	4.5	15.1	19.6	14.6
B21t	10–13	34.7	28.5	22.7	15.2	14.8	15.0	18.3	33.3	11.0
IIB22t	19–22	27.4	23.8	20.2	18.1	17.6	14.1	25.0	39.1	15.0
1132:										
Ap	2–5	26.9	23.4	19.6	10.1	9.3	5.4	14.7	20.1	9.3
B21	9–12	31.1	26.2	20.5	13.8	13.3	11.2	16.7	27.9	9.5
B22t	12–15	25.8	21.9	18.7	14.7	14.7	10.6	22.3	32.9	12.7
1133:										
Ap	2–5	27.4	24.6	20.1	10.6	10.8	0	12.6	12.6	13.9
B1	8–11	29.2	25.2	20.1	10.2	10.7	3.0	15.2	18.2	12.7
B22xt	23–26	29.8	26.1	20.0	9.2	9.6	4.2	14.4	18.6	7.8
1151:										
Ap	2–5	29.9	26.6	21.6	11.4	7.4	2.1	15.1	17.2	5.0
B1	9–12	28.4	24.7	20.3	16.2	13.0	8.1	23.3	31.4	6.0
IIB22t	19–22	29.7	25.3	22.3	19.5	15.4	10.8	29.4	40.2	7.0
1152:										
Ap	2–5	27.4	24.9	19.7	10.1	6.5	2.4	13.1	15.5	5.0
B & A	8–11	27.6	22.3	17.6	12.9	9.9	9.2	17.6	26.8	4.0
B21t	14–17	27.7	24.7	21.5	17.8	15.6	16.6	24.3	40.9	7.0
1153:										
Ap	2–5	35.9	29.5	22.6	8.8	7.4	3.3	11.7	15.0	5.0
B1	8–11	27.3	26.9	20.5	12.6	9.6	8.0	14.2	22.2	5.0
B22t	24–27	30.3	22.9	16.7	13.6	11.6	12.8	13.1	25.9	4.0
1154:										
Ap	2–5	28.6	24.6	19.3	9.8	7.0	2.5	12.7	15.2	5.0
B1	8–11	31.5	26.1	19.9	10.0	7.8	4.7	15.0	19.7	5.0
B22t	25–28	31.9	25.1	18.5	10.9	9.2	7.0	14.0	21.0	5.0
1181:										
Ap	2–5	27.4	24.9	20.6	10.7	8.9	1.1	11.7	12.8	5.0
B1	8–11	26.6	22.6	18.2	14.9	12.9	7.3	20.4	27.7	8.0
IIB22t	23–26	29.0	24.8	21.8	17.6	16.4	13.5	24.3	37.8	8.0
1182:										
Ap	2–5	32.3	27.8	22.4	13.6	10.1	4.2	14.9	19.1	5.0
B1	6–9	29.7	25.1	19.3	13.8	11.4	7.8	16.2	24.0	5.0
IIB22t	20–23	28.8	25.7	22.9	13.4	10.4	6.1	15.3	21.4	5.0

sampling sites in single-cover watersheds—Continued

Particle size distribution: Fine silt 2 to 20 micron	Coarse silt 20 to 50 micron	Total silt 2 to 50 micron	Very fine sand .05 to 0.1 millimeters	Fine sand 0.1 to .25 millimeters	Medium sand .25 to .5 millimeters	Coarse sand 0.5 to 1.0 millimeters	Very coarse sand 1.0 to 2.0 millimeters	Total sand .05 to 2.0 millimeters	Aggregates: Mean weight diameter, Wet	Mean weight diameter, Dry	Stability index
Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Millimeters*	*Millimeters*	*Millimeters*
56.2	12.8	69.0	1.5	1.1	.9	2.1	1.7	7.3	3.52	3.33	1.45
59.3	4.7	64.0	.8	.5	.4	1.4	1.7	4.8			
65.3	2.7	68.0	.6	.6	.5	1.7	2.2	5.6			
49.4	18.1	67.5	4.0	1.7	.9	1.9	2.0	10.5	3.01	3.02	1.76
41.5	21.9	63.4	5.2	1.2	.7	2.3	3.5	12.9			
35.0	13.9	48.9	9.3	6.2	1.4	2.3	2.7	21.9			
44.3	16.0	60.3	9.3	6.4	1.9	3.1	1.9	22.6	1.30	1.29	3.48
27.2	14.7	41.9	16.2	10.1	1.2	1.9	1.7	31.1			
27.2	12.4	39.6	16.0	10.5	1.0	1.5	2.0	31.0			
51.5	13.9	65.4	5.5	2.4	1.2	2.1	1.5	12.7	1.65	1.67	3.11
43.4	14.4	57.8	6.0	.9	.4	1.0	1.9	10.2			
39.6	13.4	53.0	9.4	1.5	.3	.5	.8	12.5			
43.8	16.4	60.2	7.3	2.7	1.0	2.1	3.5	16.6	1.97	1.44	3.34
36.5	15.5	52.0	9.2	5.0	1.0	2.1	3.0	20.3			
37.5	16.7	54.2	12.3	2.2	.5	1.3	1.1	17.4			
56.6	16.2	72.8	2.9	1.3	.9	1.6	.9	7.6	2.08	1.86	2.92
46.2	16.4	62.6	2.3	.5	.3	.7	.3	4.1			
40.9	15.3	56.2	2.6	.5	.3	.6	.7	4.7			
46.8	22.6	69.4	4.9	2.5	.7	1.2	1.2	10.5	3.04	2.17	2.61
39.1	18.2	57.3	5.4	2.2	1.0	2.8	3.4	14.8			
36.2	12.1	48.3	11.6	2.9	.4	1.5	2.4	18.8			
45.8	17.9	63.7	10.8	6.6	1.4	2.5	2.4	23.7	1.57	1.74	3.03
46.9	17.7	64.6	10.6	2.4	.7	1.6	1.9	17.2			
20.5	10.8	31.3	22.8	15.9	2.5	4.5	4.4	50.1			
43.0	11.9	54.9	8.0	12.7	2.0	2.6	2.6	27.9	1.76	1.32	3.46
40.9	11.1	52.0	5.4	6.1	1.1	2.1	1.9	16.6			
30.2	8.8	39.0	8.2	7.9	1.0	2.0	1.7	20.8			
48.6	13.7	62.3	6.3	10.5	1.7	2.2	1.5	22.2	1.63	1.39	3.39
34.5	13.1	47.6	6.3	11.5	1.7	2.5	3.6	25.6			
25.7	8.2	33.9	8.2	13.9	1.2	1.0	.9	25.2			
52.6	14.5	67.1	4.6	8.7	1.7	1.9	1.0	17.9	1.51	1.46	3.32
49.3	16.5	65.8	2.9	5.5	1.2	1.4	1.0	12.0			
28.5	16.5	45.0	7.4	16.1	2.3	1.7	1.6	29.1			
38.4	15.3	53.7	8.2	16.2	2.3	2.5	1.9	31.1	.70	.90	3.00
39.9	14.7	54.6	6.2	12.2	2.2	2.6	2.5	25.7			
32.0	18.9	50.9	6.1	12.6	2.4	3.3	3.7	28.1			
45.2	14.6	59.8	13.4	7.3	2.1	2.5	2.1	27.4	1.37	1.60	3.17
33.5	12.4	45.9	14.3	8.2	1.3	1.2	1.4	26.4			
25.9	10.7	36.6	14.4	7.2	1.2	1.1	1.7	25.6			
44.0	21.3	65.3	7.5	2.6	1.4	2.5	1.6	15.6	3.29	2.62	[illegible]
36.2	21.9	58.1	10.3	1.1	.7	2.4	3.4	17.9			
40.8	22.9	63.7	12.1	1.0	.4	.8	.6	14.9			

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TABLE 11.—*Physical characteristics of soils at*

Site and horizon	Depth	Water-holding capacity 0.1 bar	0.33 bar	1.0 bar	6.0 bar	15.0 bar	Particle size distribution: Fine clay <0.2 micron	Coarse clay 2 to 0.2 micron	Total clay <2 micron	Very fine silt 2 to 5 micron
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1183:										
Ap	2–5	31.2	27.5	22.8	12.6	8.8	2.1	13.8	15.9	12.8
B21t	9–12	29.4	25.6	21.3	15.5	11.5	8.5	15.7	24.2	11.2
B22t	18–21	23.7	21.9	21.1	16.1	12.9	8.7	19.5	28.2	15.6
1211:										
Ap	2–5	30.0	26.1	19.7	9.5	8.3	4.1	13.1	17.2	5.0
B1	9–12	28.8	23.3	17.2	11.0	9.5	8.0	13.3	21.3	4.0
IIB22	22–25	25.8	19.6	16.4	9.8	8.9	8.2	11.1	19.3	3.0
1212:										
Ap	2–5	33.2	26.4	18.9	8.7	5.8	1.5	8.4	9.9	4.0
B21	9–12	32.0	28.9	21.8	7.1	4.2	.9	9.5	10.4	3.0
B22	20–23	28.4	23.3	20.5	8.1	5.2	1.0	7.9	8.9	2.0
1213:										
Ap	2–5	32.2	27.0	21.1	10.8	7.7	1.8	10.2	12.0	4.0
B21	9–12	35.7	30.0	18.6	8.7	6.3	4.0	11.2	15.2	4.0
B22	19–22	26.5	22.2	16.9	8.3	5.9	3.0	10.6	13.6	4.0
1214:										
Ap	2–5	31.4	26.0	19.2	8.9	8.3	1.5	10.5	12.0	13.2
B2g	12–25	27.9	24.0	19.2	8.8	8.1	4.6	13.6	18.2	9.6
Bxt	21–24	32.5	27.8	22.6	13.7	12.7	10.7	15.2	25.9	11.4
1231:										
Ap	2–5	31.5	28.0	21.8	12.4	11.5	3.6	14.4	18.0	5.0
B1	8–11	32.7	27.2	21.3	16.4	15.0	11.6	17.4	29.0	6.0
IIB22t	17–20	22.7	19.7	17.7	17.9	16.7	13.4	24.7	38.1	6.0
1232:										
Ap	2–5	30.4	25.8	20.7	11.1	10.3	3.6	13.9	17.5	12.1
B21t	9–12	31.5	26.1	20.0	15.8	15.4	11.9	16.5	28.4	8.5
IIB22t	16–19	25.3	22.9	22.3	17.7	17.4	13.4	21.8	35.2	12.7
1233:										
Ap	2–5	30.2	26.6	22.2	13.6	11.3	1.7	13.9	15.6	5.0
B1	7–10	30.3	25.9	20.8	13.7	11.8	6.7	16.0	22.7	5.0
B22t	23–26	29.1	25.1	19.4	16.3	14.3	10.4	20.6	31.0	7.0
1271:										
Ap	2–5	32.5	28.5	21.1	10.1	10.0	3.1	14.0	17.1	13.2
B21t	12–15	35.9	28.2	21.9	13.6	13.4	12.2	13.8	26.0	7.7
B22t	23–26	46.4	32.0	24.6	13.6	13.5	14.2	12.7	26.9	6.3
1272:										
Ap	2–5	30.2	26.4	21.1	11.4	10.8	6.2	15.0	21.2	11.1
B21t	10–13	35.6	29.4	23.6	16.1	15.8	12.3	18.8	31.1	9.8
IIB22t	15–18	22.8	19.6	17.3	16.9	16.2	13.6	24.7	38.3	12.2
1273:										
Ap	2–5	28.7	24.6	19.0	11.6	10.8	3.3	14.5	17.8	10.0
B21t	11–14	27.4	22.6	17.4	15.2	14.5	12.6	20.1	32.7	8.2
B22t	18–21	23.5	21.2	17.9	15.3	14.8	11.3	20.1	31.4	11.0
1281:										
Ap	2–5	23.3	19.6	14.7	9.1	7.4	2.9	10.8	13.7	4.0
B21	9–12	30.0	24.4	19.7	11.9	10.4	11.1	12.2	23.3	4.0
B22	13–16	33.6	25.4	20.3	10.0	8.7	9.2	10.8	20.0	4.0
1282:										
Ap	2–5	26.4	23.0	17.9	10.0	7.0	1.5	10.4	11.9	4.0
B1	7–10	29.8	25.4	16.5	10.7	7.6	4.7	12.3	17.0	4.0
B22	21–24	30.2	26.8	18.7	10.0	7.0	4.3	10.4	14.7	4.0
1283:										
Ap	2–5	30.7	26.6	20.1	10.4	7.9	1.3	10.8	12.1	5.0
B21	9–12	28.0	25.6	20.7	11.1	8.2	4.3	13.5	17.8	5.0
B22	17–20	43.7	39.7	28.4	8.5	6.2	2.0	9.8	11.8	4.0

sampling sites in single-cover watersheds—Continued

Particle size distribution									Aggregates		
									Mean weight diameter		
Fine silt 2 to 20 micron	Coarse silt 20 to 50 micron	Total silt 2 to 50 micron	Very fine sand .05 to 0.1 millimeters	Fine sand 0.1 to .25 millimeters	Medium sand .25 to .5 millimeters	Coarse sand 0.5 to 1.0 millimeters	Very coarse sand 1.0 to 2.0 millimeters	Total sand .05 to 2.0 millimeters	Wet	Dry	Stability index
Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Millimeters*	*Millimeters*	*Millimeters*
49.6	16.4	66.0	10.1	4.2	1.8	1.7	1.1	18.1	2.48	2.43	2.35
43.6	23.8	67.4	4.7	1.0	.5	1.3	.9	8.4			
56.1	10.8	66.9	2.0	.6	.4	1.1	.8	4.9			
37.3	13.0	50.3	16.2	12.3	1.4	1.4	1.2	32.5	3.68	3.15	1.63
25.3	9.5	34.8	21.1	19.4	1.6	1.0	.8	43.9			
17.0	8.4	25.4	25.4	24.7	2.2	1.8	1.2	55.3			
27.4	12.1	39.5	22.7	18.3	2.9	3.0	3.7	50.6	3.30	2.64	2.14
23.2	11.1	34.3	24.6	20.8	4.1	3.3	2.5	55.3			
17.3	11.8	29.1	26.4	17.9	4.0	6.3	7.4	62.0			
33.5	10.7	44.2	20.2	16.6	2.0	2.4	2.6	43.8	3.01	2.07	2.71
32.5	10.6	43.1	17.9	17.5	3.2	1.9	1.2	41.7			
35.8	11.3	47.1	17.4	16.0	3.0	1.7	1.2	39.3			
45.1	15.3	60.4	13.4	9.1	1.1	1.6	2.4	27.6	3.90	3.30	1.47
45.0	15.3	60.3	9.3	6.5	.8	2.1	2.8	21.5			
42.7	14.2	56.9	7.8	5.9	1.1	1.8	.6	17.2			
56.0	16.4	72.4	3.5	1.9	1.2	2.0	1.0	9.6	1.45	1.46	3.31
46.0	19.7	65.7	1.8	1.2	.7	1.1	.5	5.3			
41.6	14.1	55.7	4.6	.9	.1	.2	.4	6.2			
52.7	21.3	74.0	3.4	1.8	1.1	1.6	.6	8.5	1.58	1.29	3.49
40.9	21.8	62.7	3.3	1.5	.6	1.1	1.4	8.9			
30.8	15.7	46.5	7.9	2.2	.8	2.5	4.9	18.3			
51.1	13.3	64.4	6.7	5.9	2.1	3.0	2.3	20.0	1.64	1.73	3.04
40.0	15.5	55.5	6.1	7.2	2.4	2.5	3.6	21.8			
30.0	12.7	42.7	10.3	9.7	2.1	1.9	2.3	26.3			
58.7	18.1	76.8	2.4	1.4	.8	1.1	.4	6.1	.47	.56	4.22
44.3	25.0	69.3	2.6	.9	.5	.6	.1	4.7			
41.8	25.7	67.5	3.4	.7	.6	.8	.1	5.6			
51.2	17.8	69.0	4.3	2.1	.9	1.4	1.1	9.8	1.87	1.53	3.25
32.8	15.6	48.4	10.8	4.5	.8	1.5	2.9	20.5			
37.2	12.3	49.5	9.7	1.6	.2	.3	.4	12.2			
49.7	16.9	66.6	5.5	3.4	1.3	2.4	3.0	15.6	1.82	1.60	3.18
27.7	12.5	40.2	14.6	8.9	1.1	1.3	1.2	27.1			
31.0	9.1	40.1	12.3	10.8	1.1	2.0	2.3	28.5			
36.2	12.6	48.8	14.8	14.9	2.8	2.5	2.5	37.5	2.57	2.32	2.45
34.4	14.9	49.3	12.6	11.1	1.8	1.0	.9	27.4			
25.0	11.7	36.7	17.2	20.1	3.2	1.7	1.1	43.3			
35.3	14.3	49.6	16.5	14.0	2.5	3.2	2.3	38.5	3.76	3.28	1.49
27.9	14.4	42.3	20.3	14.0	2.4	2.2	1.8	40.7			
23.0	14.0	37.0	22.4	13.6	2.8	4.5	5.0	48.3			
40.6	15.9	56.5	15.1	9.2	1.8	2.5	2.8	31.4	1.81	1.69	3.00
43.1	17.7	60.8	10.5	5.8	1.4	1.7	2.0	21.4			
31.1	15.5	46.6	17.1	9.4	2.3	4.1	8.7	41.6			

TABLE 11.—*Physical characteristics of soils at*

Site and horizon	Depth	Water-holding capacity 0.1 bar	Water-holding capacity 0.33 bar	Water-holding capacity 1.0 bar	Water-holding capacity 6.0 bar	Water-holding capacity 15.0 bar	Particle size distribution: Fine clay <0.2 micron	Particle size distribution: Coarse clay 2 to 0.2 micron	Particle size distribution: Total clay <2 micron	Particle size distribution: Very fine silt 2 to 5 micron
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1291:										
Ap	2–5	28.0	25.3	21.1	11.9	12.3	0	11.9	11.9	14.5
B21	6–9	26.7	23.5	19.7	10.1	10.6	5.7	15.4	21.1	12.0
B22	15–18	27.3	23.8	22.3	9.6	9.5	6.2	14.0	20.2	8.4
1292:										
Ap	2–5	31.4	29.0	23.3	12.7	12.3	2.3	12.4	14.7	9.7
B21	5–8	28.1	24.0	19.1	7.9	7.8	3.6	11.1	14.7	7.9
B22	14–17	31.6	26.1	20.5	7.0	7.0	3.2	10.1	13.3	7.8
1293:										
Ap	2–5	31.6	28.4	25.3	12.4	12.1	2.7	14.6	17.3	12.2
B21	12–15	29.1	25.3	21.2	11.6	11.5	4.3	17.9	22.2	10.6
B23t	26–29	25.8	22.5	19.1	12.6	12.4	6.6	18.2	24.8	11.8
1301:										
Ap2	2–5	32.5	29.2	22.4	15.9	15.1	1.2	12.0	13.2	10.2
B21	6–9	31.5	27.4	22.8	9.9	9.9	3.0	16.6	19.6	10.0
B22	24–27	40.6	34.7	31.3	8.7	7.8	2.3	16.4	18.7	10.5
1302:										
Ap2	2–5	26.2	23.2	18.1	7.9	6.9	2.3	10.6	12.9	8.8
B1	8–11	24.3	20.9	15.7	7.2	7.0	1.6	13.5	15.1	9.7
B22	21–24	23.4	19.2	14.3	6.6	6.5	1.9	8.9	10.8	5.4
1303:										
Ap	2–5	30.6	28.5	24.6	13.3	13.0	1.4	15.5	16.9	14.2
B1	7–10	32.9	28.9	24.6	13.6	13.5	6.6	18.9	25.5	11.5
B22t	19–22	31.9	28.5	22.3	14.9	14.4	8.6	19.2	27.8	12.5
1351:										
Ap2	2–5	30.5	27.2	20.2	11.1	10.1	1.2	10.8	12.0	14.3
B21t	8–11	26.6	21.6	15.9	11.2	11.2	5.3	16.0	21.3	12.4
B22t	13–16	36.6	29.1	26.0	15.2	13.7	11.0	17.7	28.7	12.6
1352:										
Ap2	2–5	29.5	24.0	18.9	8.8	7.9	2.6	9.9	12.5	6.4
B21	8–11	39.7	33.4	27.5	8.8	7.0	3.2	11.0	14.2	6.5
B22	20–23	32.2	27.2	20.0	6.5	6.3	2.7	7.6	10.3	3.1
1353:										
Ap2	2–5	27.5	25.8	18.5	10.2	7.9	2.9	9.9	12.8	11.6
B21t	8–11	30.4	25.8	19.9	9.7	6.5	4.5	12.4	16.9	9.3
B22t	18–21	28.1	22.4	14.6	9.1	6.5	5.9	9.2	15.1	6.9
1881:										
Ap1	2–5	28.8	24.9	18.4	9.2	7.9	3.3	13.4	16.7	10.7
B21t	14–17	29.5	23.4	17.8	11.5	9.4	7.9	13.3	21.2	7.9
IIB22t	21–24	34.0	25.2	20.6	9.4	9.2	8.3	9.6	17.9	6.4
1882:										
Ap	2–5	28.3	23.6	18.3	11.4	10.0	4.0	14.9	18.9	9.0
B21t	16–19	33.3	26.6	19.8	10.3	10.1	8.3	12.0	20.3	3.7
IIB22t	22–25	30.6	25.4	18.5	9.8	9.4	5.7	13.7	19.4	4.6
1883:										
Ap1	2–5	28.7	24.8	18.2	8.1	7.4	.6	13.7	14.3	10.7
B21t	16–19	34.3	28.0	21.9	11.7	11.7	8.7	14.8	23.5	7.4
B22xt	25–28	31.1	25.1	17.3	10.3	9.5	7.4	12.8	20.2	6.4
1911:										
Ap	2–5	27.1	23.8	19.1	10.1	8.8	4.5	12.9	17.4	5.0
B1	8–11	30.3	25.3	19.3	11.9	11.2	9.6	13.4	23.0	5.0
IIB22t	24–27	28.4	22.5	16.5	10.4	9.6	9.2	10.0	19.2	4.0
1912:										
Ap	2–5	24.2	24.3	18.0	10.7	8.8	2.2	11.3	13.5	5.0
B1	8–11	24.7	21.3	16.9	11.1	10.4	7.1	14.3	21.4	5.0
IIB22t	24–27	30.0	24.3	18.1	17.4	9.7	9.1	10.5	19.6	4.0

sampling sites in single-cover watersheds—Continued

Particle size distribution									Aggregates		
Fine silt 2 to 20 micron	Coarse silt 20 to 50 micron	Total silt 2 to 50 micron	Very fine sand .05 to 0.1 millimeters	Fine sand 0.1 to .25 millimeters	Medium sand .25 to .5 millimeters	Coarse sand 0.5 to 1.0 millimeters	Very coarse sand 1.0 to 2.0 millimeters	Total sand .05 to 2.0 millimeters	Mean weight diameter: Wet	Mean weight diameter: Dry	Stability index
Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Millimeters*	*Millimeters*	*Millimeters*
44.8	15.4	60.2	9.2	4.9	1.7	3.7	8.4	27.9	3.39	3.32	1.46
45.7	13.7	59.4	7.2	4.2	1.7	3.0	3.4	19.5			
29.5	10.8	40.3	14.1	9.2	3.1	5.7	7.4	39.5			
37.1	14.0	51.1	10.6	5.8	2.2	5.4	10.2	34.2	2.77	3.07	1.71
28.3	15.5	43.8	11.6	6.5	3.0	7.9	12.5	41.5			
29.2	17.0	46.2	13.2	6.9	2.8	7.4	10.2	40.5			
41.4	15.0	56.4	9.5	4.8	1.7	3.6	6.7	26.3	2.90	3.24	1.54
38.3	15.6	53.9	9.5	4.3	1.7	3.6	4.8	23.9			
41.3	14.2	55.5	9.2	3.9	1.4	2.6	2.6	19.7			
35.8	16.9	52.7	17.7	7.4	1.9	3.5	3.6	34.1	3.14	2.48	2.30
36.2	15.0	51.2	11.2	3.9	2.0	4.1	8.0	29.2			
38.2	21.0	59.2	14.2	2.3	.8	2.3	2.5	22.1			
34.3	12.4	46.7	6.3	14.9	12.3	5.2	1.7	40.4	3.03	3.81	.97
40.1	13.4	53.5	7.1	10.8	9.1	3.6	.8	31.4			
19.9	10.6	30.5	26.2	18.0	8.8	4.4	1.3	58.7			
47.1	13.9	61.0	8.4	5.7	2.1	2.8	3.1	22.1	3.42	3.03	1.75
45.5	15.0	60.5	6.0	3.0	1.3	2.0	1.7	14.0			
47.0	14.5	61.5	4.4	2.1	1.0	1.8	1.4	10.7			
50.1	19.7	69.8	10.2	4.0	1.2	1.5	1.3	18.2	2.99	3.00	1.78
47.3	18.7	66.0	7.6	2.0	.6	1.4	1.1	12.7			
40.6	16.8	57.4	6.9	2.0	1.1	2.4	1.5	13.9			
27.7	10.8	38.5	15.4	22.2	3.1	3.3	5.0	49.0	2.54	2.72	2.06
20.8	9.0	29.8	14.8	23.2	4.8	5.2	8.0	56.0			
12.7	8.8	21.5	20.3	33.6	7.9	4.8	1.6	68.2			
41.2	14.7	55.9	9.9	12.1	2.6	3.0	3.7	31.3			
33.8	13.1	46.9	10.1	11.9	3.7	5.0	5.5	36.2	3.85	3.37	1.41
28.9	16.8	45.7	12.5	16.1	4.6	3.8	2.2	39.2			
46.8	20.4	67.2	8.2	5.8	.8	.8	.5	16.1			
34.6	16.4	51.0	14.1	10.6	1.2	1.0	.9	27.8	1.05	.91	3.87
21.4	14.5	35.9	26.3	14.5	1.6	2.1	1.7	46.2			
43.8	19.2	63.0	9.5	5.1	.9	1.5	1.1	18.1			
26.9	20.5	47.4	15.6	10.7	2.1	2.6	1.3	32.3	1.78	1.61	3.17
26.7	20.5	47.2	15.7	11.1	2.1	2.3	2.2	33.4			
47.1	22.9	70.0	7.0	6.5	.8	.8	.6	15.7			
40.5	24.9	65.4	5.0	5.2	.5	.3	.1	11.1	1.08	.91	3.86
31.1	22.5	53.6	9.4	14.3	1.6	.8	.1	26.2			
45.7	21.2	66.9	7.1	6.3	1.1	.9	.3	15.7			
35.5	19.7	55.2	10.4	8.6	1.4	.9	.5	21.8	1.44	1.28	3.50
21.2	11.4	32.6	19.6	22.4	3.3	1.8	1.1	48.2			
50.6	17.5	68.1	8.8	6.0	1.1	1.5	1.0	18.4			
47.5	16.1	63.6	7.4	5.0	.9	1.0	.7	15.0	1.96	1.93	2.84
22.2	12.2	34.4	22.2	16.7	2.5	2.2	2.4	46.0			

TABLE 11.—*Physical characteristics of soils at*

Site and horizon	Depth	Water-holding capacity 0.1 bar	0.33 bar	1.0 bar	6.0 bar	15.0 bar	Particle size distribution: Fine clay <0.2 micron	Coarse clay 2 to 0.2 micron	Total clay <2 micron	Very fine silt 2 to 5 micron
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1913:										
Ap	2–5	36.3	26.0	19.5	10.6	7.7	1.1	10.0	11.1	5.0
B & A	9–12	27.8	23.3	17.1	10.4	7.2	5.0	14.5	19.5	5.0
IIB22t	25–28	45.5	33.5	28.4	10.0	7.4	5.7	12.3	18.0	4.0
1921:										
Ap	2–5	25.7	22.2	17.0	9.7	6.8	1.8	11.2	13.0	5.0
B21	8–11	29.0	25.6	19.0	9.5	7.0	5.4	11.8	17.2	4.0
IIB22	20–23	33.1	25.9	20.1	8.3	6.0	4.5	9.0	13.5	3.0
1922:										
Ap	2–5	25.0	22.2	17.9	10.4	9.3	4.1	12.4	16.5	4.0
B21t	8–11	28.4	24.5	20.1	13.1	12.1	12.2	13.2	25.4	4.0
IIB22t	21–24	25.7	21.7	17.6	11.1	10.4	9.9	11.4	21.3	4.0
1923:										
Ap	2–5	29.1	24.5	19.0	9.1	7.2	1.8	9.2	11.0	4.0
B21	7–10	34.8	28.8	22.2	7.6	5.6	3.2	9.9	13.1	4.0
B22	18–21	44.0	37.6	28.2	6.8	5.1	2.8	8.4	11.2	3.0
1924:										
Ap	2–5	29.2	26.3	21.5	8.7	8.6	3.6	11.9	15.5	10.7
B1	7–10	36.8	31.6	25.2	8.8	7.8	4.4	12.2	16.6	9.1
B21t	16–19	31.2	27.2	22.8	12.6	11.3	8.3	14.4	22.7	11.6

specified pretreatments employing the following criteria:

Illite(Mica): Identified by a series of peaks at 10, 5, and 3.3 angstroms (Å) that are not appreciably affected by either glycol or heat treatments. Illite is used as a general term for clays that have a 10 Å peak with pronounced low angle skewness.

Vermiculite: Identified by its 14 Å peak which does not expand upon glycolation but collapses to 10 Å upon heating to 400° C.

Expandable minerals: Identified by a 14 Å peak when air dry which expands to variable spacings above 14 Å upon glycolation but collapses to 10 Å upon heating to 400° C. This group includes montmorillonite and other expanding lattice clays.

Kaolinite: Identified by a series of peaks at about 7.1 and 3.6 Å that are not affected by glycolation. Upon heat treatment at 550° C the peaks disappear because the mineral becomes amorphous.

Interstratified 10–14 Å: Identified by a broad peak in the region between 10–14 Å on both air-dry and glycolated samples. This group would include mixed layer assemblages of mica-vermiculite or mica-chlorite in various proportions.

Quartz: Identified by peaks at 3.3 and 4.26 Å that are unaffected by glycolation or heat treatments.

Clay mineral composition of the six profiles examined are presented in table 13. In general, these soils exhibit a preponderance of vermiculite in A horizons with increasing illite content in B and C horizons. This may be interpreted as evidence of pedogenic transformation of mica to vermiculite in the more intensely weathered upper portions of the profile. However, such a possible relationship is confounded by the strong probability of a loess mantle or loess substratum admixture in A and B horizons of these soils, particularly soils found on more stable positions in this landscape. It is possible that at least a part of the observed differences in mica-vermiculite mineral content with depth reflects inherited, rather then pedogenic, weathering origins. Similar precautions are appropriate in interpreting depth distributions of other clay minerals.

Soils investigated in this area contain appreciably greater amounts of kaolinite (10 to 30 percent) than soils in glaciated sectors of Ohio (5 to 10 percent and commonly less than 5 percent). X-ray diffraction analysis of six underclays associated with different coal measures in the geologic column on or in close vicinity to the watershed area, indicates that kaolinite comprises 15 to 65 percent of these deposits (table 14).

It would appear that soils derived from these clays or closely associated acid sandstones (Dekalb); siltstones and shales (lower portions of Keene, Rayne, Coshocton, and Berks); or collovium derived from Pennsylvanian-age rocks (Clarksburg) likely would contain kaolinite largely inherited from bedrock sources. In contrast, silty upper portions of the Keene and Rayne profiles, which have derived from loess or loess-residuum admixtures, contain substantially less kaolinite (table 13).

Expandable minerals, such as montmorillonite with high shrink-swell potential and high cation-exchange capacities, are essentially absent in the Dekalb and Berks profiles. This probably reflects the paucity of these minerals in parent rock sources. Likewise, their low base status is neither favorable for pedogenic synthesis of mont-

sampling sites in single-cover watersheds—Continued

Particle size distribution									Aggregates		
Fine silt 2 to 20 micron	Coarse silt 20 to 50 micron	Total silt 2 to 50 micron	Very fine sand .05 to 0.1 millimeters	Fine sand 0.1 to .25 millimeters	Medium sand .25 to .5 millimeters	Coarse sand 0.5 to 1.0 millimeters	Very coarse sand 1.0 to 2.0 millimeters	Total sand .05 to 2.0 millimeters	Mean weight diameter Wet	Mean weight diameter Dry	Stability index
Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Millimeters*	*Millimeters*	*Millimeters*
51.9	18.6	70.5	9.0	5.1	1.2	1.7	1.4	18.4	2.18	1.76	3.02
46.2	19.9	66.1	8.0	3.9	1.0	1.0	.5	14.4			
29.1	18.2	47.3	17.7	10.3	2.1	2.2	2.4	34.7			
40.6	17.5	58.1	13.4	11.1	1.9	1.5	1.0	28.9	2.43	2.24	2.54
26.4	14.3	40.7	21.5	14.9	2.6	1.6	1.5	42.1			
17.3	11.5	28.8	28.8	18.3	5.0	2.9	2.7	57.7			
33.1	14.4	47.5	15.9	14.9	1.6	1.7	1.9	36.0	3.41	2.99	1.79
27.4	10.8	38.2	19.8	13.7	1.5	1.0	.4	36.4			
20.9	10.3	31.2	24.6	19.2	2.0	1.2	.5	47.5			
31.4	16.3	47.7	18.4	16.5	2.2	2.1	2.1	41.3	2.83	2.45	2.32
24.9	16.3	41.2	22.5	15.8	2.7	2.4	2.3	45.7			
19.7	15.4	35.1	26.6	18.1	3.9	3.0	2.1	53.7			
36.1	15.8	51.9	16.9	8.1	1.4	2.4	3.8	32.6	3.53	2.47	2.30
26.8	18.0	44.8	20.6	8.2	1.5	3.3	5.0	38.6			
35.5	15.6	51.1	12.3	6.6	1.7	2.8	2.8	26.2			

morillonite nor its stability once synthesized. On the other hand, most of the underclay deposits and presumably shale deposits of this area contain from 10 to 20 percent expandable components. Soils derived from these deposits could inherit such minerals in moderate quantities. There may be some evidence for pedogenic formation of expandable minerals in the loess section of the Keene profile (table 13) although this could simply reflect lithological differences. This profile contains the most expandable minerals of those analyzed.

An important aspect of the clay mineralogy of these soils is the presence of small to large amounts of interlayer hydroxy aluminum sandwiched between individual layers of vermiculite or montmorillonite components, or both (table 13). X-ray diffraction evidence for these interlayers is their resistance to collapse from 14 to 10 angstroms upon heating at 400° or 550° C. If interlayer aluminum is present, a distinct peak at about 12 angstroms or a broad shoulder between 10 to 14 angstroms will remain after these heat treatments.

The presence of interlayer aluminum imparts profound physical-chemical properties to these clays, namely: (a) increase in acidic buffering capacity, (b) decrease in cation-exchange capacity, (c) increase in pH-dependent component of CEC, (d) decrease in ability to sorb such polar organic compounds as pesticides between the interlayers, (e) decrease in shrink-swell capacity, and (f) decrease in K-fixation ability.

Evidences that interlayer hydroxy aluminum components are pedogenic rather than inherited are twofold. First, in most profiles (Keene, fine-loamy variant, excepted), there is a decrease in amounts of interlayer aluminum with depth, that is, from the most intensely weathered zones to the parent material. Secondly, none of the underclays examined (table 14) had any evidence of interlayer aluminum components. The literature also suggests that, in general, the better drained, most intensely weathered, soils have more interlayer aluminum.

Clay mineral and organic matter contributions to cation-exchange capacity (CEC) for these soils are presented in table 15. For most horizons, there is reasonably close agreement between calculated and observed values. Discrepancies could reflect one or a combination of the following sources of error:

a. Incorrect clay mineralogy data;
b. Incorrect CEC values assumed for the clay mineral or organic matter components;
c. Presence of amorphous constituents not considered, or
d. CEC contributions from the >2 micron fraction.

The CEC values assumed for these calculations are similar to those reported by Grim (13) except values for vermiculite, montmorillonite (expandables), and interstratified 10- to 14-angstrom components. These have been decreased approximately 15 to 20 percent for blockage of potential exchange sites by interlayer aluminum.

Values for the CEC or organic matter were obtained from multiple regression coefficients of CEC as a function

[illegible]

TABLE 12.—*Chemical characteristics of soils at sites in single-cover watersheds*

Site and horizon	Depth	pH	Concentration						
			Mg	Ca	Na	K	P	CEC	O.M.
	Inches		*Parts per million*	*Parts per million*	*Parts per million*	*Parts per million*	*Parts per million*	*Milli-equivalent per 100 grams*	*Percent*
1021:									
Ap2	2–5	7.1	123	5160	22	52	7.0	16.0	2.7
B1	8–11	6.5	150	2688	42	76	3.8	11.1	.5
IIB22t	22–25	4.5	396	402	43	92	1.2	13.8	.4
1022:									
Ap2	2–5	7.0	146	4720	23	65	11.2	26.2	3.7
B1	7–10	7.0	82	2608	34	64	5.9	9.5	.4
B22t	21–24	5.3	112	680	40	69	4.0	9.4	.3
1023:									
Ap2	2–5	6.5	137	1456	22	52	13.4	10.6	3.1
B21	7–10	6.4	82	604	29	47	6.5	7.6	.6
IIB22	19–22	5.9	122	668	28	47	2.6	7.1	.6
1031:									
Ap	2–5	6.1	146	1068	19	142	6.5	11.1	1.8
B21t	8–11	4.8	139	645	30	77	2.4	13.3	.4
B22t	22–25	4.3	182	358	27	65	3.4	12.3	.4
1032:									
Ap	2–5	6.5	292	1832	27	123	16.6	14.4	2.6
B21t	7–10	5.5	138	965	39	63	2.6	13.5	.7
B22t	20–23	4.7	145	500	38	56	2.1	12.0	.4
1033:									
Ap	2–5	6.6	146	1920	28	132	42.5	14.8	2.8
B21t	9–12	4.7	106	888	29	88	1.2	12.9	.5
B22t	16–19	4.4	106	498	35	81	1.5	10.0	.5
1061:									
Ap	2–5	7.3	54	4880	30	55	16.2	10.8	1.8
B1	7–10	5.6	73	780	34	60	3.5	12.4	.5
B22t	26–29	4.5	148	465	53	63	2.8	11.9	.3
1062:									
Ap	2–5	5.7	71	960	20	85	14.2	9.5	1.6
B1	8–11	5.4	78	592	36	53	3.1	9.4	.3
B2	16–19	5.2	139	500	40	43	8.5	8.4	.2
1063:									
Ap	2–5	5.0	64	704	22	83	14.6	8.6	1.5
B21t	11–14	5.7	52	680	35	53	5.0	9.6	.6
B22t	21–24	4.6	57	498	31	41	7.8	8.2	.2
1064:									
Ap	2–5	5.4	83	512	24	63	7.8	9.9	1.6
B1	9–12	4.9	110	732	39	62	1.9	11.1	.3
B21t	17–20	4.7	182	332	33	49	2.4	9.4	.2
1091:									
Ap	2–5	5.8	123	888	42	111	19.2	10.2	2.0
B21	8–11	5.4	170	640	49	71	15.0	9.4	.5
B22	18–21	4.4	110	680	32	76	3.8	10.6	.3
1092:									
Ap	2–5	6.3	128	1082	29	158	41.2	11.0	2.2
B1	7–10	6.5	80	680	32	92	6.9	8.6	.5
B22t	25–28	5.3	200	602	34	69	5.0	9.5	.3
1093:									
Ap	2–5	6.1	140	916	22	166	37.5	10.4	2.5
B1	6–9	6.8	85	670	33	49	9.8	8.9	.6
B22t	24–27	6.4	175	625	36	43	4.0	8.4	.3
1101:									
Ap	2–5	5.5	79	888	20	98	9.8	10.4	1.8
B21t	8–11	4.8	118	532	28	67	7.5	11.1	.4
B22t	20–23	4.7	228	408	35	73	5.8	16.8	.4

TABLE 12.—*Chemical characteristics of soils at sites in single-cover watersheds*—Continued

Site and horizon	Depth	pH	Concentration: Mg	Ca	Na	K	P	CEC	O.M.
	Inches		*Parts per million*	*Parts per million*	*Parts per million*	*Parts per million*	*Parts per million*	*Milli-equivalent per 100 grams*	*Percent*
1102:									
Ap	2–5	4.8	76	496	22	126	8.4	10.9	1.6
B21t	8–11	4.5	73	392	23	73	5.6	12.6	.7
B22t	16–19	4.5	143	472	24	61	5.1	11.3	.4
1103:									
Ap	2–5	5.6	96	704	27	163	5.8	13.6	2.0
B21t	8–11	4.9	194	824	29	72	2.9	11.5	.6
B22t	16–19	4.5	182	536	35	73	6.2	13.1	.3
1111:									
Ap	2–5	6.5	300	1280	31	88	10.4	11.8	2.3
B21t	9–12	5.0	132	430	29	60	6.9	10.4	.6
IIB22t	22–25	4.5	142	458	34	69	5.0	12.0	.2
1112:									
Ap	2–5	6.7	300	1432	29	93	7.8	13.0	2.1
B1	7–10	6.8	242	675	31	73	1.2	14.9	.6
IIB22t	19–22	4.5	102	400	34	62	1.5	11.8	.5
1113:									
Ap	2–5	6.6	256	1208	22	120	6.5	12.4	2.0
B21t	9–12	4.7	208	708	26	78	.9	10.3	.4
IIB22t	17–20	4.4	230	378	24	78	1.2	2.9	.5
1131:									
Ap	2–5	5.7	222	716	24	135	9.1	11.4	2.0
B21t	10–13	4.5	340	628	48	123	2.9	14.0	.5
IIB22t	19–22	4.3	984	534	35	112	3.8	16.9	.3
1132:									
Ap	2–5	6.5	234	916	19	166	6.8	10.7	2.1
B21	9–12	5.1	328	900	32	89	.9	12.2	.4
B22t	12–15	4.4	348	398	28	87	2.6	12.1	.3
1133:									
Ap	2–5	6.9	364	756	22	111	6.5	11.0	2.0
B1	8–11	6.7	220	836	40	67	1.5	7.8	.5
B22xt	23–26	4.5	160	320	28	60	2.1	7.4	.4
1151:									
Ap	2–5	4.8	88	458	24	65	7.2	8.7	1.7
B1	9–12	4.7	80	562	29	56	1.1	10.2	.5
IIB22t	19–22	4.5	174	230	27	69	1.5	13.2	.5
1152:									
Ap	2–5	5.9	96	609	27	67	5.5	8.4	1.8
B & A	8–11	5.4	80	585	24	58	1.2	10.9	.4
B21t	15–18	4.7	155	348	22	73	1.2	14.7	.4
1153:									
Ap	2–5	5.5	88	580	27	100	5.8	8.6	1.7
B1	8–11	4.9	58	392	31	52	1.5	9.9	.6
B22t	24–27	4.7	175	520	24	67	1.6	11.5	.3
1154:									
Ap	2–5	5.4	83	496	29	100	5.9	8.1	1.9
B1	8–11	5.5	97	348	20	69	1.6	7.4	.6
B22t	25–28	5.4	80	465	24	57	1.6	10.4	.4
1181:									
Ap	2–5	5.7	111	604	28	85	6.8	8.4	1.7
B1	8–11	4.7	118	430	23	59	4.2	8.9	.4
IIB22t	23–26	4.5	130	320	25	71	1.2	11.9	.3
1182:									
Ap	2–5	5.1	140	532	31	93	5.0	11.1	1.5
B1	6–9	5.0	200	300	35	83	1.9	13.9	.4
IIB22t	20–23	4.8	220	376	24	66	2.1	5.4	.3

TABLE 12.—*Chemical characteristics of soils at sites in single-cover watersheds*—Continued

Site and horizon	Depth	pH	Concentration						
			Mg	Ca	Na	K	P	CEC	O.M.
	Inches		*Parts per million*	*Parts per million*	*Parts per million*	*Parts per million*	*Parts per million*	*Milli-equivalent per 100 grams*	*Percent*
1183:									
Ap	2–5	5.4	134	556	200	83	5.0	9.8	2.0
B21t	9–12	4.8	278	556	38	75	2.6	13.6	.4
B22t	18–21	4.6	1080	584	47	95	.6	15.4	.2
1211:									
Ap	2–5	6.2	146	1000	45	120	23.4	9.8	2.4
B1	9–12	5.7	174	508	20	65	4.8	1.9	.4
IIB22	22–25	4.9	97	450	34	69	3.5	10.1	.2
1212:									
Ap	2–5	6.9	165	1082	29	178	34.5	8.7	2.2
B21	9–12	7.3	126	420	26	31	14.1	5.9	.6
B22	20–23	7.1	108	592	25	29	8.4	7.5	.5
1213:									
Ap	2–5	6.6	140	1096	39	163	22.1	9.8	2.3
B21	9–12	7.3	153	558	30	55	5.2	7.9	.4
B22	19–22	7.3	104	545	29	43	15.0	6.9	.3
1214:									
Ap	2–5	6.6	290	1408	46	129	25.0	12.5	3.6
B2g	12–15	6.8	182	900	40	48	1.1	8.6	.6
Bxt	21–24	5.7	888	3120	53	94	.6	13.6	.3
1231:									
Ap	2–5	6.6	300	1760	43	81	10.6	13.0	2.7
B1	8–11	6.5	200	965	31	81	.6	12.9	.4
IIB22t	17–20	4.3	228	424	35	108	.6	13.1	.2
1232:									
Ap	2–5	6.5	164	1408	36	160	12.6	12.0	2.1
B21t	9–12	6.4	280	3744	34	114	1.9	13.2	.4
IIB22t	16–19	4.5	776	796	32	100	1.2	14.2	.2
1233:									
Ap	2–5	6.6	182	1040	46	158	15.9	12.4	3.0
B1	7–10	6.3	62	502	24	69	0	8.4	.4
B22t	23–26	4.8	90	365	25	63	0	9.6	.2
1271:									
Ap	2–5	6.2	153	1400	38	117	5.5	11.7	1.6
B21t	12–15	5.9	350	3120	64	102	.9	12.3	.3
B22t	23–26	4.7	952	668	39	104	.6	13.6	.2
1272:									
Ap	2–5	6.5	256	1672	38	171	26.9	13.3	2.6
B21t	10–13	4.5	400	676	35	95	.9	14.9	.3
IIB22t	15–18	4.3	832	290	42	114	1.1	26.3	.2
1273:									
Ap	2–5	6.6	182	1696	46	106	17.1	11.8	2.2
B21t	11–14	4.4	286	668	30	79	1.2	10.8	.3
B22t	18–21	4.3	326	266	31	83	1.9	10.0	.2
1281:									
Ap	2–5	5.9	128	880	39	69	20.2	9.6	2.2
B21	9–12	4.7	174	462	25	88	2.1	12.8	.4
B22	13–16	4.4	104	400	26	73	1.9	11.3	.3
1282:									
Ap	2–5	6.3	140	956	29	141	45.2	10.2	2.1
B1	7–10	6.4	163	525	27	47	1.1	9.2	.5
B22	21–24	5.1	100	425	21	56	3.1	9.6	.3
1283:									
Ap	2–5	5.7	135	1012	53	120	30.0	9.9	2.1
B21	9–12	5.8	182	500	27	68	4.5	8.8	.4
B22	17–20	4.7	46	398	26	43	4.2	7.7	.3

TABLE 12.—*Chemical characteristics of soils at sites in single-cover watersheds*—Continued

Site and horizon	Depth	pH	Concentration						
			Mg	Ca	Na	K	P	CEC	O.M.
	Inches		*Parts per million*	*Parts per million*	*Parts per million*	*Parts per million*	*Parts per million*	*Milli-equivalent per 100 grams*	*Percent*
1291:									
Ap	2–5	5.9	86	1176	60	154	10.1	12.1	2.9
B21	6–9	5.7	55	752	28	200	6.8	8.1	.8
B22	15–18	4.7	52	632	32	75	6.2	9.6	.4
1292:									
Ap	2–5	5.9	80	1028	56	90	10.6	9.8	2.6
B21	5–8	6.4	52	932	29	53	3.1	7.9	.7
B22	14–17	6.2	142	920	32	62	3.1	7.5	.4
1293:									
Ap	2–5	5.8	104	1184	49	95	13.3	13.3	3.0
B21	12–15	5.8	91	888	33	69	8.6	9.2	.5
B23t	26–29	5.1	252	840	36	74	5.6	10.9	.4
1301:									
Ap2	2–5	6.6	153	2352	68	108	30.2	14.2	3.7
B21	6–9	5.6	124	2608	22	81	17.5	9.6	.4
B22	24–27	5.0	270	1128	25	103	15.4	9.9	.3
1302:									
Ap2	2–5	7.0	75	1512	47	36	18.1	10.0	2.5
B1	8–11	6.9	16	916	29	39	11.2	6.4	.6
B22	21–24	6.0	21	888	34	62	3.8	7.0	.3
1303:									
Ap	2–5	7.0	127	2192	48	87	23.4	15.0	3.4
B1	7–10	6.6	85	3024	44	80	11.9	10.5	.5
B22t	19–22	4.9	254	1000	29	95	6.8	12.2	.3
1351:									
Ap2	2–5	6.1	97	1144	476	76	5.1	10.6	2.3
B21t	8–11	5.1	160	656	29	67	5.9	9.9	.4
B22t	13–16	4.9	952	570	53	93	2.1	16.9	.3
1352:									
Ap2	2–5	6.9	86	1672	612	142	10.5	9.7	2.2
B21	8–11	6.4	24	736	27	54	4.0	7.0	.6
B22	20–23	5.4	132	604	22	52	5.1	6.7	.3
1353:									
Ap2	2–5	6.7	163	1148	12	95	7.2	10.2	2.7
B21	8–11	5.1	43	512	24	66	2.6	6.9	.3
B22	18–21	5.3	182	548	24	61	2.6	7.7	.3
1881:									
Ap1	2–5	6.9	350	1072	40	98	10.5	16.9	1.7
B21t	14–17	6.4	336	2576	36	86	5.5	3.4	.8
IIB22t	21–24	5.1	270	848	24	77	2.9	9.5	.3
1882:									
Ap	2–5	6.4	254	944	38	109	7.8	9.6	1.5
B21t	16–19	6.5	374	956	27	86	1.9	10.0	.2
IIB22t	22–25	5.4	336	704	20	71	2.9	8.5	.2
1883:									
Ap1	2–5	6.1	208	848	54	67	10.6	8.7	1.7
B21t	16–19	5.1	584	836	25	93	1.6	11.8	.2
B22xt	25–28	4.8	776	542	27	86	1.5	10.4	.2
1911:									
Ap	2–5	6.6	416	1280	53	284	57.0	12.2	2.7
B1	8–11	5.7	165	475	34	139	4.0	11.1	.5
IIB22t	24–27	4.9	122	358	23	78	2.4	11.2	.3
1912:									
Ap	2–5	6.6	254	1040	53	240	41.2	10.1	2.4
B1	8–11	4.8	138	355	26	77	2.9	10.7	.3
IIB22t	24–27	6.7	178	465	29	92	1.1	9.2	.2

TABLE 12.—*Chemical characteristics of soils at sites in single-cover watersheds*—Continued

Site and horizon	Depth	pH	Concentration						
			Mg	Ca	Na	K	P	CEC	O.M.
	Inches		*Parts per million*	*Parts per million*	*Parts per million*	*Parts per million*	*Parts per million*	*Milli-equivalent per 100 grams*	*Percent*
1913:									
Ap	2–5	6.7	324	1408	52	370	100.0	12.3	3.5
B & A	9–12	7.0	122	490	30	50	10.2	7.7	.4
IIB22t	25–28	6.0	174	362	28	55	6.2	7.9	.3
1921:									
Ap	2–5	6.0	150	808	48	41	37.0	9.0	1.8
B21	8–11	6.0	158	573	30	47	5.9	9.4	.4
B22	20–23	5.3	94	508	32	50	2.6	9.2	.3
1922:									
Ap	2–5	5.8	172	1176	38	106	13.8	11.4	2.2
B21t	8–11	5.4	118	540	28	60	1.2	15.1	.5
IIB22t	21–24	6.5	130	732	53	114	1.5	13.4	.3
1923:									
Ap	2–5	5.7	160	756	37	65	46.8	9.1	2.4
B21	7–10	6.0	91	355	31	126	22.0	6.9	.4
B22	18–21	5.1	163	662	34	95	15.4	7.0	.3
1924:									
Ap	2–5	5.6	142	616	40	71	5.5	9.6	1.8
B1	7–10	5.1	124	478	34	40	2.1	7.3	.3
B21t	16–19	4.7	254	344	35	67	1.5	11.9	.2

of organic matter and clay for numerous Ohio and Alaskan soils (unpublished data from Soil Characterization Laboratory, Department of Agronomy, The Ohio State University). Observed total CEC was determined by summation of exchangeable Ca, Mg, K, and H.

It is apparent from table 15 that organic matter contributes from about one-third to three-fourths of the CEC in surface horizons. In coarse-textured surface horizons relatively high in organic matter (Dekalb, table 15), organic matter is the major contributor to CEC; organic matter tends to mask the small CEC contribution by clay minerals. In all other profiles with silt loam or loam surfaces that contain smaller amounts of organic matter, approximately one-third to one-half of the CEC can be attributed to organic matter components. Conversely, in subsoil horizons which commonly contain decreasing amounts of organic matter with depth, essentially all of the CEC is due to clay mineral components. Under these circumstances the CEC is a function of clay mineralogy and soil texture (clay percentage); it may be low as in the case of Dekalb or moderately high as with Keene (table 15).

From the above observation, the proportion of the total CEC contributed by organic versus clay mineral fractions in the particulate phase of surface runoff products would be the function of:

a. The erosion history of the landscape (slight, moderate, or severely eroded),
b. Kind and distribution of soils,
c. Soil clay mineralogy,
d. Soil textures, and
e. The organic enrichment factor associated with erosion of lower density materials.

Micromorphology: Thin-section analyses of selected horizons from representative profiles of three soils described earlier were performed to determine whether the subsoil horizons should be classed as argillic or cambic. These soils represent conditions where it was not possible by field evidence alone to positively establish the presence or absence of clay films in the form of bridges between sand and silt grains, as linings around pores within the matrix, or as structural ped coatings. The purpose of this work was to determine the cross-sectional areal percentage of oriented clay films (argillans), the thickness of such features, and their distribution.

Soils, horizons, and sampling zones included in this work were the following:

Berks	B21	10–13 inches
	B22	17–19 inches
Dekalb	B2	15–20 inches
	B3	25–30 inches
Rayne	B22t	15–20 inches
	B3t	25–30 inches

Moist, oriented clods of 200 to 300 cm^3 were carefully collected from specified soil horizons, placed in a plastic-film wrap and aluminum foil, and put into pint cardboard cartons for transport to the laboratory. The wrap and aluminum foil maintained field moisture content and kept samples intact while in transport. Upon air-drying in the laboratory, samples were impregnated and sectioned using procedure outlined by Brewer (*6*). A Castolite-styrene mixture was used as the impregnating agent and epoxy cement was used to secure the soil slabs to a glass slide. Slides were polished to a 30 micron thickness. Sections were cut of both horizontal and vertical orientation. Eight transects

TABLE 13.—*Clay mineral percentages of selected soils*

Horizon	Depth	Clay minerals					
		Illite	Vermiculite	Expandables	Interstratified 10–14 Å	Kaolinite	Quartz
	Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
			Berks[1]				
Ap	0–5	33	29	------	5	17	17
B21	5–13	32	27	T[2]	T	27	14
B22	13–19	48	17	------	5	17	17
B3	19–24	57	16	------	T	12	15
			Clarksburg[1]				
Ap	0–8	30	30	ND[3]	7	18	13
A&B	8–14	30	30	ND	ND	20	15
B1t	14–21	30	24	7	ND	20	13
B2t	21–28	33	11	10	ND	25	15
Bx1t	28–40	45	15	8	ND	21	12
Bx2t	40–61	47	13	6	6	17	12
			Coshocton				
Ap	0–7	24	31	T	10	16	14
B21t	10–14	36	21	11	6	18	8
B22t	14–17	35	17	9	11	18	10
IIIB3	27–46	48	14	4	8	19	7
IIIC	46–58	46	13	6	11	18	6
			Dekalb				
A1	0–3	25	32	ND	11	20	12
A21	6–10	18	34	ND	9	27	11
A22	10–16	22	29	ND	8	28	13
B	16–21	24	20	T	9	36	11
C	27–42	43	13	T	T	30	12
			Keene				
Ap	0–7	14	45	T	ND	5	26
B1	9–14	25	28	13	ND	7	23
B21t	18–21	26	28	22	ND	12	12
B22t	21–23	31	28	23	ND	10	9
IIB24tg	27–33	54	13	8	ND	18	7
IIB31	39–42	65	11	3	ND	13	8
IIC2	59–66	60	14	4	ND	13	9
			Rayne[1]				
Ap	0–9	20	44	ND	ND	11	24
B21t	9–17	31	30	7	ND	11	21
B22t	17–27	31	27	6	ND	18	17
B3t	27–40	45	20	3	ND	18	14
C	40–45	49	21	3	ND	15	15

[1] Most horizons contain trace amounts to about 5 percent chlorite.
[2] T = trace amounts detected; no quantitative estimation attempted.
[3] ND = not detected.

TABLE 14.—*Percentages of clay mineral of coal underclay*

Geologic formation	Clay minerals			
	Illite	Kaolinite	Expandables[1]	Quartz
	Percent	*Percent*	*Percent*	*Percent*
Middle Kittanning (1)	55	35	10	----
Middle Kittanning (2)	35	35	30	Trace
Lower Kittanning	30	60	10	----
Brookville	25	65	10	----
Tionesta	65	15	15	5
Bedford	55	25	20	Trace

[1] Expandable minerals include mainly montmorillonite and regular interstratified mica-montmorillonite mixed layer assemblages. The interstratified components yield peaks at 12.5 Å and 26 Å on air-dry patterns but lose these 2 peaks upon glycolation. Sharp 17 Å peaks occur for glycolated samples. Interstratified components are most abundant in Middle Kittanning (1) and Bedford clays with slight amounts in Tionesta and Lower Kittanning clays.

(four vertical and four horizontal) were made across the thin section employing a point counting stage to observe morphological features at 0.1 millimeter intervals. This resulted in approximately 1,500 to 2,000 total counts for the combined vertical and horizontal slide sections from which percentages of argillans were calculated. Assuming 2,000 counts were made, the probable error using a 95 percent confidence interval would be ± 20 percent of the determined percentage if the argillans comprised 5 percent of the cross-sectional area or ± 10 percent if they comprised as much as 15 percent. These cross-sectional percentages were used because they approximate determined percentages (table 16).

Table 16 presents pertinent micromorphological data for the horizons examined. The following are other comments concerning these horizons:

Berks B21 — The matrix of this horizon is dominated by fine silt quartz grains with numerous sandstone and siltstone lithics. Horizon likely developed from silty shale or siltstone, with the inclusion of some sandstone.

B22 — Similar to above horizon but some micas observed that are closely associated with sandstone fragments rather than dispersed throughout the matrix.

Dekalb B2 — The matrix of this soil is mostly quartz sand grains with some fresh feldspars and micas. More commonly the micas exhibit frayed edges. Pores in this soil are mostly packing voids. Sand grains are commonly stained with iron.

Rayne B22t — This horizon contains many sandstone lithic fragments which have similar composition and fabric to the matrix. This suggests the horizon developed mostly from sandstone. Most micas and feldspars observed seem associated with sandstone fragments rather than matrix.

B3t — This horizon has a finer textured fabric (more silt and clay with less sand) suggesting its derivation mainly from siltstone. On the basis of thin sections a distinct lithologic break would be recognized between this horizon and the overlying B22t. This break is not so evident in the particle-size analysis of this soil.

TABLE 15.—*Relative amounts of interlayer hydroxy aluminum components and calculated contributions of the clay mineral and organic matter components to the cation-exchange capacity (CEC)*

Horizon	Depth	Interlayer aluminum[1]	Remarks	Calculated CEC[2]			Observed total CEC	CEC contributed by minerals (based on calculated CEC)
				Clay minerals	Organic matter	Total		
	Inches		*Angstroms*	*Milliequivalents per 100 grams*				*Percent*
			Berks					
Ap	0–5	L	Peak at 12 A	10.1	9.0	19.1	15.3	53
B21	5–13	L	Strong peaks at 12 A	10.0	2.2	12.2	11.0	82
B22	13–19	L	do.	9.6	1.1	10.7	12.7	90
B3	19–24	M	do.	10.1	1.1	11.2	14.6	90
			Clarksburg					
Ap	0–8	L	Peak at 12 A	9.8	7.6	17.4	15.9	56
A & B	8–14	L	do.	10.1	2.7	12.8	10.5	79
B1t	14–21	M	do.	9.9	1.8	11.7	11.4	85
B2t	21–28	M	do.	9.6	1.4	11.0	14.0	87
Bx1t	28–40	M	Shoulder at 10–12 A	10.3	.9	11.2	13.2	92
Bx2t	40–59	S	do.	11.9	.9	12.8	14.4	93
			Coshocton					
Ap	0–7	L	Peak at 12 A at 550° C	9.3	5.0	14.3	12.3	65
B21t	10–14	L	do.	15.3	.6	15.9	15.6	96
B22t	14–17	L	do.	15.1	.6	15.7	17.4	96
IIIB3	27–46	L	do.	10.4	--------	10.4	14.3	100
IIIC	46–58	L	Peak at 12 A at 400° and 550° C.	13.4	--------	13.4	15.7	100
			Dekalb					
A1	0–3	L	Broad peak at 12 A	4.5	13.0	17.5	21.3	26
A21	6–10	L	do.	3.8	1.6	5.4	4.7	70
A22	10–16	L	do.	2.8	.5	3.3	3.8	85
B2	16–21	M	No peak; shoulder at 10–12 A.	2.8	--------	2.8	3.3	100
C	27–42	S	do.	1.2	--------	1.2	3.0	100
			Keene					
Ap	0–7	L	Broad peak at 12 A	9.7	5.8	15.5	12.7	63
B1	9–14	L	No peak; shoulder at 10–12 A.	16.1	.6	16.7	15.8	96
B21t	18–21	M	do.	19.2	.1	19.3	18.3	99
B22t	21–23	M	do.	16.1	.1	16.2	21.2	99
IIIB24tg	27–33	M	do.	18.8	--------	18.8	16.5	100
IIB31	39–42	S	do.	12.9	--------	12.9	13.6	100
IIC2	59–66	S	do.	14.3	--------	14.3	14.9	100
			Rayne					
Ap	0–9	L	Peak at 12 A	9.8	4.5	14.3	11.7	68
B21t	9–17	M	do.	13.8	1.8	15.6	13.9	89
B22t	17–27	L	Strong peaks at 12 A	10.6	.6	11.2	13.8	95
B3t	27–40	M	do.	8.7	.6	9.3	14.3	94
C	40–55	M	do.	9.4	.6	10.0	13.9	94

[1] Relative evidence of interlayer aluminum (S) small, (M) medium, or (L) large amounts.
[2] Assumed CEC values for clay minerals and organic matter:

Illite — 40 meq/100 g clay
Vermiculite — 120 meq/100 g clay
Expandables — 80 meq/100 g clay
Interstratified — 70 meq/100 g clay
Kaolinite — 5 meq/100 g clay
Organic Matter (O.M.) — if >50 percent base saturation 260 meq/100 g O.M. or 450 meq/100 g clay minerals.
if <50 percent base saturated 160 meq/100 g O.M. or 275 meq/100 g clay minerals.

TABLE 16.—*Micromorphological features of selected horizons from 3 soils of the North Appalachian Experimental Watershed*

Soil and horizon	Depth	Total counts	Oriented clay[1]		Degree of orientation[2]	Location of oriented clay	Thickness of oriented clay	Argillic horizon	Remarks[3]
	Inches		*Percent*				*Millimeters*		
Berks:									
B21	10–13	2,159	5.4 4.3 4.8	θ ↑	Strong continuous.	Along pores and channels in s-matrix and along ped surfaces.	0.03–0.15 (mostly 0.05).	Yes	Strongly insepic plasmic fabric; sharp extinction bands.
B22	17–19	1,633	2.9 1.3 2.2	θ ↑	Moderate to weakly continuous with a few strong continuous.	Around lithics, along pores and channels within s-matrix; very few along ped surfaces.	0.01–0.15 (mostly 0.05).	Yes ? Very weak	Weakly insepic to skelsepic plasmic fabric. Argillic horizon much weaker than B21.
Dekalb:									
B2	15–20	1,000	6.0 0.0 3.0	θ	Moderate and strongly continuous.	Bridges between grains and around packing voids.	0.05–0.3 (mostly 0.2).	Yes ? Very weak	Granular s-matrix fabric (no plasmic structure); no oriented clay on vertical slide; sharp extinction bands.
B3	25–30	1,475	6.0 4.9 5.5	θ	Moderate continuous.	Same	0.03–0.1 (mostly 0.05).	Yes Very weak	Same.
Rayne:									
B22t	15–20	1,759	15.2 14.4 14.8	θ	Moderate to strongly continuous.	Most around lithics; a few around voids in the s-matrix.	0.1–0.3 (mostly 0.15).	Yes	Insepic fabric both in lithics and s-matrix; sharp extinction bands.
B3t	25–30	2,067	14.0 16.2 15.1	θ	Strongly continuous.	Most occurs as papules and plugged pores within s-matrix; only occasionally along pores and ped surfaces.	0.1–0.3	Yes	Strongly insepic; very few lithorelics; oriented clay has flow features with distinct extinction bands.

[1] Symbols (θ) represent horizontally oriented cross sections and (↑) vertically oriented sections.

[2] Terminology for degree of orientation taken from Brewer (6) and is not to be confused with coverage or abundance. Here, continuous implies clay flow features by illuviation where individual clay particles were not identified.

[3] Terminology for fabrics taken from Brewer (6). Insepic implies that much of the plasma (clay) occurs as islands or patches in s-matrix with remainder, not associated with pedological features, as random individual particles with a flecked orientation.

All of the horizons, with possible exceptions of Dekalb B2 and Berks B22, have ample oriented clay to constitute more than 1 percent of the cross sectional area. The B2 vertically oriented section of Dekalb lacks oriented clay throughout the entire section, but it contains sufficient clay bridges and lined pores in localized areas of the horizontal section to meet the 1 percent cross sectional areal requirement. In the B3 horizon of Dekalb, oriented clay features are so thin (table 16) that they frequently would not be identified by a 10× or 14× field hand lens. However, both the B2 and B3 horizons of this soil were described as having faint, very patchy clay bridges between sand grains and around lithics, which is consistent with thin-section observations. These horizons would be considered borderline argillic-cambic.

The Berks B22 horizon likewise is borderline argillic-cambic; but the overlying B21 is clearly argillic, and the profile should be classified with an argillic horizon. Clay films were not noted in the field description of B21, but they were noted in the B22 horizon. On the basis of micromorphology, the strongest argillic is in the B21 horizon.

The Rayne profile has distinct argillic horizons from the standpoint of percentage of oriented clay. However, clay films were commonly absent on ped surfaces and this condition would make field identification of an argillic horizon less certain and would tend to underestimate the horizon's distinctiveness. Thin-section data for this profile are generally consistent with field descriptions, but more clay films were noted on ped surfaces in the field than were observed in thin sections.

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GLOSSARY

AGGREGATE, SOIL Many fine particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

ALLUVIUM Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

AVAILABLE MOISTURE CAPACITY Difference between the amount of water in a soil at field capacity and the amount in the same soil at the permanent wilting point; commonly expressed as inches of water per inch depth of soil.

BASE SATURATION Degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

CATION Ion carrying a positive charge of electricity. The common soil cations are calcium, magnesium, sodium, potassium, and hydrogen.

CATION-EXCHANGE CAPACITY Measure of the total amount of exchangeable cations that can be held by the soil. It is expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7) or at some other stated pH value. The term as applied to soils is synonymous with base-exchange capacity but is more precise in its meaning.

CHANNERY SOIL Soil that contains thin, flat fragments of sandstone, limestone, or schist as much as 6 inches in length along the longer axis. A single piece is called a fragment.

CLAY As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

CLAY FILM Thin coating of clay on the surface of a soil aggregate. Synonyms are clay coat and clay skin.

COARSE FRAGMENTS Rock or mineral particles > 2 millimeters in diameter. The following names are used for coarse fragments in soils.

Shape and material	Descriptive term of fragment with diameter of— Less than 3 in	3 to 10 in	More than 10 in
Rounded or subrounded:			
All kinds	Gravelly	Cobbly	Stony.
Irregular and angular:			
Chert	Cherty	Coarse cherty	Stony.
Other	Angular gravelly.	Angular gravelly.	Stony.
	Less than 6 in	6 to 15 in	More than 15 in
Thin and flat:			
Limestone, sandstone, or schist.	Channery	Flaggy	Stony.
Slate	Slaty	Flaggy	Stony.
Shale	Shaly	Flaggy	Stony.

COLLUVIUM Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

COMPLEX, SOIL Mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

CONSISTENCE, SOIL Feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose, noncoherent; will 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.

CREEP, SOIL Downward movement of masses of soil and soil material on slopes, primarily through the action of gravity. The movement is generally slow and irregular. It occurs most commonly when the lower part of the soil is nearly saturated with water, and it may be facilitated by alternate freezing and thawing.

DRAINAGE, SOIL Relative rapidity and extent of removal of water, under natural conditions, from on and within the soil.

EROSION Wearing away of the land surface by wind, running water, and other geological agents.

FERTILITY, SOIL Quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other such growth factors as light, moisture, temperature, and the physical condition of the soil are favorable

FIRST BOTTOM Normal flood plain of a stream subject to frequent or occasional flooding.

FLOOD PLAIN Nearly level land, consisting of stream sediment, that borders a stream and is subject to flooding unless protected artificially.

FRAGIPAN Loamy, brittle, subsurface horizon that is very low in organic matter and clay but is rich in silt or very fine sand. The layer is seemingly cemented when dry, has a hard or very hard consistence, and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

FRAGMENT Individual piece of thin flat limestone, sandstone, or schist 2 millimeters to 6 inches in diameter. A soil that contains many fragments is referred to as channery. See **channery soil**.

GRAVELLY Containing appreciable or significant amounts of gravel. (used to describe soils or lands). See **coarse fragments**.

HORIZON, SOIL Layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. The relative position of the several soil horizons in a typical soil profile, and their nomenclature, are:

O horizon. Organic horizon of mineral soils.

A horizon. Horizon at the surface. From this horizon, except in dark-colored, humic Gley soils, some soluble minerals and clay have been removed by percolating water. The major A horizon may be subdivided into A1, the part that is dark colored because of organic matter, and A2, the part that is leached and light colored. In woodlands, a layer of organic matter accumulates on top of the mineral soil; this layer is called the A0 horizon. When a soil is plowed, these parts of the A horizon are mixed and the plow layer is called the Ap horizon.

B horizon. Horizon in which clay oxides or other materials have accumulated, or in which alteration obliterates parent material structure. It may be subdivided into B1, B2, or B3 horizons.

C horizon. Material immediately under the true soil. In chemical, physical, and mineral composition it is presumed to be similar to the material from which at least a part of the overlying solum has developed.

R horizon. Underlying consolidated bedrock.

Roman numerals. Prefixed to the master horizon or layer designations (O, A, B, C, R) to indicate lithologic discontinuities either within or below the solum. The first, or uppermost, material is not numbered, for the Roman numeral I is understood; the second contrasting material is numbered II, and others are numbered III, IV, and so on, consecutively downward. For example, a sequence from the surface downward might be A1, A2, B1, IIB2, IIB3, IIC1, IIC2.

599-820 O - 76 - 6

Following are the subscript symbols used in this report with those letters that designate the master horizons:

g—strong gleying
p—plow layer
t—illuvial clay
x—fragipan character

HYDROLOGIC RESPONSE UNIT Land units of relative homogenity with respect to soil type, land form, and land use that fall into a sequence compatible with the hydraulics of overland and subsurface flows.

INCLUSION Kind of soil that has been included in mapping a soil of different kind because the area was too small to be mapped separately on a map of the scale used.

INFILTRATION Downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is downward movement of water through soil layers or material.

KRILIUM Soil additive claimed to increase water stability of clayey soil.

LEACHING, SOIL Removal of materials in solution by percolating water.

LITHICS Features derived from the current rock, usually recognizable by the rock structure and fabric.

MAPPING UNIT Any soil, miscellaneous land type, soil complex, or undifferentiated soil group shown on the detailed soil map and identified by a letter symbol.

MORPHOLOGY, SOIL Makeup of the soil, including the texture, structure, consistence, color, and other physical, chemical, mineralogical, and biological properties of the various horizons that make up the soil profile.

MOTTLED Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are abundance—*few*, *common*, and *many*, size—*fine*, *medium*, and *coarse*, and contrast—*faint*, *distinct*, and *prominent*. The size measurements are *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

NO-TILL Farming practice in which seed is planted in a vegetation-covered surface without tillage.

PARENT MATERIAL Horizon of weathered rock or partly weathered soil material from which soil has formed; horizon C in the soil profile.

PED Individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

PERMEABILITY Quality of a soil horizon that enables water or air to move through it. Terms to describe permeability are *very slow*, *slow*, *moderately slow*, *moderate*, *moderately rapid*, *rapid*, and *very rapid*.

pH See **Reaction, soil**.

PHASE, SOIL Subdivision of a soil type, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects management.

PROFILE, SOIL Vertical section of the soil through all its horizons and extending into the parent material.

REACTION, SOIL Degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or sour, soil gives an acid reaction, an alkaline soil, an alkaline reaction. The degrees of acidity or alkalinity are:

Word(s) description	*pH value*	*Word(s) description*	*pH value*
Extremely acid	below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.5	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline.	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

RELIEF Elevation or inequalities of a land surface, considered collectively.

RESIDUUM Unconsolidated and partly weathered mineral materials accumulated by disintegration of consolidated rock in place.

SAND Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

SERIES, SOIL Group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

SHALY A, Containing a large amount of shale fragments, as a soil; B, A soil phase as, for example, *shaly* phase. See **coarse fragments**.

SILT Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

SOIL Natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting upon parent material, as conditioned by relief over periods of time.

SOIL SEPARATES Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are: *Very coarse sand* (2 to 1 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *find sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter) *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

SOLUM Upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soils includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

STONES Rock fragments greater than 10 inches in diameter if rounded and greater than 15 inches along the longer axis if flat. See **coarse fragments**.

STONY Soils that contain stones in numbers that interfere with or prevent tillage.

STRATIFIED Composed of, or arranged in, strata or layers, such as stratified alluvium. The term is confined to geological material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

STRUCTURE, SOIL Arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structures are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

SUBSOIL Technically, the B horizon, roughly, the part of the profile below plow depth.

SUBSTRATUM Any layer lying beneath the solum, or true, soil; the C or D horizon.

SURFACE LAYER Term used in nontechnical soil descriptions for one or more layers above the subsoil. Includes A horizon and part of B horizon; has no depth limit.

SURFACE SOIL Soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness; the plowed layer.

TERRACE (GEOLOGICAL) Old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces, deposited by the sea, are generally wide.

TEXTURE, SOIL Relative proportions of sand, silt, and clay particles in a mass of soil. (See also Clay, Sand, and Silt.) The basic textural classes, in order of increasing proportions of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

TILTH, SOIL Condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

TOPSOIL Presumed fertile soil or soil material, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

TYPE, SOIL Subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

UPLAND (GEOLOGY) Land consisting of material unworked by water in recent geologic time and lying, in general, at a higher elevation than the alluvial plain or stream terrace. Land above the lowlands along rivers.

VARIANT, SOIL Soil variant is a taxonomic soil unit closely related to another such taxonomic unit as a soil series, but departing from it in at least one differentiating characteristic at the series level, from which it derives its name as modified by the principal distinguishing feature.

WATER TABLE Highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

WEATHERING, SOIL All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

APPENDIX A

Single-cover watershed maps, descriptions, land use, and profiles

Single-cover watershed maps show topography, soil mapping units, and location of soil core sampling sites. Location of each watershed appears on figure 4. General physical characteristics of each watershed are presented with land use history. The soil profile at each core sampling site is described in detail. Physical and chemical characteristics of materials at sampling sites on single-cover watersheds are in tables 11 and 12.

Watershed 102

Soil in the upper part of watershed 102 developed from coarse shale and siltstone containing small areas of discontinuous lenses of finer material. Infiltration rates are high and water moves down rapidly through the soil and fractured sandstone bedrock in the lower three-fourths of the watershed. The entire watershed shows evidence of colluvial mixing of parent soil materials with strong local differences in content of stone and silty material.

Descriptions of the upper part of the profile at three sites in watershed 102 are given below. Physical and chemical characteristics of materials at these sites are given in tables 11 and 12.

This watershed of 18 percent slope has been used for pasture throughout the period of record. Livestock from 1938 through 1944 was mostly sheep and a few horses. Then, beef cattle were pastured in this area. Vegetative cover was shallow-rooted grass and weeds until 1947 when the area was disked, harrowed, seeded to alfalfa-bromegrass, fertilized, and cultipacked. This treatment was repeated in 1964. Deep-rooted grass and legumes have prevailed since 1947.

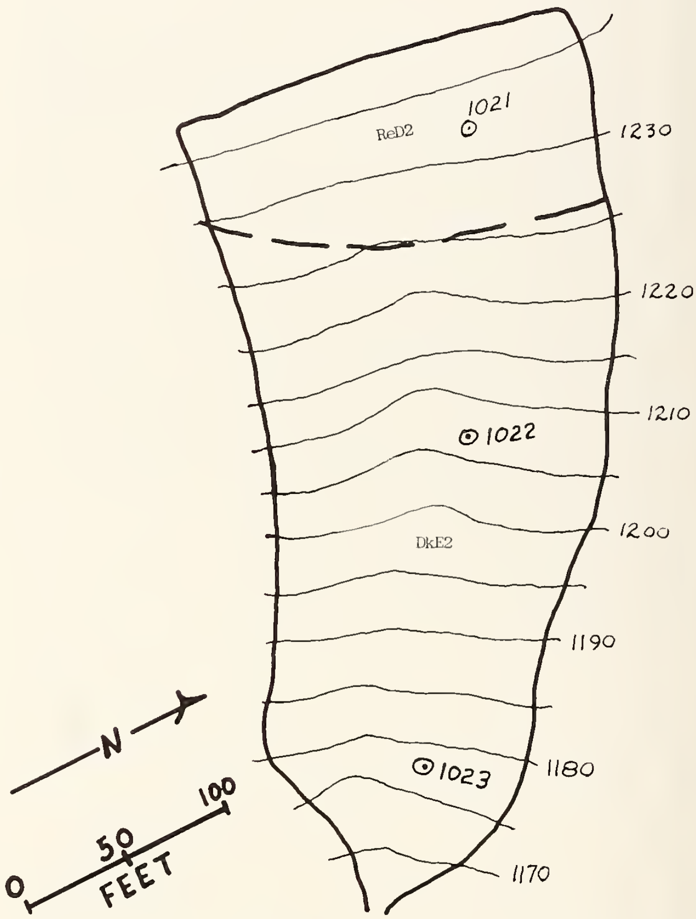

FIGURE 32.—Map of watershed 102, 1.26 acres: ReD2—Rayne silt loam, 12 to 18 percent slopes, moderately eroded; and DkE2—Dekalb channery sandy loam, 18 to 25 percent slopes, moderately eroded.

TABLE 17.—*Description of soil by horizons at core sites in watershed 102*

Profile classification, site, and horizon	Description
Coshocton silt loam[1]:	
1021:	
Ap1	0 to 2 inches, very dark grayish-brown (10YR 3/2), dark-brown (10YR 4/3) crushed; silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 5 percent siltstone fragments.
Ap2	2 to 8 inches, dark-brown (10YR 3/3, 10YR 4/3) crushed silt loam; (Other properties same as Ap1.)
B1	8 to 11 inches, yellowish-brown (10YR 5/4); silt loam; weak medium subangular blocky structure; friable; common roots; 5 percent siltstone fragments.
B21t	11 to 20 inches, yellowish-brown (10YR 5/4), heavy silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films; 5 to 10 percent siltstone fragments.
IIB22t	20 to 28 inches, yellowish-brown (10YR 5/6), silty clay loam; many coarse distinct light brownish-gray (2.5Y 6/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky structure; firm; common roots; thin patchy brown (7.5YR 5/4) clay films; 10 percent siltstone fragments.
IIB23t	28 to 30 inches, dark yellowish-brown (10YR 4/4) silty clay loam; many coarse distinct light brownish-gray (2.5Y 6.2) mottles; weak medium subangular blocky structure; firm; few roots; thin patchy brown (7.5YR 5/4) clay films; 10 percent siltstone fragments.
Rayne silt loam[2]:	
1022:	
Ap1	0–2 inches, very dark grayish-brown (10YR 3/2), dark-brown (10YR 3/3) crushed; silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 10 percent shale fragments.
Ap2	2–7 inches, dark-brown (10YR 3/3, 10YR 4/3) crushed silt loam; (other properties same as Ap1).
B1	7–13 inches, strong brown (7.5YR 5/6) silt loam; weak medium subangular blocky structure; friable; common roots; 10 percent shale fragments.
B21t	13–18 inches, yellowish-brown (10YR 5/4) shaly silt loam; weak medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films; 15 percent shale fragments.
B22t	18–28 inches, yellowish-brown (10YR 5/4) heavy shaly silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films; 30 percent shale and sandstone fragments.
Dekalb silt loam[3]:	
1023:	
Ap1	0–3 inches, very dark grayish-brown (10YR 3/2), dark brown (10YR 3/3) crushed; silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 10 percent sandstone fragments.
Ap2	3–7 inches, dark-brown (10YR 3/3), dark yellowish-brown (10YR 3/4) crushed silt loam; (other properties same as Ap1).
B21	7–16 inches, strong brown (7.5YR 5/6) silt loam; weak medium subangular blocky structure; friable; common roots; 10 percent sandstone fragments.
IIB22	16–25 inches, yellowish-brown (10YR 5/4) channery loam; weak medium subangular blocky structure; friable; common roots; thin very patchy dark brown (7.5YR 4/4) clay films; 40 percent sandstone fragments.
IIR	25–28 inches, soft sandstone with dark-brown (7.5YR 4/4) clay films.

[1] Common inclusion in Rayne mapping units.

[2] Common inclusion in Dekalb mapping units.

[3] Contains less sand and sandstone fragments than required for the Dekalb Series; this is a common inclusion in Dekalb mapping units.

Watershed 103

Soils in watershed 103 developed from sandy shales or siltstone in the upper half of the watershed and from a finer textured clay shale in the lower half. The Middle Kittanning clay lies at the divide between the two parent materials and is a barrier to downward movement of water above it. Infiltration rates are rapid in the coarser textured soils in the upper part of the watershed but tend to become slow in the lower part of the watershed after prolonged wetting. The Lower Kittanning clay lies at an elevation 16 feet below the runoff flume.

This watershed of 11 percent average slope has been cropped throughout the study period as follows:

1937	oats	1943	wheat
1938	corn	1944	meadow
1939	oats to wheat	1945	meadow
1940	wheat	1946	continue 4-year rotation of C-W-M-M
1941	meadow		
1942	corn		

Runoff records began in March 1939. Improved practices of higher fertility level and contour tillage (table 3) began in 1942. Its counterpart in prevailing (poor) practices was watershed 110.

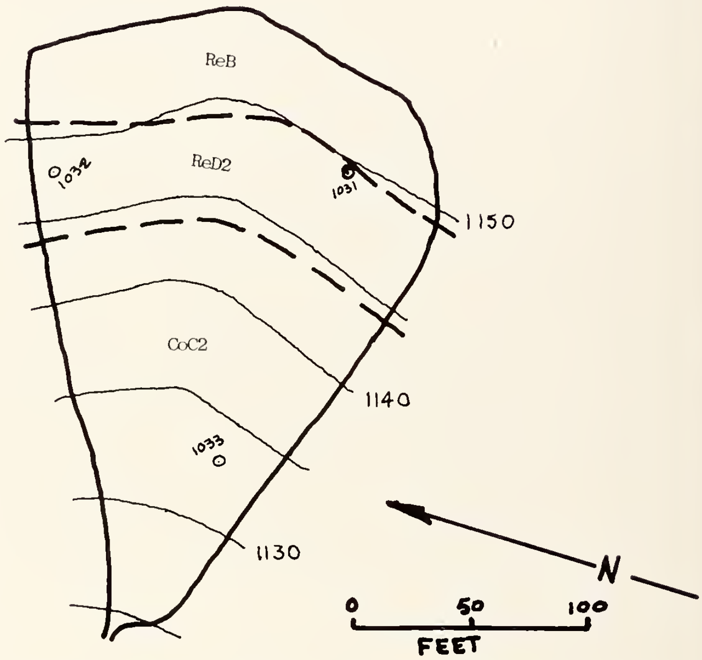

FIGURE 33.—Map of watershed 103, 0.65 acre: ReB—Rayne silt loam, 2 to 6 percent slopes; ReD2—Rayne silt loam, 12 to 18 percent slopes, moderately eroded; and CoC2—Coshocton silt loam, 6 to 12 percent slopes, moderately eroded.

TABLE 18.—*Description of soil by horizons at core sites in watershed 103*

Profile classification, site, and horizon	Description
Rayne silt loam:	
1031:	
Ap	0–8 inches, dark-brown (10YR 4/3), dark yellowish-brown (10YR 4/4) crushed silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 5 percent sandy shale fragments.
B21t	8–19 inches, yellowish-brown (10YR 5/6) heavy shaly silt loam; moderate fine and medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 15 percent sandy shale fragments.
B22t	19–28 inches, yellowish-brown (10YR 5/4) heavy very shaly silt loam; weak medium subangular blocky structure; friable; few roots; thin continuous dark-brown (7.5YR 4/4) clay films; 55 percent sandy shale fragments.
1032:	
Ap	0–7 inches, dark-brown (10YR 4/3), dark yellowish-brown (10YR 4/4) crushed silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 2 percent sandy shale fragments.
B21t	7–17 inches, yellowish-brown (10YR 5/6) heavy shaly silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 15 percent sandy shale fragments.
B22t	17–26 inches, yellowish-brown (10YR 5/4) heavy very shaly silt loam; moderate thick platy structure parting to moderate fine subangular blocky structure; friable; common roots; thin continuous dark-brown (7.5YR 4/4) clay films; 50 percent sandy shale fragments.
Keene silt loam[1]:	
1033:	
Ap	0–8 inches, dark grayish-brown (10YR 4/2), dark-brown (10YR 4/3) crushed silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots.
B21t	8–13 inches, yellowish-brown (10YR 5/4) heavy silt loam; few fine distinct pale-brown (10YR 6/3) and yellowish-brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5 YR 5/4) clay films; 2 percent shale fragments.
B22t	13–18 inches, yellowish-brown (10YR 5/4) light silty clay loam; many medium distinct yellowish-brown (10YR 5/6) and common fine distinct light brownish-gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films; 5 percent shale fragments.
IIB23t	18–28 inches, yellowish-brown (10YR 5/6) ped interiors with light brownish-gray (2.5Y 6/2) ped surfaces; silty clay loam; common fine distinct light brownish-gray (10YR 6/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky structure; firm; common roots; thin patchy brown (7.5YR 5/4) clay films; 5 percent shale fragments.

[1] Common inclusion in Coshocton mapping units.

Watershed 104

This watershed lies just south of and adjacent to watershed 102, and it has soils of similar origin and morphology. Shale fragments from the ridge above have moved down by colluvial action to influence the upper part of the watershed. A manmade diversion defines the upslope boundary and diverts upslope runoff around the gaged area.

Below the shale-influenced area (map unit Re), the soils are developed from sandstone, resulting in rapid permeability and infiltration rates. Infiltrated water does not reappear at the surface above the runoff measuring flume which is situated approximately 18 feet above the nearly impermeable Middle Kittanning clay. Extensive probing in this area indicates that the fractured bedrock lies between 3 and 8 feet below the surface.

For a description of physical and chemical characteristics of watershed 104 soils, see watershed 102.

This watershed of 21 percent average slope was used for pasture throughout the study period until 1969 when continuous no-till corn culture was started. Livestock from 1938 through 1944 was mostly sheep and a few horses. Then beef cattle were pastured in this area. Fertilizer and seed applied in 1940 improved the vegetation from poverty grass into bluegrass and clover. Fertilizer was applied occasionally thereafter as needed. Runoff records began in March 1937.

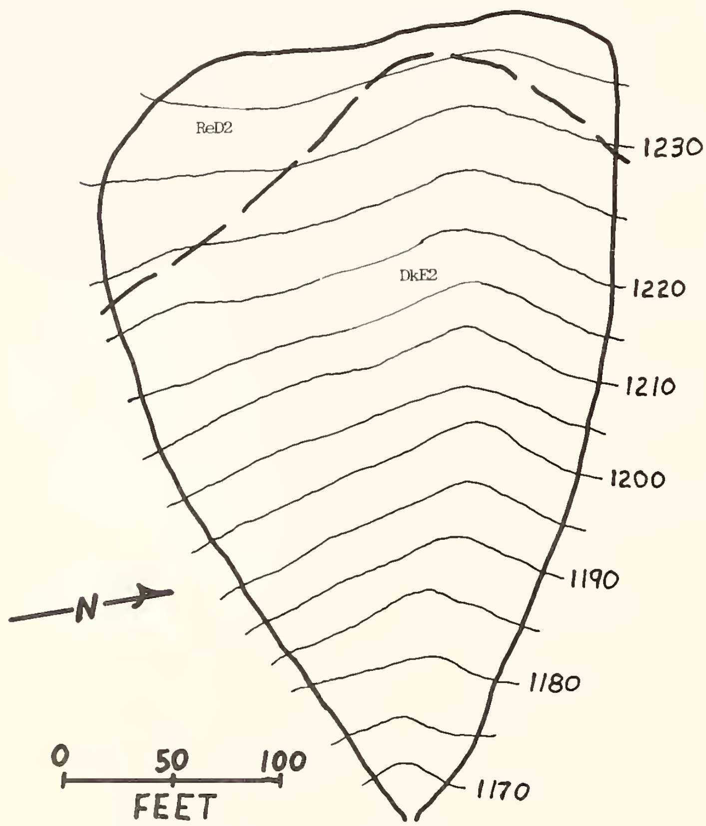

FIGURE 34.—Map of watershed 104, 1.33 acres: ReD2—Rayne silt loam, 12 to 18 percent slopes, moderately eroded; and DkE2—Dekalb channery sandy loam, 18 to 25 percent slopes, moderately eroded.

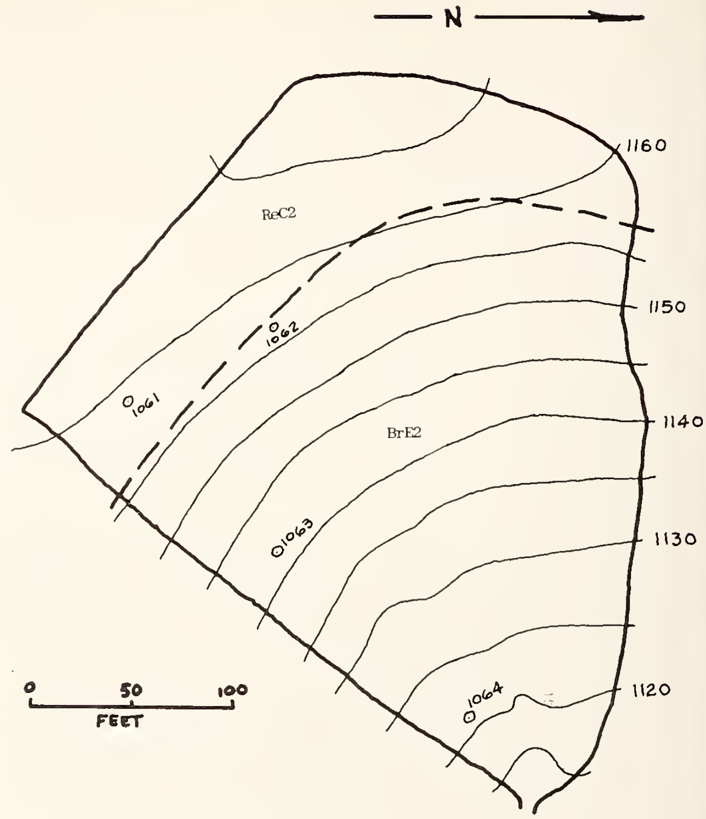

FIGURE 35.—Map of watershed 106, 1.56 acres: ReC2—Rayne silt loam, 6 to 12 percent slopes; and BrE2—Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded.

Watershed 106

Silty surface deposits have been mixed by tillage into the loamy parent material derived from sandstone bedrock at the top of this watershed. Farther downslope, the parent material grades into a sandy shale with many fractures, becoming consolidated bedrock below 3 feet in depth. During the nongrowing season, infiltrated water builds up a water mound on the Middle Kittanning clay which lies 6 feet below the runoff measuring flume. This causes infiltrated water from the upper part of the watershed to resurface downhill just above the flume, sustaining flow on the falling side of storm runoff hydrographs. This same condition keeps the small alluvial area above the flume wet for prolonged periods in the early spring, in prime condition for runoff.

This watershed of 14 percent average slope has been cropped throughout its study period as follows:

TABLE 19.—*Description of soil by horizons at core sites in watershed 106*

Profile classification, site, and horizon	Description
Rayne silt loam:	
1061:	
Ap	0–8 inches, dark-brown (10YR 3/3, 10YR 4/3) crushed silt loam; weak fine subangular blocky structure parting to moderate fine granular structure; friable; many roots; 2 percent sandstone and shale fragments.
B1	8–14 inches, yellowish-brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common roots; 2 percent sandstone and shale fragments; few mica flakes.
B21t	14–25 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 5 percent sandstone and shale fragments; many mica flakes.
B22t	25–30 inches, yellowish-brown (10YR 5/4) heavy silt loam; weak medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 10 percent sandstone and shale fragments; many mica particles; several Fe and Mn concretions.
Berks silt loam:	
1062:	
Ap	0–8 inches, dark-brown (10YR 4/3) dark yellowish-brown (10YR 4/4) crushed silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 5 percent sandstone and shale fragments; many mica flakes.
B1	8–12 inches, yellowish-brown (10YR 5/6) channery loam; weak fine subangular blocky structure; friable; many roots; 30 percent sandstone and shale fragments; many mica flakes.
B2	12–23 inches, yellowish-brown (10YR 5/6) channery loam; weak medium subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 40 percent sandstone and shale fragments; many mica flakes.
B3	23–29 inches, yellowish-brown (10YR 5/6) very channery loam; weak coarse subangular blocky structure; friable; few roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 50 percent pale-brown (10YR 6/3) sandstone channers.
Berks loam[1]:	
1063:	
Ap	0–11 inches, dark-brown (10YR 4/3), dark yellowish-brown (10YR 4/4) crushed loam; weak medium subangular blocky structure parting to weak fine granular structure; friable; many roots; 10 percent sandy shale fragments.
B21t	11–18 inches, yellowish-brown (10YR 5/4) shaly loam; weak medium subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 30 percent sandy shale fragments.
B22t	18–28 inches, yellowish-brown (10YR 5/4) very shaly loam; weak medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 65 percent sandy shale fragments.
Berks shaly loam[2]:	
1064:	
Ap	0–9 inches, dark-brown (10YR 4/3), dark yellowish-brown (10YR 4/4) crushed shaly loam; weak fine granular structure; friable; many roots; 15 percent sandy shale fragments.
B1	9–15 inches, yellowish-brown (10YR 5/4) shaly loam; weak medium subangular blocky structure; friable; common roots; 20 percent sandy shale fragments.
B21t	15–24 inches, yellowish-brown (10YR 5/4) shaly loam; weak medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/2) clay films on vertical faces; 25 percent sandy shale fragments.
B22t	24–28 inches, yellowish-brown (10YR 5/4) very shaly loam; weak coarse subangular blocky structure; friable; few roots, thin patchy brown (7.5YR 5/2) clay films in pores and on stones, 50 percent sandy shale fragments

[1] Contains more clay films in subsoil than allowable for Berks Series; a common inclusion in Berks mapping units.

[2] Common inclusion in Berks mapping units.

1937 meadow
1940 pasture
1942 wheat to meadow
1943 meadow
1944 corn to wheat
1945 wheat
1946 meadow
1947 meadow
1948 continue 4-year rotation of C-W-M-M

Records began in March 1939 when management of the land was at low level fertility with straight, sloping rows (table 3). Its counterpart in improved practices was watershed 121.

Watershed 107

Sandstone is the dominant parent material for the soils in the upper part of watershed 107. Topsoil is thin because of excessive erosion before 1930; however, infiltration rates are still high, especially in the loamy areas. Colluviation has carried the sandstone influence down to the middle and lower slopes of the watershed where the bedrock grades into siltstone and shale. A clay layer lies above the shale, but its outcrop is covered by several feet of porous colluvial material. There are no seep spots in the watershed at that elevation. Pine trees planted in the late 1930's have shed a thick layer of needles on the ground surface that has been effective in retarding runoff since the early and mid-1940's.

Runoff records began in July 1938 and were terminated in March 1946 when revegetation practically stopped runoff and erosion. Also, tunnels were discovered from earlier underground coal mining operations near and possibly beneath the watershed.

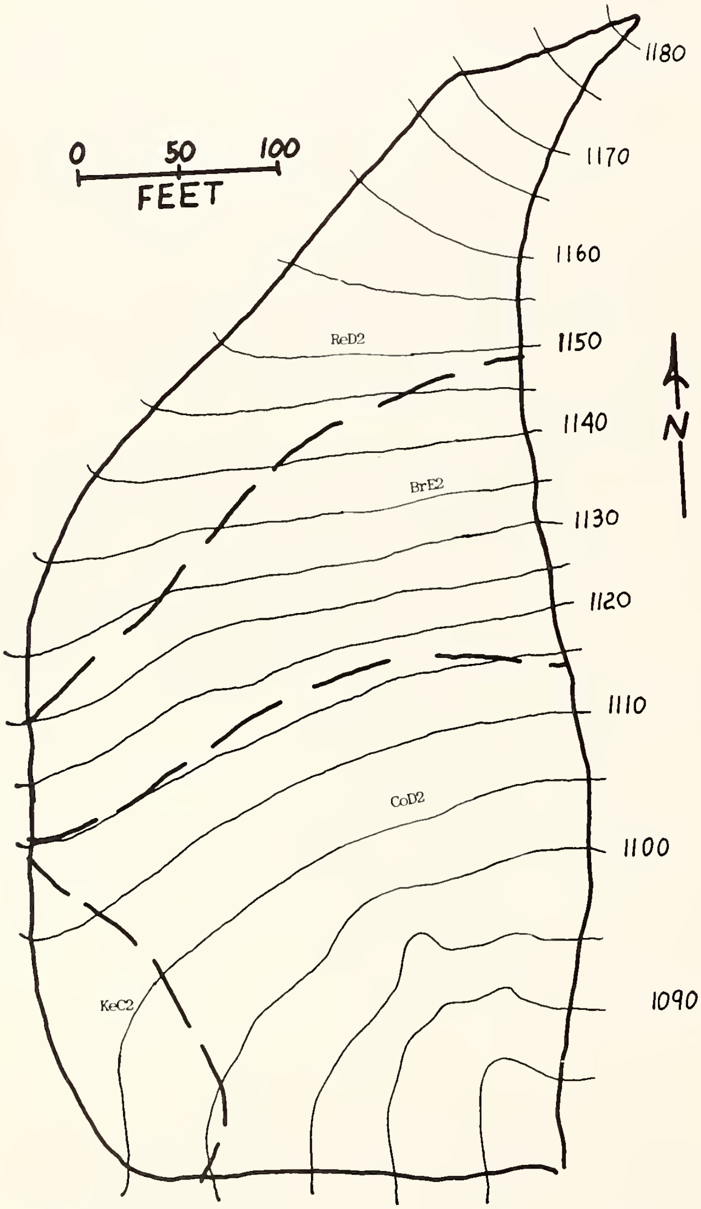

FIGURE 36.—Map of watershed 107, 2.59 acres: ReD2—Rayne silt loam, 12 to 18 percent slopes, moderately eroded; BrE2—Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded; CoD2—Coshocton silt loam, 12 to 18 percent slopes, moderately eroded; and KeC2—Keene silt loam, 6 to 12 percent slopes, moderately eroded.

Watershed 109

Soils in the upper third of this watershed developed from a sandy shale, which after weathering left many pebble- and cobble-sized stones near enough to the surface to be exposed by conventional tillage operations. In the lower two-thirds of the watershed the parent material is a finer grained silty shale, which produced finer textured soils with fewer stones near the surface. Near the bottom of the watershed, deposition of fine upslope material accentuates the difference in stone content between the upper and lower parts. Infiltration is good, especially in the deeper soil just above the flume, and runoff during the growing season is consequently low. The Middle Kittanning clay is 21 feet below the flume.

Lysimeters Y102 A, B, and C are located about 60 feet north of this watershed near the boundary of the sandy and silty parent material of the BrD2 and ReC2 mapping units.

Cropping history of this watershed and the lysimeters was as follows:

1938	meadow to corn	1943	meadow
1939	oats to wheat	1944	meadow
1940	wheat to meadow	1945	corn, continued in a 4-year rotation of C-W-M-M
1941	corn to wheat		
1942	wheat		

Runoff records began in July 1938, and improved practices (table 3) started in 1941. Cropping of watersheds 115 (prevailing practices) and 123 (improved practices) was identical to that of watershed 109.

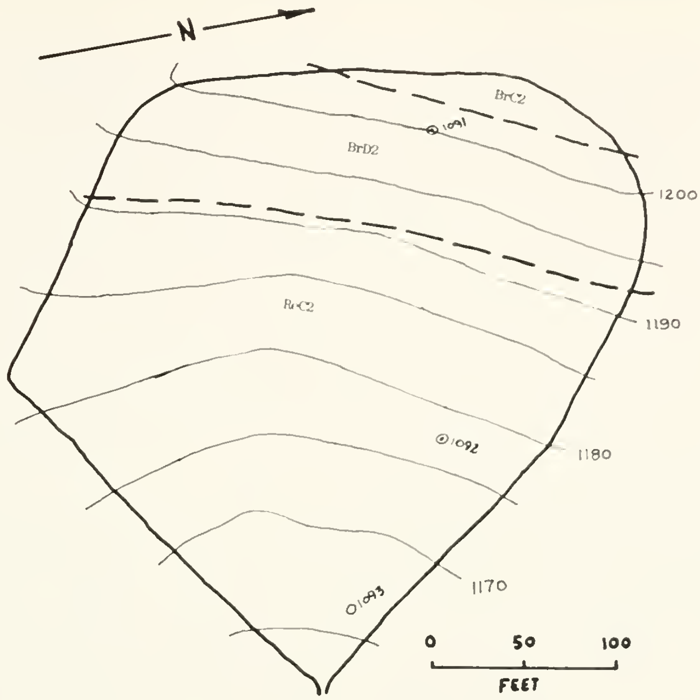

FIGURE 37.—Map of watershed 109, 1.69 acres: BrC2—Berks shaly silt loam, 6 to 12 percent slopes, moderately eroded; BrD2—Berks shaly silt loam, 12 to 18 percent slopes, moderately eroded; and ReC2—Rayne silt loam, 6 to 12 percent slopes, moderately eroded.

TABLE 20.—*Description of soil by horizons at core sites in watershed 109*

Profile classification, site, and horizon	Description
Berks silt loam:	
1091:	
Ap	0–8 inches, dark-brown (10YR 4/3) silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; common roots; 10 percent sandy shale fragments.
B21	8–12 inches, strong brown (7.5YR 5/6) shaly loam; weak medium subangular blocky structure; friable; common roots; 20 percent sandy shale fragments.
B22	12–28 inches, yellowish-brown (10YR 5/4) very shaly silt loam; weak fine subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 65 percent sandy shale fragment.
Rayne silt loam:	
1092:	
Ap	0–7 inches, dark-brown (10YR 3/3, 10YR 4/3) crushed silt loam; weak fine granular structure; friable; many roots.
B1	7–16 inches, dark yellowish-brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; many roots; 5 percent shale fragments.
B21t	16–23 inches, yellowish-brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy dark yellowish-brown (10YR 4/4) clay films; 5 percent shale fragments.
B22t	23–30 inches, brown (10YR 5/3) shaly loam; weak medium subangular blocky structure; friable; common roots; thin patchy dark yellowish-brown (10YR 4/4) clay films; 15 percent sandy shale fragments.
1093:	
Ap	0–6 inches, dark-brown (10YR 3/3) silt loam; weak fine granular structure; friable; common roots; 2 percent shale fragments.
B1	6–15 inches, dark yellowish-brown (10YR 4/4) shaly silt loam; weak fine subangular blocky structure; friable; common roots; 15 percent shale fragments.
B21t	15–22 inches, yellowish-brown (10YR 5/4) heavy shaly silt loam; moderate medium subangular blocky structure; friable; few roots, thin patchy brown (7.5YR 5/4) clay films; 15 percent shale fragments.
B22t	22–30 inches, yellowish-brown (10YR 5/4) heavy shaly silt loam; common medium distinct light brownish-gray (10YR 6/2) mottles, massive; firm; few roots; moderate patchy brown (7.5YR 5/4) clay films; 15 percent shale fragments; few FeMn concretions.

Watershed 110

Soils and parent material of this watershed are similar to those of the adjoining watershed 103. A sandy shale parent material in the upper half supports the well-drained Rayne soils. Below the Middle Kittanning clay, which lies at an elevation midway between the flume and ridgetop divide, the soil is less well-drained Keene silt loam developed over clay shale.

A small area immediately above the flume is developed from the sandy parent material that is extensive below the flume. The Lower Kittanning clay is only 4 feet below the flume. The lack of prolonged base flow and continued wetness in this area immediately above the clay, indicates that an old tile drainage system may be influencing the hydrologic performance of this watershed.

Cropping history follows:

1937	oats	1943	wheat
1938	corn	1944	meadow
1939	oats to wheat	1945	meadow
1940	wheat	1946	corn, continued in a 4-year rotation of C-W-M-M
1941	meadow		
1942	corn		

Runoff records started in March 1939. Prevailing (poor) farming practices were maintained throughout the study period. Cropping of watershed 103 (improved practices) was identical to that of watershed 110.

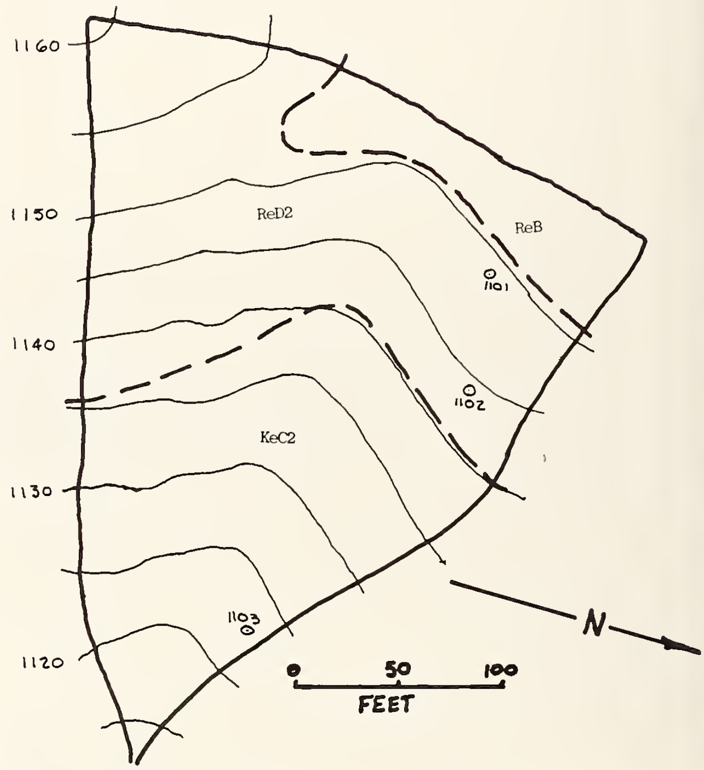

FIGURE 38.—Map of watershed 110, 1.27 acres: ReD2—Rayne silt loam, 12 to 18 percent slopes, moderately eroded; ReB—Rayne silt loam, 2 to 6 percent slopes; and KeC2—Keene silt loam, 6 to 12 percent slopes, moderately eroded.

TABLE 21.—*Description of soil by horizons at core sites in watershed 110*

Profile classification, site, and horizon	Description
Rayne silt loam:	
1101:	
Ap	0–8 inches, dark-brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to weak fine granular structure; friable; many roots; 2 percent shale fragments.
B21t	8–18 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy dark yellowish-brown (10YR 4/4) clay films; 5 percent shale fragments.
B22t	18–26 inches, yellowish-brown (10YR 5/4) heavy shaly silt loam; weak medium subangular blocky structure; friable; common roots; thin patchy dark yellowish-brown (10YR 4/4) clay films; 35 percent shale fragments (siltstone).
B3t	26–29 inches, light olive-brown (2.5Y 5/4) heavy very shaly silt loam; massive, friable; few roots; thin patchy dark yellowish-brown (10YR 4/4) clay films; 75 percent shale fragments (siltstone).
1102:	
Ap	0–8 inches, dark-brown (10YR 4/3) silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 2 percent shale fragments.
B21t	8–14 inches, strong brown (7.5YR 5/6) heavy silt loam; moderate fine subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 5 percent shale fragments.
B22t	14–21 inches, yellowish-brown (10YR 5/4) heavy shaly silt loam; weak fine subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 15 percent shale and siltstone fragments.
B23t	21–29 inches, yellowish-brown (10YR 5/4) heavy shaly silt loam; moderate medium platy structure; firm; few roots; thin patchy dark yellowish-brown (10YR 4/4) clay films; 30 percent yellowish-brown (10YR 5/4) soft siltstone fragments with light olive-gray (5Y 6/2) surfaces.
Keene silt loam:	
1103:	
Ap	0–8 inches, dark-brown (10YR 4/3) silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 5 percent shale fragments.
B21t	8–14 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films; 2 percent shale fragments.
B22t	14–20 inches, yellowish-brown (10YR 5/4) heavy silt loam; few fine distinct light brownish-gray (10YR 6/2) and common fine distinct yellowish-brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films; 5 percent shale fragments.
IIB23t	20–28 inches, yellowish-brown (10YR 5/6) heavy silty clay loam; many coarse prominent gray (5Y 6/1) and few fine distinct yellowish-red (5YR 5/6) mottles; strong medium prismatic structure parting to moderate medium angular blocky structure; firm; few roots; thin patchy yellowish-brown (10YR 5/4) clay films; 5–10 percent shale fragments.

Watershed 111

This watershed lies on the northeast side of a broad ridge with gentle slopes. The influence of loess and shale parent materials have produced moderately well-drained soils with silty surfaces in this position. Keene is the dominant soil, with Coshocton occurring where the shale content is greater than 15 percent.

The deep soils and gentle slopes of this watershed produce little runoff. Because Lower Kittanning clay lies 15 feet below the flume, subsurface water mostly bypasses the flume. Only in late winter and early spring, when the profile is nearly saturated, does runoff continue long after rainfall ceases.

Cropping history follows:

1938	corn	1949	meadow
1939	oats	1950	meadow
1940	wheat	1951	corn, plow and subsoil chiseled, mulched, continued in 4-year rotation of C-W-M-M
1941	corn and meadow strips		
1942	wheat and meadow strips		
1943	meadow and corn strips		
1944	meadow and wheat strips	1955	corn, disk mulch
1945	corn and meadow strips	1959	corn, plow-plant
1946	wheat and meadow strips	1963	corn, rotovate mulch
1947	corn, mulch plow	1967	corn, conventional
1948	wheat		

Runoff records started in August 1939. Although the standard 4-year rotation of C-W-M-M has been followed since 1946, tillage for corn crops in 1951, 1955, 1959, and 1963 was nonstandard. The 4-year rotation on this watershed was the same and synchronous with that on paired watersheds 113 (improved) and 118 (prevailing) practices. It was used as a spare watershed on which new ideas for improving the conservation effort could be tested.

Contour stripcropping under improved practices was applied to this watershed during the period 1941–46. The area was too small to be representative of stripcropping. Single cropping was used after 1946.

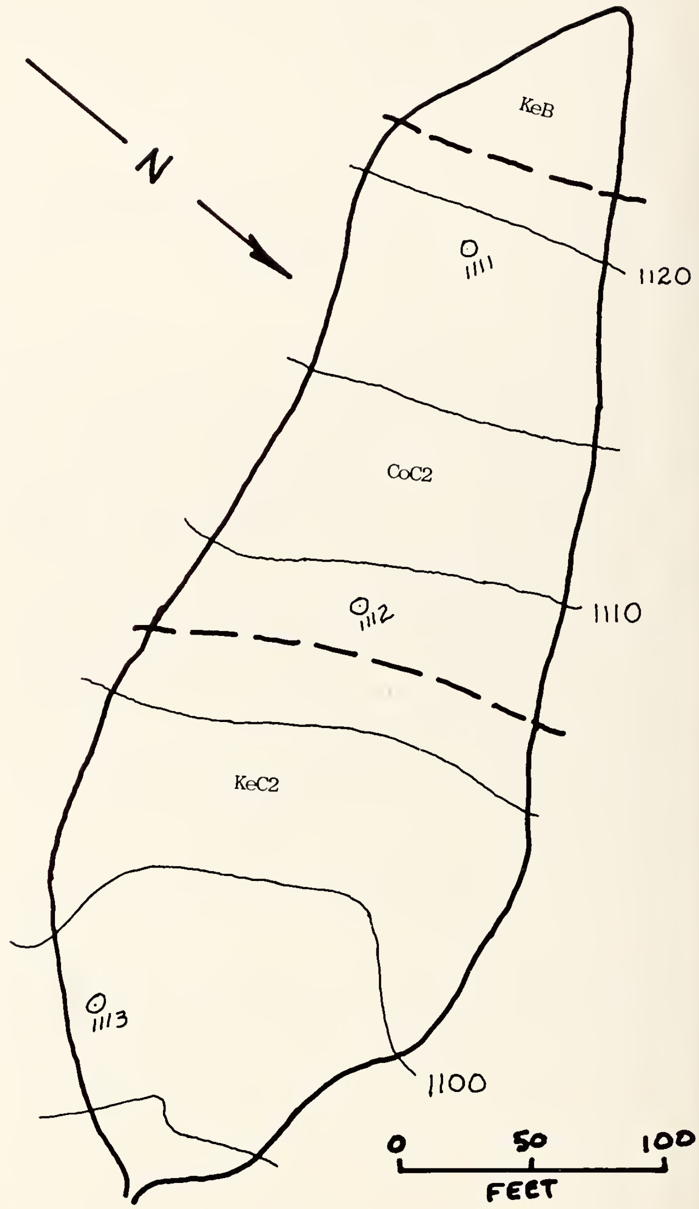

FIGURE 39.—Map of watershed 111, 1.18 acres: KeB—Keene silt loam, 2 to 6 percent slopes; CoC2—Coshocton silt loam, 6 to 12 percent slopes, moderately eroded; and KeC2—Keene silt loam, 6 to 12 percent slopes, moderately eroded.

TABLE 22.—*Description of soil by horizons at core sites in watershed 111*

Profile classification, site, and horizon	Description
Coshocton silt loam:	
1111:	
Ap	0–9 inches, dark grayish-brown (10YR 4/2), dark-brown (10YR 4/3) crushed silt loam; 10 percent yellowish-brown (10YR 5/4) subsoil mixed; weak medium subangular blocky structure parting to weak fine granular structure; friable; many roots; 5 percent shale fragments.
B21t	9–18 inches, yellowish-brown (10YR 5/4) heavy shaly silt loam; common fine distinct pale-brown (10YR 6/3) and few fine distinct yellowish-brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 30 percent shale fragments (siltstone and ironstone).
IIB22t	18–30 inches, strong brown (7.5YR 5/6) heavy silty clay loam; many coarse distinct light olive-gray (5Y 6/2) mottles and ped surfaces; moderate medium prismatic structure parting to moderate medium angular blocky structure; firm; common roots; thin patchy reddish-brown (5YR 4/4) clay films; 5 to 10 percent siltstone and ironstone fragments.
1112:	
Ap	0–7 inches, dark grayish-brown (10YR 4/2), dark-brown (10YR 4/3) crushed silt loam; common medium distinct yellowish-brown (10YR 5/4) subsoil mixed; weak medium subangular blocky structure parting to weak fine granular structure; friable; many roots; 2 percent shale fragments.
B1	7–14 inches, yellowish-brown (10YR 5/4) silt loam; dark yellowish-brown (10YR 4/4) surface color; weak medium subangular blocky structure; friable; common roots; 2 percent shale fragments.
B21t	14–18 inches, yellowish-brown (10YR 5/4) heavy silt loam; few fine distinct light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films; 5 percent shale fragments.
IIB22t	18–24 inches, yellowish-brown (10YR 5/4) silty clay loam; common fine prominent yellowish-red (5YR 5/6) and common fine distinct light brownish-gray (2.5Y 6/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky structure; firm; common roots; thin patchy brown (7.5YR 5/4) clay films; 10 percent shale fragments.
IIB23t	24–31 inches, dark yellowish-brown (10YR 4/4) heavy shaly silt loam; light olive-gray (5Y 6/2) silt coatings; few medium distinct strong brown (7.5YR 5/6) mottles; weak medium angular blocky structure parting to weak medium platy structure; firm; few roots; thin patchy dark-brown (7.5YR 4/4) clay films and light olive-gray (5Y 6/2) silt coatings; 25 percent shale fragments.
1113[1]:	
Ap	0–9 inches, dark-brown (10YR 4/3) silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots.
B21t	9–16 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; thin very patchy yellowish-brown (10YR 5/4) clay films; friable; common roots; 2 percent shale fragments.
IIB22t	16–22 inches, strong brown (7.5YR 5/6) silty clay loam; light yellowish-brown (10YR 6/4) ped surfaces; common fine distinct yellowish-red (5YR 5/6) and few fine distinct light brownish-gray (10YR 6/2) mottles; moderate medium prismatic structure parting to moderate medium angular blocky structure; friable; thin patchy brown (7.5YR 5/4) clay films; common roots; 5 percent shale fragments.
IIB23t	22–26 inches, dark-brown (7.5YR 4/4) light very shaly silty clay loam; many coarse distinct gray (10YR 6/1) mottles; platy rock structure; few roots; thin continuous brown (7.5YR 5/4) clay films; 75 percent shale fragments.

[1] Common inclusion in Keene mapping units.

Watershed 113

Slope is the dominant factor influencing runoff from this watershed. Although the average slope weighted on an area basis is only 9.3 percent, the lower third is nearly 14 percent. The upper half has Keene soils on B and C slopes with Middle Kittanning clay only 3 feet below the surface in the uppermost parts. Erosion of fines from the steeper slopes has resulted in a higher stone content near the surface in the lower part of the watershed.

Lower Kittanning clay is at an elevation 8 feet above the flume, but the outcrop, well covered with colluvial material, does not appear to support an active seepy area. The next significant clay layer in geologic sequence is Brookville clay 32 feet below the flume.

Cropping history follows:

1938	corn	1944	wheat
1939	oats	1945	meadow
1940	wheat	1946	meadow
1941	meadow	1947	corn, continued in a 4-year rotation of C-W-M-M.
1942	meadow		
1943	corn		

Runoff records began in August 1939. Improved practices began in 1943. Watershed 118 (prevailing practices) has an identical cropping history.

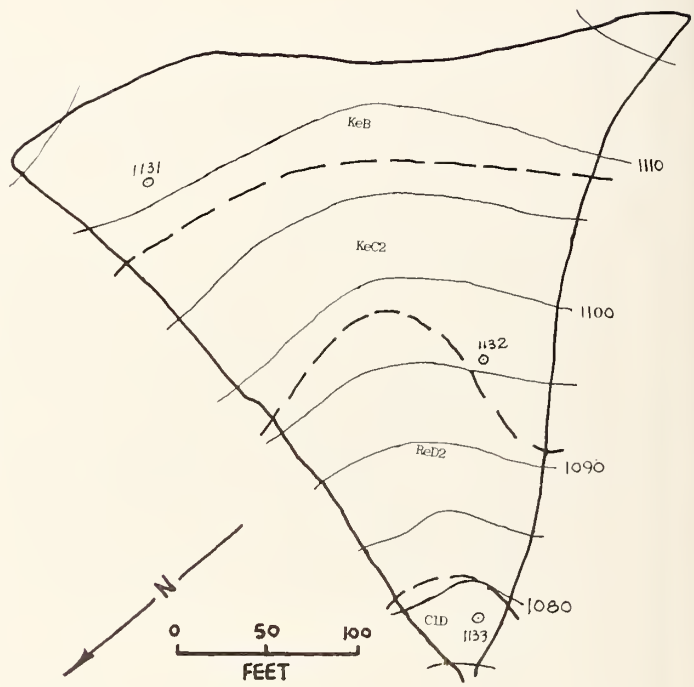

FIGURE 40.—Map of watershed 113, 1.45 acres: KeB—Keene silt loam, 2 to 6 percent slopes; KeC2—Keene silt loam, 6 to 12 percent slopes, moderately eroded; ReD2—Rayne silt loam, 12 to 18 percent slopes, moderately eroded; and ClD—Clarksburg silt loam, 12 to 18 percent slopes.

TABLE 23.—*Description of soil by horizons at core sites in watershed 113*

Profile classification, site, and horizon	Description
Keene silt loam:	
1131:	
Ap	0–8 inches, dark-brown (10YR 4/3) silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; common roots.
B1	8–11 inches, yellowish-brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; common roots.
B21t	11–15 inches, yellowish-brown (10YR 5/4) heavy silt loam; moderate fine and medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films.
IIB22t	15–27 inches, yellowish-brown (10YR 5/4) interior with light brownish-gray (2.5Y 6/2) surface; heavy silty clay loam; many medium distinct gray (10YR 6/1) and few fine distinct yellowish-brown (10YR 5/8) mottles; moderate medium prismatic structure parting to moderate medium angular blocky structure; firm; common roots; thin patchy brown (7.5 YR 5/4) clay films; 2–5 percent shale fragments.
IIB23t	27–30 inches, yellowish-brown (10YR 5/6) heavy silty clay loam; common medium distinct yellowish-brown (10YR 5/8) and light brownish-gray (10YR 6/2) mottles; weak medium prismatic structure parting to weak medium angular blocky structure; firm; few roots; thin patchy brown (7.5YR 5/4) clay films; 5 percent shale fragments.
Coshocton silt loam[1]:	
1132:	
Ap	0–9 inches, dark-brown (10YR 4/3) silt loam; 5 percent chunks of yellowish-brown (10YR 5/4) subsoil mixed; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 2 percent shale fragments.
B21	9–12 inches, strong brown (7.5YR 5/6) heavy silt loam; weak medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films; 10 percent shale fragments.
B22t	12–15 inches, yellowish-brown (10YR 5/6) heavy shaly silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films; 25 percent shale fragments.
IIB23t	15–30 inches, yellowish-brown (10YR 5/4) silty clay loam; common fine distinct yellowish-red (5YR 5/6) and gray (5Y 6/1) mottles; moderate medium and fine angular blocky structure; firm; common roots; thin patchy brown (7.5YR 5/4) clay films; 10 percent shale fragments.
Clarksburg channery silt loam[2]:	
1133:	
Ap	0–8 inches, dark-brown (10YR 4/3) channery silt loam; weak fine granular structure; friable; many roots; 20 percent sandstone and shale fragments.
B1	8–12 inches, yellowish-brown (10YR 5/4) channery silt loam; weak fine subangular blocky structure; friable; common roots; 15 percent sandstone and shale fragments.
B21t	12–22 inches, light yellowish-brown (10YR 6/4) channery loam; weak medium subangular blocky structure; friable; few roots; thin patchy brown (7.5YR 5/4) clay films; 20 percent sandstone and shale fragments.
B22xt	22–28 inches, dark-brown (7.5YR 4/2) channery loam; common fine distinct light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) mottles; weak medium and coarse prismatic structure; firm; dense; few roots; moderate continuous yellowish-brown (10YR 5/4) and light brownish-gray (2.5Y 6/2) clay films; 15 percent sandstone and shale fragments.

[1] Common inclusion in Keene mapping units.

[2] Colors are not as bright and fragipan is not as strong as most Clarksburg soils; a common inclusion in Clarksburg mapping units.

Watershed 115

Soils in the middle and upper part of this watershed, developed from shale parent material, have heavy textured B horizons that restrict water movement. As a result, runoff is relatively high, especially with intense storms and wet antecedent conditions, even though the average slope is less than that of any of the other small watersheds. Keene and Coshocton soils are mapped in areas that have finer textured subsoils, and areas that have lighter subsoils and more coarse fragments in the profile are mapped as Rayne.

An unnamed, discontinuous clay layer appears to approach the surface in the lower middle of the watershed, forcing subsurface water to surface in this area. A broken drainage tile in that area is also suspected. The Clarion clay is 8 feet below the flume.

Cropping history follows:

1938	corn	1943	meadow
1939	oats	1944	meadow
1940	wheat	1945	corn, continued in a 4-year rotation of C-W-M-M
1941	corn		
1942	wheat		

Runoff records began in December 1938. Prevailing farming practices (table 3) were used throughout the study period. It is paired with watersheds 109 and 123 (improved practices) because they have the same cropping history.

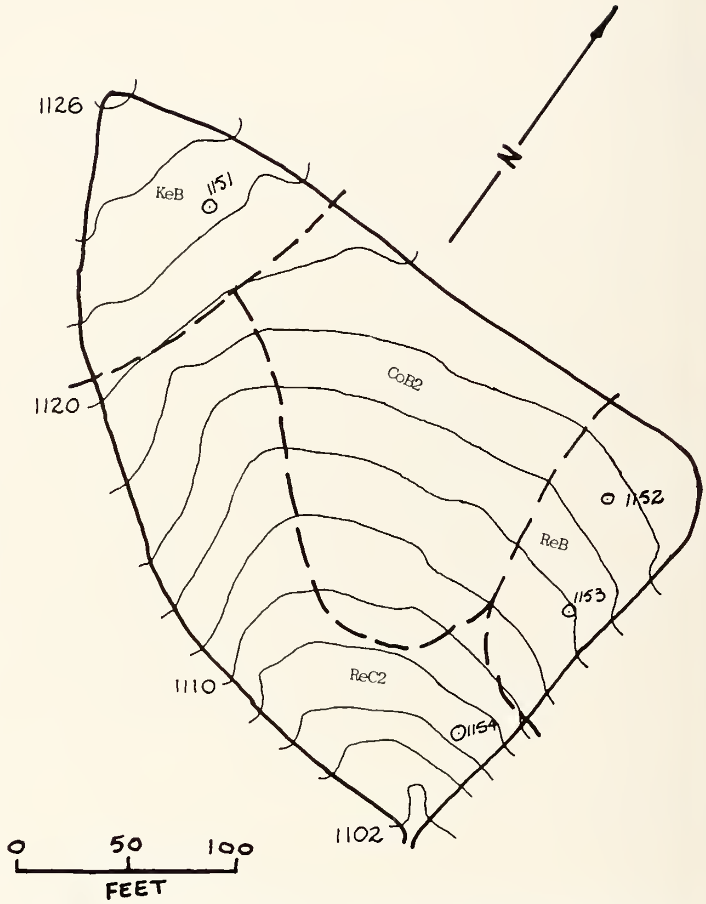

FIGURE 41.—Map of watershed 115, 1.61 acres: KeB—Keene silt loam, 2 to 6 percent slopes; CoB2—Coshocton silt loam, 2 to 6 percent slopes, moderately eroded; ReB—Rayne silt loam, 2 to 6 percent slopes; and ReC2—Rayne silt loam, 6 to 12 percent slopes, moderately eroded.

TABLE 24.—*Description of soil by horizons at core sites in watershed 115*

Profile classification, site, and horizon	Description
Coshocton silt loam[1]:	
1151:	
Ap	0–9 inches, dark-brown (10YR 4/3) silt loam; weak fine subangular blocky structure parting to moderate very fine granular structure; friable; common roots; 2 percent shale fragments.
B1	9–12 inches, strong brown (7.5YR 5/6) silt loam; moderate fine and medium subangular blocky structure; friable; common roots; brown (7.5YR 5/4) silt coatings; 5 percent shale fragments.
B21t	12–17 inches, strong brown (7.5YR 5/6) light silty clay loam; moderate fine and medium subangular blocky structure; firm; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 10 percent shale fragments.
IIB22t	17–25 inches, brown (7.5YR 5/4) heavy silty clay loam; common fine prominent light brownish-gray (2.5Y 6/2) and common fine distinct yellowish-red (5YR 5/6) mottles; moderate medium prismatic structure; firm; common roots; thin continuous dark-brown (7.5YR 4/4) clay films; 5 percent shale fragments.
1152[2]:	
Ap	0–8 inches, dark-brown (10YR 3/3, 10YR 4/3) crushed silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; common roots; 2–5 percent shale fragments.
B & A	8–11 inches, yellowish-brown (10YR 5/4) silt loam; weak coarse subangular blocky structure; friable; common roots; porous; 2–5 percent shale fragments.
B21t	11–17 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films; 5–10 percent shale fragments.
*	17–21 inches, mixed yellowish-brown (10YR 5/6) and dark-brown (10YR 3/3) silt loam; weak medium subangular blocky structure; friable; common roots; 5 percent shale fragments; disturbed layer—probably old root channel—high organic content, very porous.
IIB22t	21–28 inches, strong brown (7.5YR 5/6) heavy silty clay loam; few fine distinct light brownish-gray (10YR 6/2) and yellowish-red (5YR 5/8) mottles; moderate medium prismatic structure parting to weak coarse subangular blocky structure; firm; common roots; thin patchy brown (7.5YR 5/4) clay films; 5–10 percent shale fragments.
Rayne silt loam:	
1153:	
Ap	0–8 inches, dark-brown (10YR 3/3, 10YR 4/3) crushed silt loam; weak fine granular structure; friable; common roots; 2 percent shale and sandstone fragments.
B1	8–17 inches, dark yellowish-brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; common roots; thin patchy yellowish-brown (10YR 5/4) silt coatings; 2 percent shale and sandstone fragments.
B21t	17–23 inches, yellowish-brown (10YR 5/4) heavy silt loam; common fine distinct yellowish-brown (10YR 5/6) mottles; weak fine subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films on ped surfaces; 5 percent shale and sandstone fragments.
B22t	23–29 inches, yellowish-brown (10YR 5/6) heavy silt loam; few fine distinct light brownish-gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few roots; thin patchy yellowish-brown (10YR 5/4) clay films on ped surfaces and moderate continuous grayish-brown (10YR 5/2) coatings in pores; 10 percent shale and sandstone fragments.
1154:	
Ap	0–8 inches, dark-brown (10YR 3/3) silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; common roots; 5 percent shale and sandstone fragments.
B1	8–15 inches, yellowish-brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots; 10 percent shale and sandstone fragments.
B21t	15–25 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; friable; few roots; thin patchy brown (7.5YR 5/4) clay films; 10–15 percent shale and sandstone fragments.
B22t	25–29 inches, yellowish-brown (10YR 5/6) light silty clay loam; common medium distinct pale-brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; few roots; thin patchy brown (7.5YR 5/4) clay films; 10–15 percent shale and sandstone fragments.

[1] Common inclusion in Keene mapping units.

[2] Common inclusion in Rayne mapping units.

Watershed 118

Coshocton soils, developed over clay shale, cover most of the watershed except for a small area of Clarksburg soil just above the runoff gaging flume. Plowing operations in this watershed occasionally expose large stones that must be hauled from the watershed to permit planting and cultivating. In 1967 just north of the watershed, a spring was developed that may have influenced annual water yields and timing of storm runoff by lowering the water table in this area. The Brookville clay lies 10 feet below the flume.

Cropping history for this prevailing practice watershed is the same as that for watershed 113 (improved practices) previously presented.

Runoff records began in August 1939.

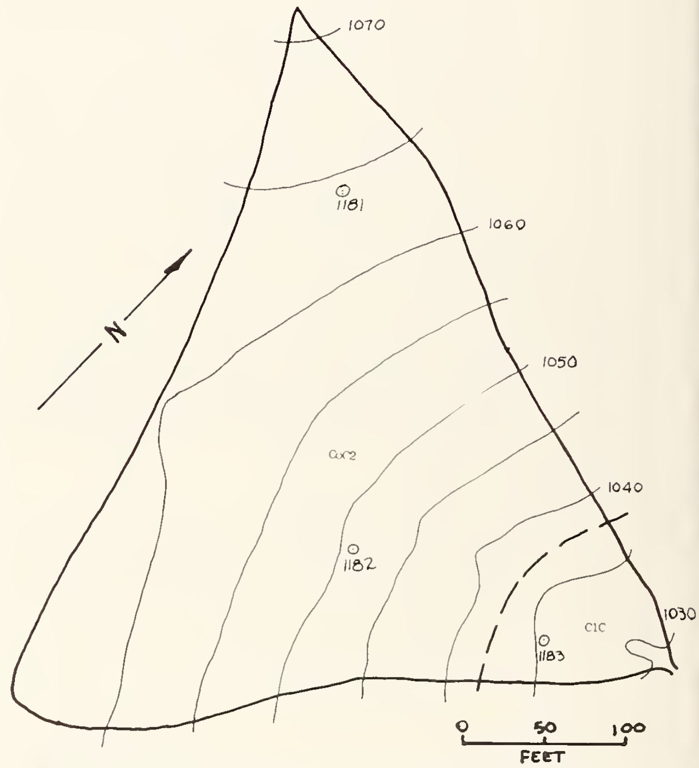

Figure 42.—Map of watershed 118, 1.96 acres: CoC2—Coshocton silt loam, 6 to 12 percent slopes, moderately eroded; and ClC—Clarksburg silt loam, 6 to 12 percent slopes.

TABLE 25.—*Description of soil by horizons at core sites in watershed 118*

Profile classification, site, and horizon	Description
Coshocton silt loam:	
1181:	
Ap	0–8 inches, dark-brown (10YR 3/3, 10YR 4/3) crushed silt loam; weak fine subangular blocky structure parting to moderate very fine granular structure; friable; common roots; 2–5 percent shale fragments.
B1	8–11 inches, yellowish-brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots; 5 percent shale fragments.
B21t	11–19 inches, yellowish-brown (10YR 5/6) heavy silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films; 10 percent shale fragments.
IIB22t	19–30 inches, strong brown (7.5YR 5/6) heavy silty clay loam; many coarse prominent gray (5Y 6/1) mottles; weak medium prismatic structure parting to moderate coarse angular blocky structure; firm; few roots; thin patchy brown (7.5YR 5/4) clay films; 10 percent shale fragments.
1182:	
Ap	0–6 inches, dark-brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; many roots; 5 percent shale fragments.
B1	6–11 inches, yellowish-brown (10YR 5/4) silt loam; dark yellowish-brown (10YR 4/4) ped surface color; weak fine and medium subangular blocky structure; friable; common roots; 5–10 percent shale fragments.
B21t	11–19 inches, yellowish-brown (10YR 5/4) heavy silt loam; common medium faint dark yellowish-brown (10YR 4/4) and few fine distinct brown (10YR 5/3) mottles; moderate medium subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 10 percent shale fragments.
IIB22t	19–24 inches, yellowish-brown (10YR 5/6) silty clay loam; many coarse prominent grayish-brown (2.5Y 5/2) mottles; moderate medium prismatic structure parting to moderate medium angular blocky structure; firm; few roots, thin patchy brown (7.5YR 5/4) clay films; 10 percent shale fragments.
IIB23t	24–29 inches, light olive-brown (2.5Y 5/4) silty clay loam; common medium distinct yellowish-brown (10YR 5/6) and common fine faint grayish-brown (2.5Y 5/2) mottles; weak medium prismatic structure parting to moderate medium angular blocky structure; firm; few roots; thin patchy brown (7.5YR 5/4) clay films; 10–15 percent shale fragments; many FeMn concretions.
Glenford silt loam[1]:	
1183:	
Ap	0–9 inches, dark-brown (10YR 4/3) silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 2 percent shale fragments.
B21t	9–16 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films; 2 percent shale fragments.
B22t	16–23 inches, yellowish-brown (10YR 5/4) heavy silt loam; many coarse prominent gray (5Y 6/1) and few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films, 2 percent shale fragments; few FeMn concretions.
B23t	23–30 inches, dark grayish-brown (10YR 4/2) silty clay loam; many coarse prominent gray (5Y 6/1) mottles; moderate medium angular blocky structure; firm; few roots; thin very patchy brown (7.5 YR 5/4) clay films; 5 percent shale fragments, many FeMn concretions.

[1] Common inclusion in Clarksburg mapping units.

Watershed 121

A silt cap over sandstone bedrock makes the top of this watershed similar to the top of watershed 106. On the steeper slopes in the middle, the soils contain more rock fragments and less fine material. An unexplained wet condition in the lower third of the watershed may be influenced by an old, abandoned tile drainage system. A small area of stony colluvial soil, similar to that at the bottom of watersheds 113 and 118, lies just above the flume. Middle Kittanning clay is less than 4 feet below the flume.

Cropping history follows:

1939	oats	1945	wheat
1940	wheat	1946	meadow
1941	meadow	1947	meadow
1942	wheat	1948	corn, continued in a 4-year rotation of C-W-M-M
1943	meadow		
1944	corn		

Runoff records began in March 1939. Improved farming practices started in 1944. Watershed 106 (prevailing practices) has the same cropping history.

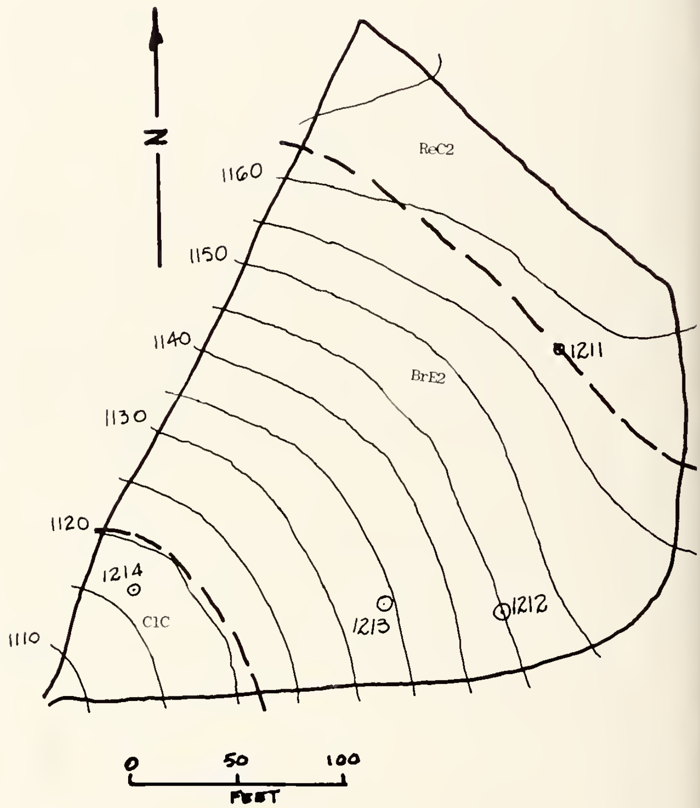

FIGURE 43.—Map of watershed 121, 1.42 acres: ReC2—Rayne silt loam, 6 to 12 percent slopes, moderately eroded; BrE2—Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded; and ClC—Clarksburg silt loam, 6 to 12 percent slopes.

TABLE 26.—*Description of soil by horizons at core sites in watershed 121*

Profile classification, site, and horizon	Description
Berks silt loam:	
1211:	
Ap	0–9 inches, dark-brown (10YR 4/3) silt loam; weak fine subangular blocky structure parting to moderate fine granular structure; friable; many roots; 5–10 percent sandstone and shale fragments.
B1	9–14 inches, strong brown (7.5YR 5/6) silt loam; weak medium subangular blocky structure; friable; common roots; 5–10 percent sandstone and shale fragments; high mica content.
B21	14–19 inches, strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 5–10 percent sandstone and shale fragments; high mica content.
IIB22	19–29 inches, yellowish-brown (10YR 5/6) heavy very channery loam; weak coarse subangular blocky structure; friable; few roots; thin very patchy dark brown (7.5YR 4/4) clay films on shale fragments; 75 percent sandstone fragments; high mica content.
Berks channery loam:	
1212:	
Ap	0–9 inches, dark-brown (10YR 4/3) channery loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 15 percent sandstone and shale fragments.
B21	9–17 inches, brown (10YR 5/3) very channery loam; weak fine subangular blocky structure; friable; common roots; 60 percent sandstone and shale fragments.
B22	17–27 inches, yellowish-brown (10YR 5/4) very channery loam; weak fine subangular blocky structure; friable; common roots; 75 percent sandstone and shale fragments.
Berks silt loam:	
1213:	
Ap	0–9 inches, dark-brown (10YR 4/3), dark yellowish-brown (10YR 4/4) crushed silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 10–15 percent shale fragments.
B21	9–14 inches, yellowish-brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots; 10–15 percent sandy shale fragments.
B22	14–28 inches, yellowish-brown (10YR 5/4) very shaly loam; weak medium subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 60 percent sandy shale fragments.
Clarksburg silt loam[1]:	
1214:	
Ap	0–7 inches, very dark grayish-brown (10YR 3/2) crushed silt loam; weak fine subangular blocky structure parting to moderate fine granular structure; very friable; many roots; 2–5 percent shale fragments.
Ap2	7–12 inches, dark grayish-brown (10YR 4/2) crushed silt loam; weak fine subangular blocky structure; friable; common roots; 5–10 percent shale fragments.
B2g	12–19 inches, light brownish-gray (10YR 6/2) silt loam; common fine distinct yellowish-brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; 10 percent shale fragments.
Bxt	19–30 inches, dark-brown (10YR 4/3) silt loam; common fine distinct strong brown (7.5YR 5/6) and common fine distinct light-gray (10YR 7/1) mottles; weak coarse prismatic structure; very firm; few roots; thin patchy dark grayish-brown (10YR 4/2) clay films; 5–10 percent shale fragments; many FeMn concretions.

[1] Colors are grayer than allowable in the Clarksburg Series. Spots of slightly wetter soils are commonly included in Clarksburg mapping units.

Watershed 123

The bottom part of this watershed is a well-drained Rayne soil showing a slight accumulation of topsoil from upslope. The rest of the watershed is Keene silt loam, moderately well drained, and developed in silt-capped clay shale bedrock. The flume is 16 feet above the Clarion clay.

Cropping history of this improved-practice watershed is the same as that for watershed 109 (improved practices) and watershed 115 (prevailing practices).

Runoff records began in December 1938.

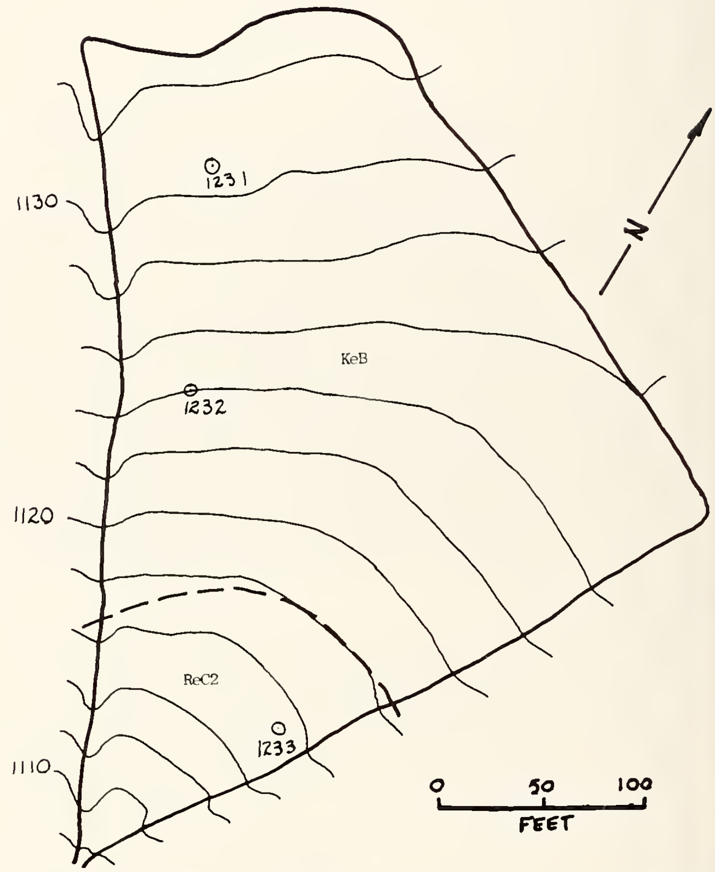

FIGURE 44.—Map of watershed 123, 1.37 acres: KeB—Keene silt loam, 2 to 6 percent slopes; and ReC2—Rayne silt loam, 6 to 12 percent slopes, moderately eroded.

TABLE 27.—*Description of soil by horizons at core sites in watershed 123*

Profile classification, site, and horizon	Description
Keene silt loam:	
1231:	
Ap	0–8 inches, dark-brown (10YR 3/3, 10YR 4/3) crushed silt loam; weak fine subangular blocky structure parting to moderate fine granular structure; friable; common roots.
B1	8–12 inches, yellowish-brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots.
B21t	12–17 inches, yellowish-brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; friable; common roots; thin patchy dark yellowish-brown (10YR 4/4) clay films; 2 percent shale fragments.
IIB22t	17–21 inches, yellowish-brown (10YR 5/4) silty clay loam; common fine distinct light brownish-gray (2.5Y 6/2) and yellowish-brown (10YR 5/8) mottles; weak medium prismatic structure parting to moderate medium angular and subangular blocky structure; firm; common roots; thin patchy brown (7.5YR 5/4) clay films; 2 percent shale fragments.
IIB23t	21–31 inches, yellowish-brown (10YR 5/4) heavy silty clay loam; many medium distinct gray (10YR 6/1) and common fine distinct yellowish-brown (10YR 5/8) mottles; strong medium prismatic structure parting to moderate medium angular blocky structure; firm; common roots; thin continuous brown (7.5YR 5/4) clay films; 5–10 percent shale fragments.
1232:	
Ap	0–9 inches, dark-brown (10YR 3/3, 10YR 4/3) crushed silt loam; weak fine granular structure; friable; common roots.
B21t	9–15 inches, yellowish-brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common roots; thin very patchy yellowish-brown (10YR 5/4) clay films.
IIB22t	15–21 inches, yellowish-brown (10YR 5/4) silty clay loam; common fine distinct light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films; 5 percent shale fragments.
IIB23t	21–26 inches, brown (10YR 5/3) heavy silty clay loam; many medium distinct gray (10YR 6/1) mottles and ped surface color, and few fine distinct yellowish-brown (10YR 5/8) mottles; weak medium prismatic structure parting to weak medium subangular blocky structure; firm; few roots; thin patchy brown, (7.5YR 5/4) clay films; 5 percent shale fragments.
IIB24t	26–30 inches, strong brown (7.5YR 5/8) shaly silty clay loam; common fine distinct pale brown (10YR 6/3) mottles; weak medium platy structure; firm few roots; thin patchy brown (7.5YR 5/4) clay films; 20 percent shale fragments; many FeMn concretions.
Rayne silt loam:	
1233:	
Ap	0–7 inches, dark-brown (10YR 3/3, 10YR 4/3) crushed silt loam; weak fine subangular blocky structure parting to weak fine granular structure. friable; common roots; 2 percent shale fragments.
B1	7–12 inches, strong brown (7.5YR 5/6) silt loam; weak medium subangular blocky structure. friable; common roots; 5 percent shale fragments.
B21t	12–20 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak coarse subangular blocky structure. friable; common roots; thin very patchy brown (7.5YR 5/4) clay films; 10–15 percent shale fragments.
B22t	20–29 inches, yellowish-brown (10YR 5/6) heavy silt loam; few fine distinct pale-brown (10YR 6/3) mottles below 25 inches; weak medium prismatic structure parting to weak coarse subangular blocky structure; friable; few roots. thin patchy brown (7.5YR 5/4) clay films; 10–15 percent shale fragments.

Watershed 124

Rayne soils developed in silt-capped sandy shale dominate the upper third of this watershed. Middle Kittanning clay outcrops in the upper middle where heavier textured Keene and Coshocton soils are found. The GfC Glenford area is an accumulation of deep silts frequently wet from upslope seep spots. Broken tile or old stone drains may aggravate the wetness in this area. There is a small area of colluvial soil immediately above the flume and no geologic clay beneath the flume to influence subsurface flow.

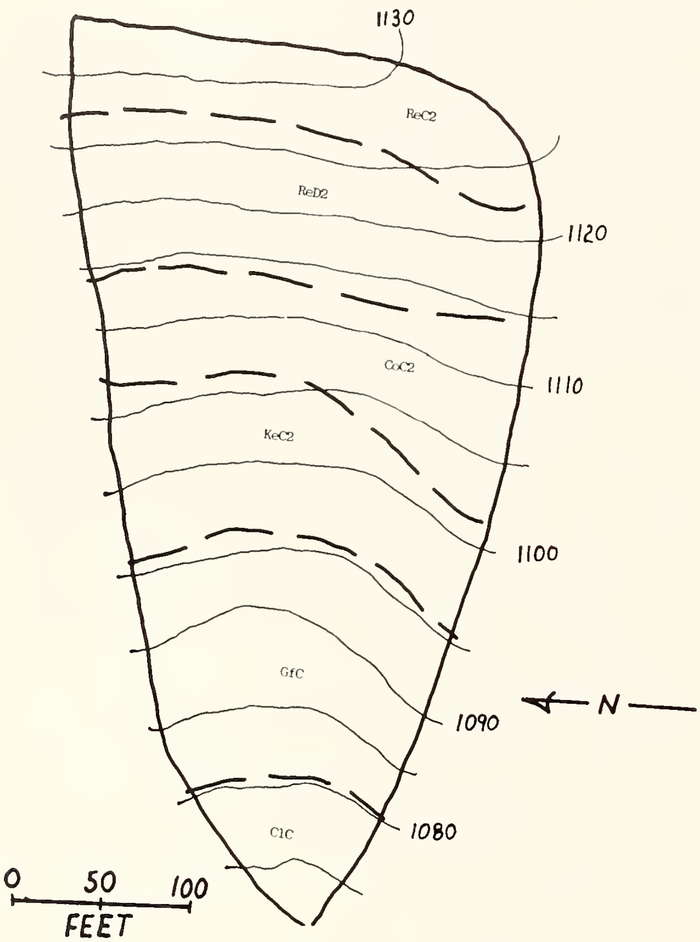

FIGURE 45.—Map of watershed 124, 2.07 acres: ReC2—Rayne silt loam, 6 to 12 percent slopes, moderately eroded; ReD2—Rayne silt loam, 12 to 18 percent slopes, moderately eroded; CoC2—Coshocton silt loam, 6 to 12 percent slopes, moderately eroded; KeC2—Keene silt loam, 6 to 12 percent slopes, moderately eroded: GfC—Glenford silt loam, 6 to 12 percent slopes; and ClC—Clarksburg silt loam, 6 to 12 percent slopes.

Cropping history follows:

1939	pasture	1944	meadow and wheat strips
1940	pasture	1945	corn and meadow strips
1941	corn	1946	wheat and meadow strips
1942	wheat and meadow strips	1947	meadow and corn strips
1943	meadow and corn strips		

Runoff records began in August 1939. Improved practices started in 1942 with contour strips. Runoff records were terminated in June 1947 as the watershed area was too small to be representative of contour stripcropping.

No soil core samples were taken on this watershed.

Watershed 127

Soils at the top of this watershed developed in a silt cap overlying interbedded clay shales and sandstone bedrock. Keene soil at the top grades into Coshocton-Rayne soil on the middle and lower slopes where more fragments are found near the surface. The bedrock texture becomes finer near the bottom of the watershed, and wet spots are in the Clarksburg area just above the runoff gaging flume. An old stone drain which has a plugged outlet was encountered in this area. Clarion clay lies 6 feet below the flume.

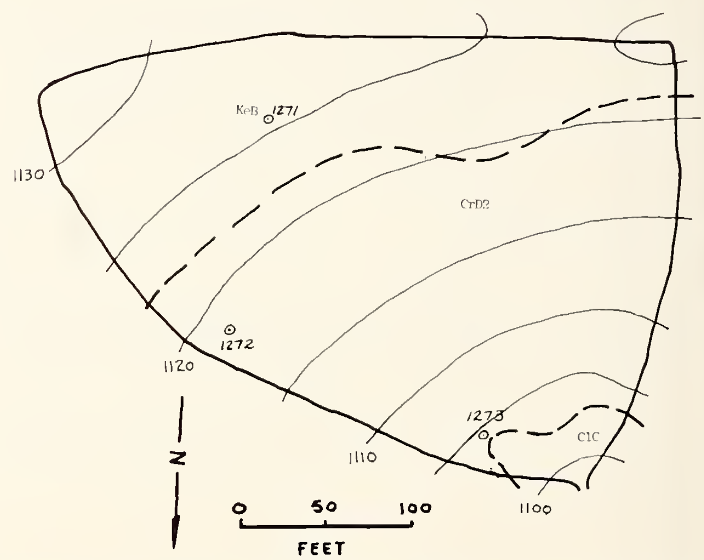

FIGURE 46.—Map of watershed 127, 1.65 acres: KeB—Keene silt loam, 2 to 6 percent slopes; CrD2—Coshocton-Rayne silt loams, 12 to 18 percent slopes, moderately eroded; and ClC—Clarksburg silt loam, 6 to 12 percent slopes.

Cropping history follows:

1949	corn, subsoil chiseled with lime and fertilizer applied at depth of 12 to 14 inches	1953	corn, continued in 4-year rotation of C-W-M-M
1950	wheat	1957	corn, plow-plant
1951	meadow-pasture	1961	corn, conventional
1952	meadow, Krilium applied with subsoiler	1965	corn, conventional
		1969	corn, deep plow-plant

Runoff records began in May 1949. As it was not in the improved and prevailing practices paired watershed study, new conservation practices were tested—mostly in the corn-cropping years. Cropping history paralleled those of watersheds 109, 115 and 123.

TABLE 28.—*Description of soil by horizons at core sites in watershed 127*

Profile classification, site, and horizon	Description
Keene silt loam[1]:	
1271:	
Ap	0–12 inches, mixed 80 percent dark grayish-brown (10YR 4/2) and 20 percent yellowish-brown (10YR 5/4) silt loam; weak fine granular structure; friable; common roots.
B21t	12–22 inches, yellowish-brown (10YR 5/6) silt loam; weak, fine and medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films.
B22t	22–27 inches, yellowish-brown (10YR 5/4) heavy silt loam; common fine distinct light brownish-gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; few roots; thin patchy brown (7.5YR 5/2) clay films.
IIB23t	27–30 inches, yellowish-brown (10YR 5/4) light silty clay loam; common fine distinct yellowish-brown (10YR 5/8) and light brownish-gray (10YR 6/2) mottles; weak coarse subangular blocky structure; friable; few roots; thin patchy grayish-brown (10YR 5/2) clay films; 5 percent shale fragments.
Coshocton silt loam:	
1272:	
Ap	0–10 inches, mixed 60 percent dark brown (10YR 4/3) and 40 percent yellowish-brown (10YR 5/4) silt loam; weak medium granular structure; friable; common roots.
B21t	10–15 inches, yellowish-brown (10YR 5/6) heavy silt loam; few fine distinct pale-brown (10YR 6/3) and yellowish-red (5YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films.
IIB22t	15–18 inches, yellowish-brown (10YR 5/6) shaly silty clay loam; few fine distinct pale-brown (10YR 6/3) and yellowish-red (5YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films; 20 percent shale fragments.
IIB23t	18–29 inches, yellowish-brown (10YR 5/6) heavy silty clay loam; light-gray (10YR 7/1) ped surface colors and many medium prominent yellowish-red (5YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky structure; firm; common roots in vertical cracks; thin continuous brown (7.5YR 5/4) and light yellowish-brown (10YR 6/4) clay films; 10 percent shale and sandstone fragments.
1273:	
Ap	0–11 inches, dark grayish-brown (10YR 4/2), dark-brown (10YR 4/3) crushed silt loam. 5 percent yellowish-brown (10YR 5/4) subsoil; weak fine granular structure; friable; common roots; 5 percent shale fragments.
B21t	11–18 inches, yellowish-brown (10YR 5/4) silt loam; few fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films; 10 percent shale fragments.
B22t	18–22 inches, yellowish-brown (10YR 5/4) shaly silt loam; few fine distinct light brownish-gray (10YR 6/2) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films; 20 percent shale and sandstone fragments.
B23t	22–29 inches, yellowish-brown (10YR 5/6) shaly clay loam; many fine distinct light brownish-gray (2.5Y 6/2) and common fine prominent yellowish-red (5YR 4/6) mottles; weak medium prismatic structure parting to weak medium angular blocky structure; firm; few roots, thin patchy brown (7.5YR 5/4) clay films, 20 percent shale and sandstone fragments; many FeMn concretions

[1] The thickness of silt capping on this soil is greater than most Keene soils.

Watershed 128

Parent materials for soils in this watershed are siltstone and sandy shale. Silts have capped the B slopes at the top, and the soils are mostly greater than 40 inches to hard rock. On the steeper middle portion, the soils are shallower and contain many shale fragments. Infiltration of rainwater is good in the upper half of the watershed. In wet seasons, subsurface flow is brought to the surface in a seepy area in the lower center part of the watershed. Middle Kittanning clay, outcropping at this point, has finer textured soils downslope. Depth to underclay at the flume is unknown.

Cropping history follows:

1939	soybeans	1949	meadow
1940	wheat	1950	corn, mulch, continued in a 4-year rotation of C-W-M-M
1941	meadow	1954	corn, mulch
1942	meadow	1958	corn, plow-plant
1943	meadow	1962	corn, plow-plant
1944	meadow	1966	corn, conventional with insecticide and high rate of N, P, K
1945	corn	1970	corn, conventional
1946	wheat		
1947	meadow		
1948	meadow		

Runoff records began in June 1939.

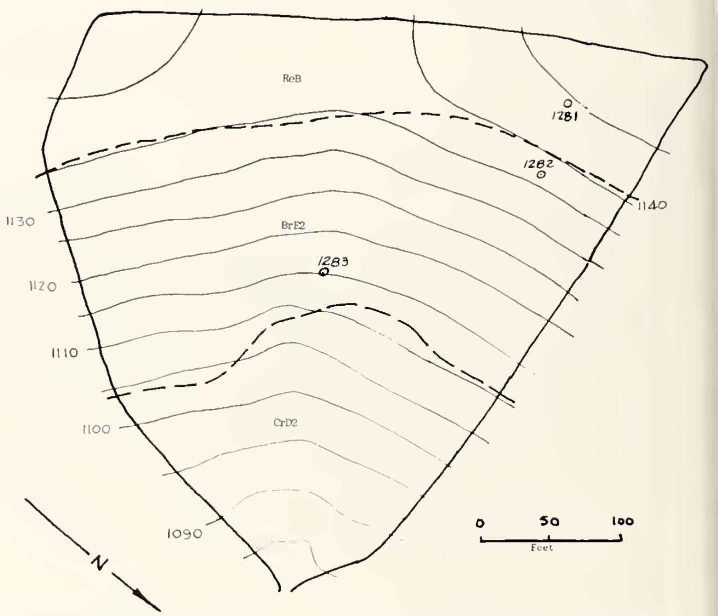

FIGURE 47.—Map of watershed 128, 2.68 acres: ReB—Rayne silt loam, 2 to 6 percent slopes; BrE2—Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded; and CrD2—Coshocton-Rayne silt loams, 12 to 18 percent slopes, moderately eroded.

Table 29.—*Description of soil by horizons at core sites in watershed 128*

Profile classification, site, and horizon	Description
Berks silt loam[1]:	
1281:	
Ap	0–9 inches, dark-brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to moderate fine granular structure; friable; many roots; 5–10 percent siltstone fragments.
B21	9–12 inches, yellowish-brown (10YR 5/6) silt loam; moderate fine subangular blocky structure; friable; common roots; 10 percent siltstone fragments.
B22	12–18 inches, yellowish-brown (10YR 5/6) channery silt loam; moderate fine subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 45 percent siltstone and sandstone fragments.
B23	18–29 inches, yellowish-brown (10YR 5/4) very channery loam; weak medium subangular blocky structure; friable; few roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 55 percent siltstone and sandstone fragments.
1282:	
Ap	0–7 inches, dark-brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to moderate medium granular structure; friable; many roots; 5–10 percent siltstone and sandy shale fragments.
B1	7–12 inches, yellowish-brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots; 10–15 percent siltstone and sandy shale fragments.
B21	12–20 inches, yellowish-brown (10YR 5/6) very channery silt loam; moderate medium subangular blocky structure; friable; common roots, thin very patchy dark-brown (7.5YR 4/4) clay films; 50 percent siltstone and sandy shale fragments; few mica flakes.
B22	20–26 inches, yellowish-brown (10YR 5/6) very channery silt loam; weak coarse subangular blocky structure; friable; few roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 65 percent siltstone and sandy shale fragments; few mica flakes.
1283:	
Ap	0–9 inches, dark-brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to moderate fine granular structure; very friable; common roots; 5 percent sandy shale fragments.
B21	9–13 inches, yellowish-brown (10YR 5/4) shaly silt loam; weak fine subangular blocky structure; friable; common roots; 15 percent sandy shale fragments.
B22	13–25 inehes, yellowish-brown (10YR 5/4) very shaly loam; weak fine and medium subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 75 percent sandy shale fragments; few mica flakes.
B23	25–31 inches, dark brown (10YR 4/3) shaly silt loam; common fine distinct pale-brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable; few roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 40 percent siltstone and sandy shale fragments.

[1] Common inclusion in Rayne mapping units.

Watershed 129

The dominant soil in this watershed is Berks, a well-drained, shaly silt loam soil. Erosion has removed much of the original surface soil, which is indicated by an accumulation of silts at the base of the watershed. The parent material in the upper part is siltstone with no clay layers present above the flume. Middle Kittanning clay lies 12 feet below the flume.

This area has been used for pasturing sheep and a few horses from the initiation of the research program, in the late 1930's, through 1945. Since 1945, beef cattle have been pastured on the watershed. Fertilizer and manure were applied when needed to provide high-level forage production.

Land treatment history follows:

1938	poverty grass
1940	limed, fertilized, disked, and seeded to alfalfa-alsike clover mixture
1945	disked, harrowed, and seeded to alfalfa, grass, and oats in May
1948	disked, harrowed, and seeded to alfalfa, ladino clover, and bromegrass
1958	reseeded alfalfa

Runoff records began in March 1938.

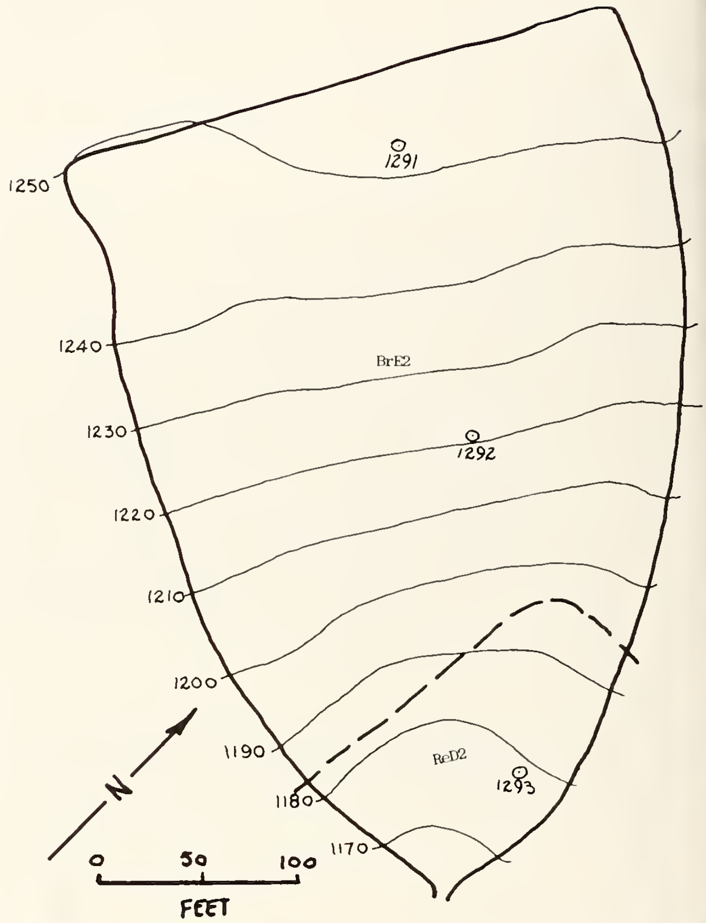

FIGURE 48.—Map of watershed 129, 2.71 acres: BrE2—Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded; and ReD2—Rayne silt loam, 12 to 18 percent slopes, moderately eroded.

TABLE 30.—*Description of soil by horizons at core sites in watershed 129*

Profile classification, site, and horizon	Description
Berks silt loam:	
1291:	
Ap	0–6 inches, dark-brown (10YR 4/3) silt loam; weak fine and medium granular structure; friable; many roots; 10 percent silty shale and siltstone fragments.
B21	6–13 inches, yellowish-brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; many roots; 5 percent silty shale and siltstone fragments.
B22	13–21 inches, yellowish-brown (10YR 5/4) shaly silt loam; weak fine subangular blocky structure; friable; common roots; 40 percent silty shale and siltstone fragments.
B23	21–30 inches, yellowish-brown (10YR 5/4) very shaly loam; weak fine subangular blocky structure; friable; few roots; thin very patchy brown (7.5YR 5/4) clay films; 80 percent silty shale and siltstone fragments.
1292:	
Ap	0–5 inches, dark grayish-brown (10YR 4/2) and dark-brown (10YR 4/3) silt loam; moderate fine granular structure; friable; many roots; 10 percent sandy shale fragments.
B21	5–13 inches, yellowish-brown (10YR 5/4) very shaly loam; weak medium subangular blocky structure; friable; common roots; 50 percent sandy shale fragments.
B22	13–19 inches, yellowish-brown (10YR 5/4) very shaly loam; weak medium subangular blocky structure; friable; very porous; few roots; thin very patchy brown (7.5YR 5/4) clay films in pores; 60 percent sandy shale fragments.
B23	19–30 inches, yellowish-brown (10YR 5/4) shaly loam; weak medium subangular blocky structure; friable; very porous; few roots; thin very patchy brown (7.5YR 5/4) clay films in pores; 35 percent sandy shale fragments.
Rayne silt loam:	
1293:	
Ap & A1	0–12 inches, dark brown (10YR 4/3) silt loam; weak fine granular structure; friable; many roots, 5 percent shale and siltstone fragments.
B1	12–25 inches, yellowish-brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots; 10 percent shale and siltstone fragments.
B21t	25–30 inches, yellowish-brown (10YR 5/4) shaly loam; weak medium subangular blocky structure; friable; few roots; thin patchy brown (7.5YR 5/4) clay films; 30 percent shale and siltstone fragments.

Watershed 130

Massive sandstone bedrock is the parent material for the soils on the upper part of this watershed. Surface textures tend to be loamy, and in much of the area there is little or no textural buildup in the profile. The high permeability of the soils and fractured bedrock allow for high infiltration rates and little runoff. Upper and Lower Freeport clay layers are thin and discontinuous near the top of the watershed, and they do not have seeps associated with them even in prolonged wet periods. A drain tile may be near the bottom of the watershed. The bedrock is dominantly shale in the lower part of the watershed. Middle Kittanning clay lies 12 feet below the flume.

This watershed has been used for hay production. Some sections are almost too steep for haying operations, and these would have been pastured if water for stock had been available. Productivity has been low; fertilizer and lime were applied frequently, but high yields were never attained.

Land treatment history follows:

1938 timothy
1940 limed, fertilized, disked, and seeded to alfalfa, red clover, alsike clover, and timothy
1942 disked, fertilized, and seeded to alfalfa, red clover, alsike clover, ladino clover, and timothy
1943 disked and sowed to grass seed
1953 shallow plowed, disked, and sowed to grass seed
1958 disked and seeded to alfalfa and grass

Runoff records began in April 1938.

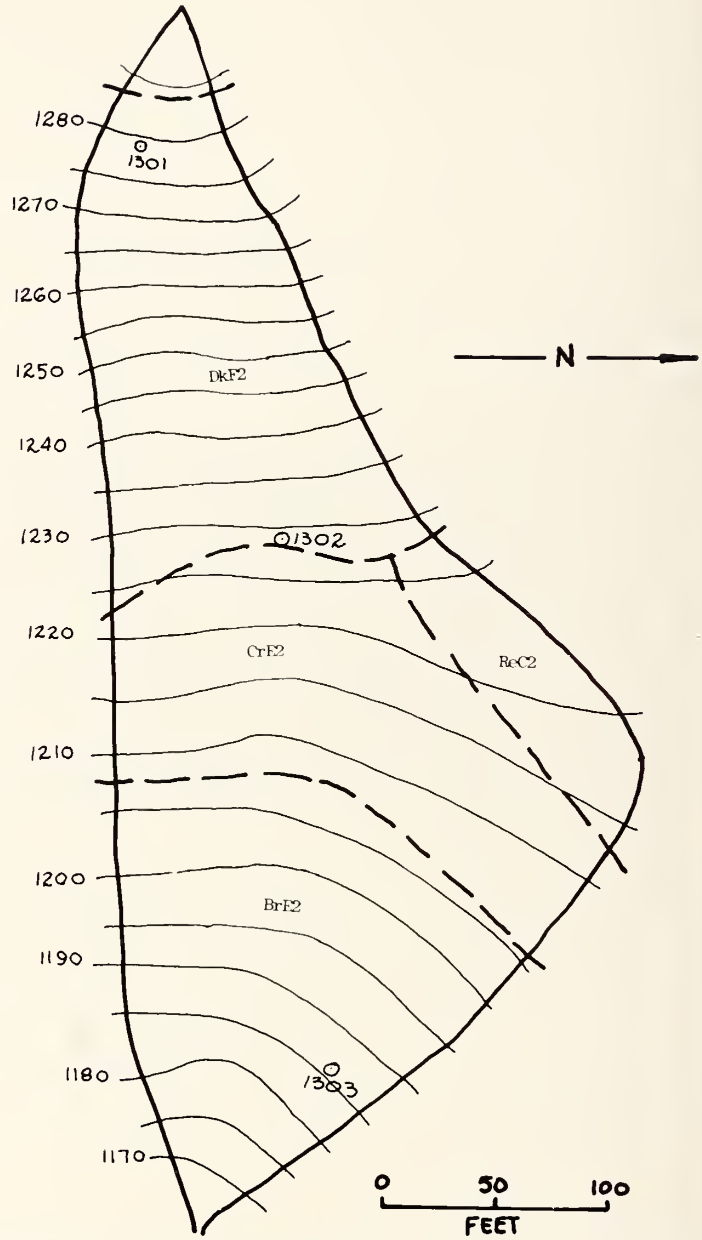

FIGURE 49.—Map of watershed 130, 1.63 acres: DkF2—Dekalb channery sandy loam, 25 to 35 percent slopes, moderately eroded; CrE2—Coshocton-Rayne silt loams, 18 to 25 percent slopes, moderately eroded; ReC2—Rayne silt loam, 6 to 12 percent slopes, moderately eroded; and BrE2—Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded.

TABLE 31.—*Description of soil by horizons at core sites in watershed 130*

Profile classification, site, and horizon	Description
Berks shaly silt loam[1]:	
1301:	
Ap1	0–2 inches, very dark grayish-brown (10YR 3/2) shaly silt loam; moderate fine granular structure; friable; many roots; 15 percent silty shale fragments.
Ap2	2–6 inches, dark brown (10YR 4/3) shaly silt loam; weak fine granular structure; friable; many roots; 15 percent silty shale fragments.
B21	6–23 inches, yellowish-brown (10YR 5/4) very shaly silt loam; weak medium subangular blocky structure; friable; thin very patchy brown (7.5YR 5/4) clay films; common roots; 60 percent silty shale fragments.
B22	23–28 inches, yellowish-brown (10YR 5/4) very shaly silt loam; weak medium subangular blocky structure; friable; few roots; thin patchy brown (7.5YR 5/4) clay films; 75 percent silty shale fragments horizontally oriented.
Dekalb loam[2]:	
1302:	
Ap1	0–3 inches, very dark grayish-brown (10YR 3/2) loam; moderate fine granular structure; very friable; many roots; 5 percent sandstone fragments.
Ap2	3–8 inches, dark-brown (10YR 4/3) loam; weak fine granular structure; friable; many roots; 5 percent sandstone fragments.
B1	8–13 inches, yellowish-brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; porous; common roots; 2–5 percent sandstone fragments.
B21	13–18 inches, yellowish-brown (10YR 5/6) loam; moderate fine and medium subangular blocky structure; friable; common roots; 10 percent sandstone fragments.
B22	18–28 inches, yellowish-brown (10YR 5/6) very channery sandy loam; platy rock structure; friable, few roots; thin very patchy brown (7.5YR 5/4) clay films; 80 percent sandstone fragments horizontally oriented.
Rayne silt loam[3]:	
1303:	
Ap	0–7 inches, dark grayish-brown (10YR 4/2) silt loam; weak fine granular structure; friable; many roots; 10 percent shale and sandstone fragments.
B1	7–14 inches, yellowish-brown (10YR 5/4) shaly silt loam; weak fine and medium subangular blocky structure; friable; common roots; 15 percent shale and sandstone fragments.
B21t	14–18 inches, yellowish-brown (10YR 5/4) shaly silt loam; moderate medium subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films; 15 percent shale and sandstone fragments.
B22t	18–24 inches, yellowish-brown (10YR 5/4) silt loam; weak medium prismatic structure parting to moderate subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films; 10 percent shale and sandstone fragments.
B23t	24–30 inches, brown (10YR 5/3) silt loam; common fine distinct light brownish-gray (10YR 6/2) and few fine distinct yellowish-brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky structure; friable; few roots; thin patchy brown (10YR 5/3) clay films; 10 percent shale and sandstone fragments.

[1] Common inclusion in Dekalb mapping units.

[2] Contains more silt than most Dekalb soils. This is a common inclusion in Dekalb mapping units.

[3] Differs from Rayne Series; gray mottles are at depths of 24 to 30 inches. Spots of Rayne soils are commonly included in Berks mapping units.

Watershed 131

This watershed lies back-to-back with watershed 130, and it has similar bedrock and soil conditions. Loamy textured soils over fractured sandstone bedrock along with deep mulch of decaying leaves provide infiltration rates high enough to preclude runoff from all but the most intense storms. Leaf litter from a mature hardwood forest covers the watershed and keeps the soil from freezing except during the most severe cold periods. Middle Kittanning clay lies 18 feet below the flume. No tile is in or near the watershed.

Mature hardwood timber, mostly in the upper part of the watershed, was cut about every 10 years to maintain maximum productivity. Special effort was made to minimize the disturbance to the forest floor during timber removal, and natural growth has continued.

A cruise of 12.8 acres of residual hardwood woodland, of which watershed 131 is a part, is summarized in table 32.

Runoff records began in May 1938. No soil core samples have been taken at this site.

TABLE 32.—*Merchantable classes of residual woodland, watershed 131, 1958*

Merchantable class	Diameter range	Basal area per acre
	Inches	*Square feet*
Sapling	1–5	10.1
Pole size	6–9	25.1
Small saw timber	10–13	37.1
Medium saw timber	14–21	38.7
Large saw timber	22+	15.3
Total	—	126.3

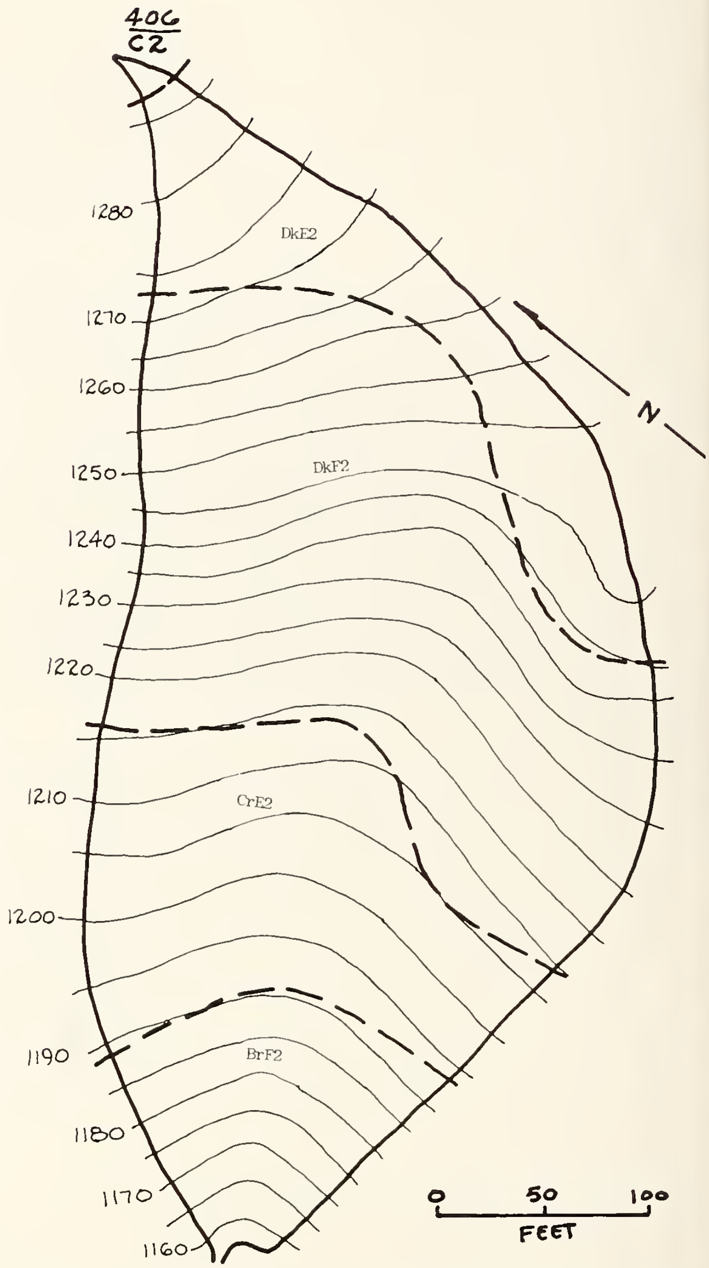

FIGURE 50.—Map of watershed 131, 2.21 acres: DkE2—Dekalb channery sandy loam, 18 to 25 percent slopes, moderately eroded; DkF2—Dekalb channery sandy loam, 25 to 35 percent slopes, moderately eroded; CrE2—Coshocton-Rayne silt loams, 18 to 25 percent slopes, moderately eroded; and BrF2—Berks shaly silt loam, 25 to 35 percent slopes, moderately eroded.

Watershed 132

Most of the soils in this watershed are formed over interbedded silty shales and clays. Clarion clay, associated with the discontinuous VanPort limestone, lies at an elevation approximately 20 feet above the flume. On the slope between this clay layer and the flume, the parent material is a silty shale, influenced by colluviation from upslope. Brookville clay lies 9 feet below the flume.

The entire watershed lies in a mature hardwood forest area that is well managed, is not grazed, and has never been cleared for farming. An unpaved service road [illegible] the watershed on the contour at approximately [illegible] feet elevation.

Runoff records began in April 1948. No soil core samples have been taken at this location.

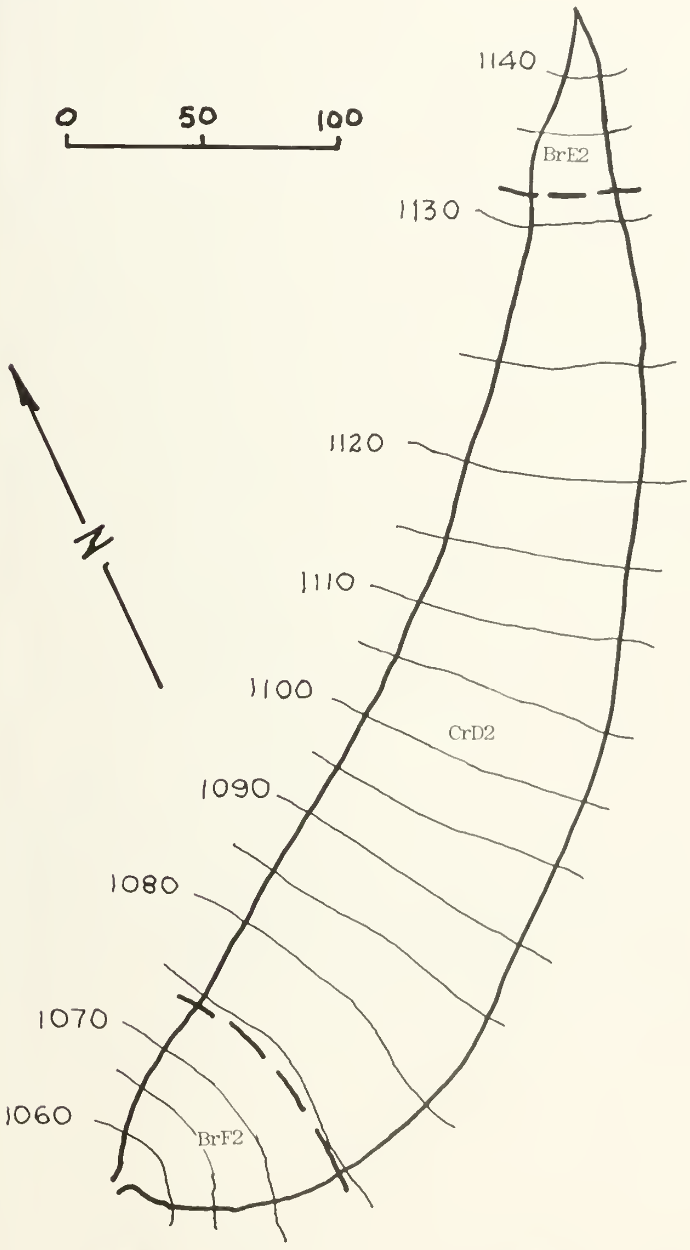

FIGURE 51.—Map of watershed 132, 0.59 acre: BrE2 Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded, CrD2 Coshocton-Rayne silt loams, 12 to 18 percent slopes, moderately eroded; and BrF2 Berks shaly silt loam, 25 to 35 percent slopes, moderately eroded.

Watershed 134

Soils on the upper two-thirds of this watershed developed from silty shale. They are steeper in the middle part than at either the top or near the flume. The area immediately above the flume appears to be influenced by the deposition of silts from the steeper area above. The Middle Kittanning clay lies approximately 15 feet below the flume. In the mid-1960's, a 3-foot vein of coal overlying this clay was strip mined in the area a few hundred feet west of the watershed.

Management history of this watershed began in 1935 with the planting of pine trees on highly eroded steep land. Nursery stock was planted on a 6- by 6-foot grid. Cropping had been abandoned 5 or more years earlier. Scrubby brush and poverty grass partly covered the soil surface at that time. Runoff was measured from May 1938 to July 1947.

In 1958, a survey indicated a total of 125 square feet of timber per acre consisted of:

White pine	16 square feet per acre
Pitch pine	50 square feet per acre
Red pine	24 square feet per acre
Hardwood species	35 square feet per acre

There has been no thinning or other management practice. No soil core samples have been taken at this watershed site.

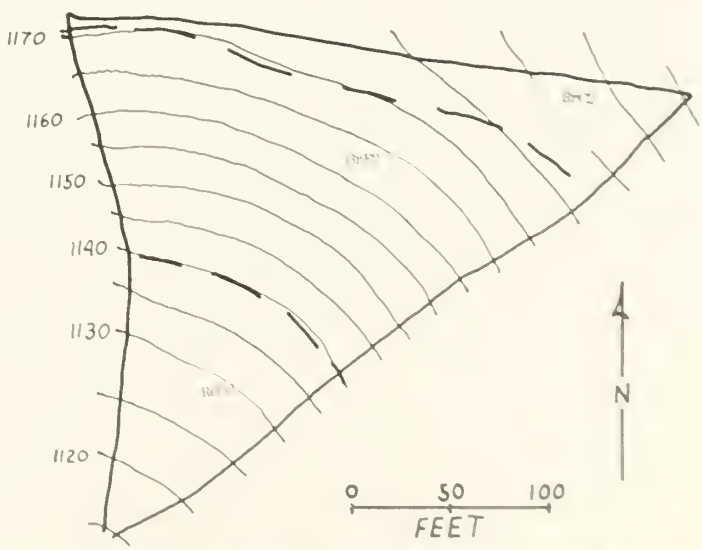

FIGURE 52.—Map of watershed 134, 0.92 acre: [illegible] Berks [illegible] loam, 6 to 12 percent slopes, moderately eroded; BrF2 Berks [illegible] silt loam, 25 to 35 percent [illegible]; and ReD2 Rayne silt loam, 12 to 18 percent [illegible].

Watershed 135

Five soil series, ranging from Keene with a heavy subsoil to Dekalb with a channery sandy loam subsoil, are mapped on this watershed. The location of mapping units reflects differences in parent material—clay shale near the top with interbedded siltstone, sandy shale, and sandstone below. Infiltration rates are high into the pastured surface, and downward movement in most of these soils is not hindered by any clay layers. There are no seeps in the watershed and no evidence of earlier tile drainage. Middle Kittanning clay lies 32 feet below the flume.

This area has been used for pasturing horses from the initiation of the research program in the late 1930's through 1946. Since then, beef cattle have been pastured on the watershed. Fertility level has been fairly low—about enough to sustain a forage yield between 0.5 and 1.0 ton per acre. There have been no seedings or pasture renovation on this watershed.

Runoff records began in March 1938.

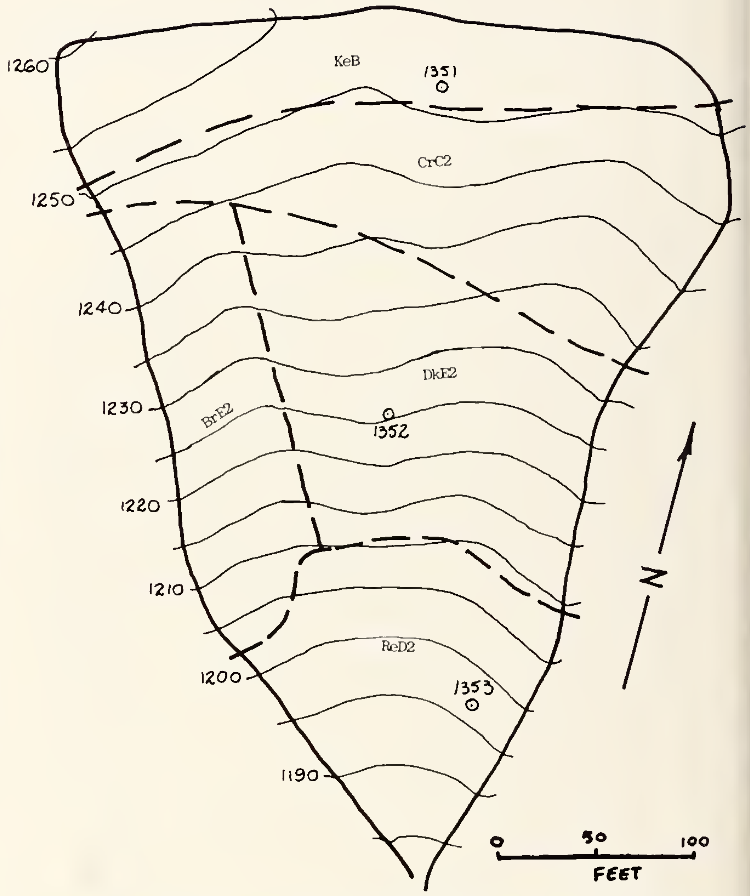

FIGURE 53.—Map of watershed 135, 2.69 acres: KeB—Keene silt loam, 2 to 6 percent slopes; CrC2—Coshocton-Rayne silt loams, 6 to 12 percent slopes, moderately eroded; BrE2—Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded; DkE2—Dekalb channery sandy loam, 18 to 25 percent slopes, moderately eroded; and ReD2—Rayne silt loam, 12 to 18 percent slopes, moderately eroded.

TABLE 33.—*Description of soil by horizons at core sites in watershed 135*

Profile classification, site, and horizon	Description
Keene silt loam:	
1351:	
Ap1	0–3 inches, dark grayish-brown (10YR 4/2) silt loam; moderate very fine granular structure; very friable; many roots; 2 percent shale fragments.
Ap2	3–8 inches, dark-brown (10YR 4/3) silt loam; weak fine granular structure; friable; many roots; 2 percent shale fragments.
B21t	8–13 inches, yellowish-brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; many roots; thin very patchy brown (7.5YR 5/4) clay films; 2 percent shale fragments.
B22t	13–17 inches, yellowish-brown (10YR 5/4) silt loam; common fine distinct pale-brown (10YR 6/3) and few fine distinct light brownish-gray (10YR 6/2) mottles; moderate fine and medium subangular blocky structure; friable; common roots; thin patchy brown (7.5YR 5/4) clay films; 10 percent shale fragments.
IIB23t	17–25 inches, yellowish-brown (10YR 5/6) silty clay loam; many medium distinct light brownish-gray (2.5Y 6/2) and common fine prominent yellowish-red (5YR 4/6) mottles; moderate and medium prismatic structure; firm; few roots; thin patchy brown (7.5YR 5/4) clay films; 5 percent shale fragments.
IIB24t	25–28 inches, mixed 60 percent light-gray (N 7/0) and 40 percent yellowish-red (5YR 4/6) silty clay loam; moderate fine and medium prismatic structure; firm; few roots; thin patchy light brownish-gray (10YR 6/2) clay films; 5 percent shale fragments.
Dekalb loam:	
1352:	
Ap	0–2 inches, very dark grayish-brown (10YR 3/2) loam; moderate very fine granular structure; very friable; many roots; 10 percent gray sandstone fragments less than 3 inches in diameter.
Ap2	2–8 inches, dark brown (10YR 4/3) dark yellowish-brown (10YR 4/4) crushed loam; weak fine granular structure; very friable; many roots; 10 percent gray sandstone fragments less than 3 inches in diameter.
B21	8–15 inches, strong brown (7.5YR 5/6) very channery sandy loam; weak fine and medium subangular blocky structure; friable; common roots; 75 percent gray sandstone fragments less than 3 inches in diameter.
B22	15–29 inches, strong brown (7.5YR 5/6) very channery sandy loam; weak medium subangular blocky structure; friable; few roots; thin very patchy dark brown (7.5YR 4/4) clay films; 60 percent gray sandstone fragments less than 3 inches in diameter; many pores.
Rayne silt loam:	
1353:	
Ap1	0–2 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate very fine granular structure; very friable; many roots; 10 percent coarse fragments.
Ap2	2–8 inches, dark brown (10YR 4/3), dark yellowish-brown (10YR 4/4) crushed silt loam; weak fine granular structure; friable; many roots; 10 percent coarse fragments.
B21t	8–15 inches, strong brown (7.5YR 5/6) channery silt loam; weak fine subangular blocky structure; friable; common roots; thin very patchy dark yellowish-brown (10YR 4/4) clay films; 25 percent coarse fragments.
B22t	15–25 inches, yellowish-brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots; thin very patchy dark yellowish-brown (10YR 4/4) clay films; 10 percent coarse fragments.
B23t	25–30 inches, yellowish-brown (10YR 5/4) channery loam; massive; firm; few roots; thin patchy brown (7.5YR 5/4) porous clay films; 25 percent coarse fragments.

Watershed 185

Sandstone near the top, siltstone in the middle, and clay shale near the bottom are the dominant bedrock types underlying the soils in this watershed. A loesslike silty material influences the upper part of the profiles, thicker in less steep cove positions and entirely removed by erosion or incorporated by tillage on steeper slopes. Infiltrating water is intercepted by Middle Kittanning clay which outcrops at an elevation 4 to 5 feet above the flume. Some of this water is measured as surface runoff, but an unmeasured amount moves beneath the flume, as evidenced by seeps immediately downslope. Some water may be collected above the Middle Kittanning clay by drainage tile, the outlets of which have not been located. Depth to the Lower Kittanning clay at the flume is 16 feet.

Cropping history follows:

1938	meadow to corn	1946	contour stripcropping, meadow and corn
1939	oats to wheat		
1940	wheat to meadow	1947	strips, meadow, and wheat
1941	meadow	1948	strips, corn, and meadow
1942	meadow to corn to wheat	1949	continue in 4-year rotation of C-W-M-M in strips
1943	wheat to meadow		
1944	meadow	1969	started continuous no-till corn on entire watershed
1945	meadow		

Runoff records began in August 1939. Improved practices (table 3) with contour stripcropping began in 1946. Corn was cut, shocked, husked, and stover removed through 1946. Since then, corn has been picked mechanically and stover disked into the soil in preparation for planting wheat in October. No soil core samples were taken on this watershed.

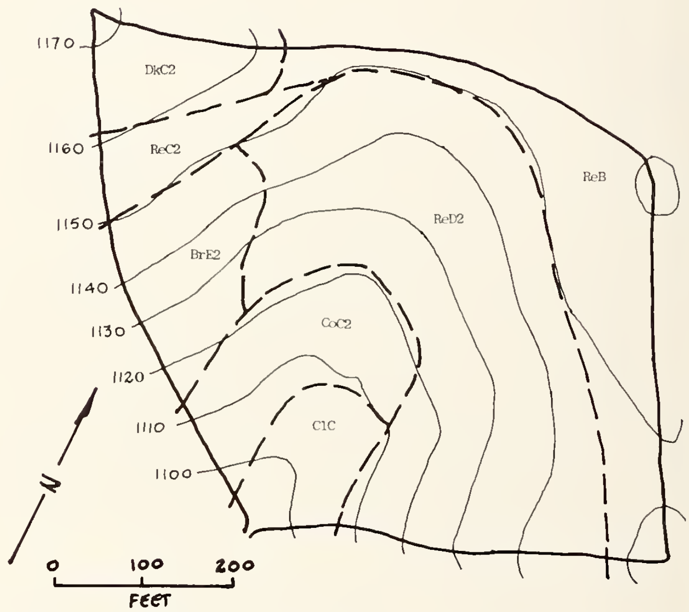

FIGURE 54.—Map of watershed 185, 7.40 acres: DkC2—Dekalb channery sandy loam, 6 to 12 percent slopes, moderately eroded; ReC2—Rayne silt loam, 6 to 12 percent slopes, moderately eroded; ReB—Rayne silt loam, 2 to 6 percent slopes; ReD2—Rayne silt loam, 12 to 18 percent slopes, moderately eroded; BrE2—Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded; CoC2—Coshocton silt loam, 6 to 12 percent slopes, moderately eroded; and ClC—Clarksburg silt loam, 6 to 12 percent slopes.

Watershed 187

This watershed has loamy textured soils with high permeabilities at the top of the slope grading to heavier textured profiles near the flume site. The bedrock parent materials are sandstone at the top, grading through siltstone and sandy shale to coal, clay, and clay shale in the middle portion. Clay shale, some of which is calcareous, is at the bottom. Two clay layers, the Middle and Lower Kittanning clays, each having a coal seam above the clay, outcrop in the lower middle part. Infiltrating water from above is forced to the surface by these impermeable layers, and much of it is carried out of the watershed by old and recently improved drainage tile systems. The Brookville clay lies 26 feet beneath the flume.

Cropping history of this watershed follows:

1939	oats to wheat
1940	wheat to meadow
1941	contour stripcropping, meadow and corn
1942	strips, meadow and wheat
1943	strips, corn and meadow
1944	strips, wheat and meadow
1945	continue in 4-year rotation of C-W-M-M in strips
1969	started continuous no-till corn on entire watershed

Runoff records began in August 1939. Improved practices (table 3) with contour stripcropping began in 1941. Corn was cut, shocked, husked, and stover was removed through 1947. Afterwards, corn was picked mechanically, and stover was disked into the soil in preparation for planting wheat in October.

In 1945, a 300-foot tile drain was laid in the main waterway with its outlet at land surface about 50 feet in front of the flume. The waterway was shaped to permit tillage tool crossing.

On May 1, 1970, two lateral drains were attached to the upper end of the old tile—about 150 feet in a north-and-south direction, and the drainage tube in the central waterway was extended through the dike so that subsurface flow would bypass the measuring flume.

In October 1970, the main waterway drain was replaced. No soil core samples were taken on this watershed.

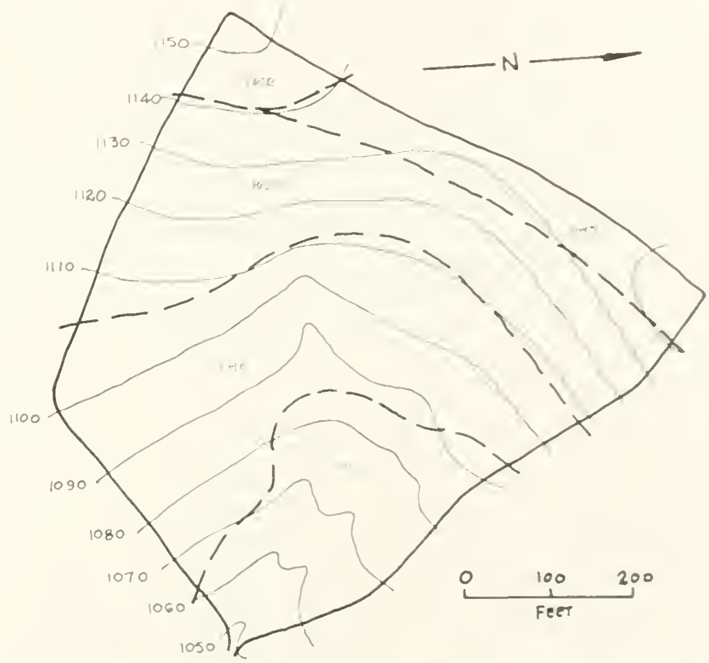

FIGURE 55.—Map of watershed 187, 7.20 acres: DkD2—Dekalb channery sandy loam, 12 to 18 percent slopes, moderately eroded, ReD2—Rayne silt loam, 12 to 18 percent slopes, moderately eroded; BrC2—Berks shaly silt loam, 6 to 12 percent slopes, moderately eroded, CrD2—Coshocton-Rayne silt loams, 12 to 18 percent slopes, moderately eroded, and ClD—Clarksburg silt loam, 12 to 18 percent slopes

Watershed 188

Soils in this watershed are developed in a loesslike silty deposit overlying a loamy textured material weathered from sandy shale and siltstone bedrock. The watershed lies in a position favorable for the accumulation and retention of windblown particles. Near the top of the watershed, the silty deposit is approximately 20 inches deep, allowing the heaviest clay accumulation to occur in the underlying residual parent material. The boundary between parent materials occurs at 26 inches of depth in the middle of the watershed and below 30 inches at the bottom of the watershed (table 34, site 1882). At the downslope site maximum clay accumulation occurs above the boundary between parent materials. There are no clay layers and no evidence of tile in the watershed. Middle Kittanning clay is 35 feet below the flume.

Cropping history of this watershed follows:

1938	meadow to corn	1955	meadow
1939	oats to wheat	1956	meadow disked for corn, mulch
1940	wheat to meadow	1957	wheat to meadow
1941	meadow	1958	meadow
1942	meadow	1959	meadow
1943	meadow	1960	meadow to plow-plant corn
1944	meadow to corn	1961	wheat to meadow
1945	wheat to meadow	1962	meadow
1946	meadow	1963	meadow
1947	meadow	1964	meadow plowed 14 inches for plow-plant corn
1948	meadow disked for corn, mulch	1965	wheat to meadow
1949	wheat to meadow	1966	meadow
1950	meadow	1967	meadow
1951	meadow	1968	meadow plowed 16 inches deep for plow-plant corn
1952	meadow to corn, mulch, subsoiled	1969	wheat to meadow
1953	wheat to meadow	1970	no-till corn
1954	meadow		

Runoff records began in July 1939. Improved practices (table 3) started in 1944. Corn was cut, shocked, husked, and stover removed through 1944. Since, corn has been picked mechanically and stover disked in preparation for planting wheat in October.

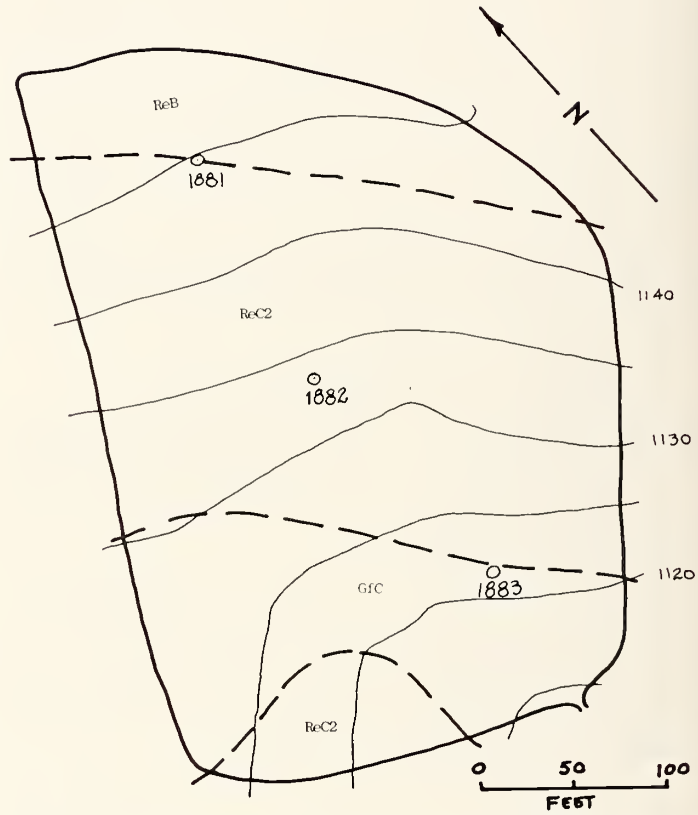

FIGURE 56.—Map of watershed 188, 2.05 acres: ReB—Rayne silt loam, 2 to 6 percent slopes; ReC2—Rayne silt loam, 6 to 12 percent slopes, moderately eroded; GfC—Glenford silt loam, 6 to 12 percent slopes; and ReC2—Rayne silt loam, 6 to 12 percent slopes, moderately eroded.

Table 34.—*Description of soil by horizons at core sites in watershed 188*

Profile classification, site, and horizon	Description
Rayne silt loam[1]:	
1881:	
Ap1	0–11 inches, dark-brown (10YR 4/3) silt loam; small areas of dark yellowish brown (10YR 4/4); weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 2 percent sandy shale fragments.
Ap2	11–14 inches, yellowish-brown (10YR 5/4) silt loam; small areas of dark brown (10YR 4/3); weak medium subangular blocky structure; friable; common roots; 2 percent sandy shale fragments.
B21t	14–20 inches, yellowish-brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 10 percent sandy shale fragments.
IIB22t	20–29 inches, yellowish-brown (10YR 5/4) very shaly loam; weak medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 50 percent sandy shale fragments.
1882:	
Ap	0–14 inches, mixed dark-brown (10YR 4/3) and dark yellowish-brown (10YR 4/4) silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 2 percent sandy shale fragments.
B21t	14–26 inches, yellowish-brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 5 percent sandy shale fragments.
IIB22t	26–29 inches, yellowish-brown (10YR 5/4) shaly loam; weak medium subangular blocky structure; friable; common roots; moderate patchy dark-brown (7.5YR 4/4) clay films; 40 percent sandy shale fragments.
Glenford silt loam:	
1883:	
Ap1	0–8 inches, dark-brown (10YR 4/3) silt loam; weak fine granular structure; friable; common roots.
Ap2	8–15 inches, mixed dark-brown (10YR 4/3) and yellowish-brown (10YR 5/4) silt loam; weak fine granular structure, friable; common roots.
B21t	15–26 inches, yellowish-brown (10YR 5/6) silt loam; weak medium subangular blocky structure, friable; few roots; thin patchy brown (7.5YR 5/4) clay films; 2–5 percent sandstone and shale fragments.
B22t	26–30 inches, yellowish-brown (10YR 5/4) silt loam; few medium distinct pale-brown (10YR 6/3) mottles; weak coarse prismatic structure, firm, dense; few roots; moderate continuous brown (7.5YR 5/4) clay films on vertical cracks and thin patchy brown (7.5YR 5/4) clay films in pores; 2 percent fragments.

[1] Part of the argillic horizon has been destroyed by deep tillage.

Watershed 191

Soils and bedrock conditions in this watershed are similar to those of watershed 188 which adjoins it on the east. The upper solum developed from wind-deposited silts while the lower horizons developed in a residual parent material weathered from sandstone and siltstone. There are no geologic clay layers or tile systems in the watershed. Middle Kittanning clay is 39 feet below the flume.

Cropping history of this watershed follows:

1938	meadow to corn
1939	oats to wheat
1940	wheat to meadow
1941	meadow
1942	meadow
1943	meadow
1944	meadow disked for corn, mulch
1945	wheat to meadow
1946	meadow
1947	meadow
1948	meadow to corn
1949	wheat to meadow
1950	meadow
1951	meadow
1952	meadow to corn, Krilium drilled and disked to 4 inches
1953	wheat to meadow
1954	meadow
1955	meadow
1956	meadow to corn
1957	wheat to meadow
1958	meadow
1959	meadow
1960	meadow to corn, plow-plant, hay mulch
1961	wheat disked for corn, narrow rows
1962	wheat to meadow
1963	meadow
1964	meadow to corn, no-till
1965	continuous no-till corn

Runoff records began in August 1939, and improved practices (table 3) started in 1944. Corn was cut, shocked, husked, and stover removed through 1944. Since 1944, corn has been picked mechanically and stover disked to prepare the soil for planting wheat in October.

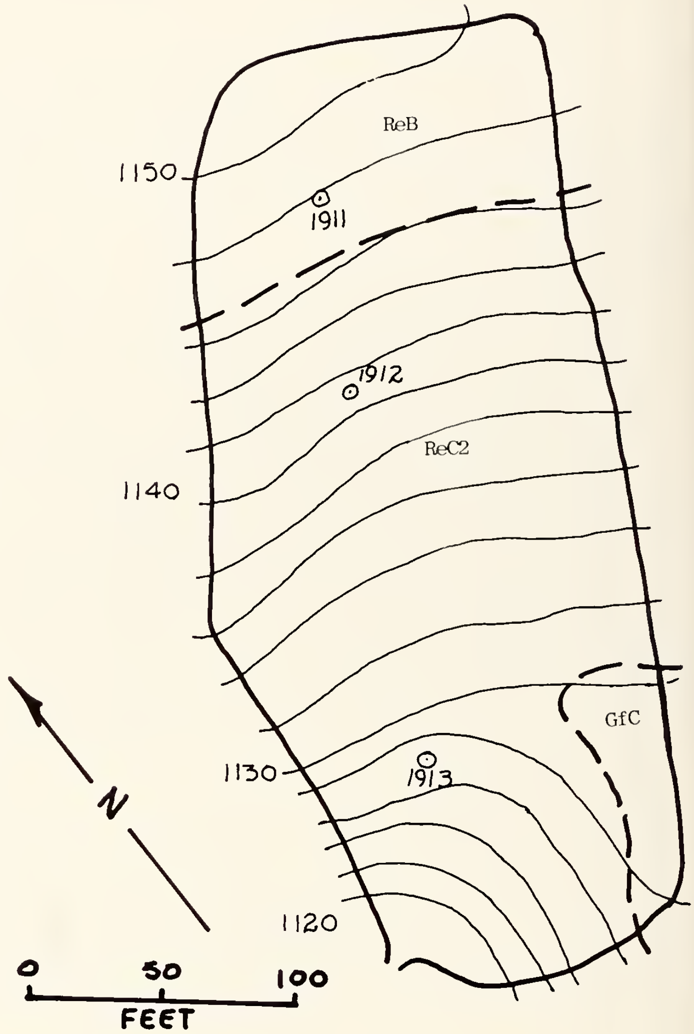

FIGURE 57.—Map of watershed 191, 1.20 acres: ReB—Rayne silt loam, 2 to 6 percent slopes; ReC2—Rayne silt loam, 6 to 12 percent slopes, moderately eroded; and GfC—Glenford silt loam, 6 to 12 percent slopes.

TABLE 35.—*Description of soil by horizons at core sites in watershed 19[illegible]*

Profile classification, site, and horizon	Description
Rayne silt loam:	
1911:	
Ap	0–8 inches, dark-brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to weak fine granular structure; friable; common roots; 2 percent sandy shale fragments.
B1	8–13 inches, yellowish-brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common roots; 5 percent sandy shale fragments.
B21t	13–22 inches, yellowish-brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; thin patchy dark yellowish-brown (10YR 4/4) clay films; 10 percent sandy shale fragments.
IIB22t	22–29 inches, yellowish-brown (10YR 5/4) loam; moderate medium subangular blocky structure; friable; few roots; thin patchy dark yellowish-brown (10YR 4/4) clay films; 10–15 percent sandy shale fragments; many mica flakes.
1912:	
Ap	0–8 inches, dark-brown (10YR 4/3) silt loam; weak fine granular structure; friable; many roots.
B1	8–13 inches, dark yellowish-brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; common roots.
B21t	13–22 inches, strong brown (7.5YR 5/6) silt loam; weak medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 5 percent shale fragments.
IIB22t	22–29 inches, dark yellowish-brown (10YR 4/4) shaly loam; weak medium subangular blocky structure; friable; few roots; moderate patchy dark-brown (7.5YR 4/4) clay films; 25 percent shale fragments.
1913:	
Ap	0–9 inches, dark-brown (10YR 3/3) silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; common roots.
B & A	9–16 inches, dark yellowish-brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; few roots; 2 percent shale fragments.
B21t	16–23 inches, yellowish-brown (10YR 5/4) shaly silt loam; moderate medium subangular blocky structure; friable; few roots; thin patchy dark-brown (7.5YR 4/4) clay films; 20 percent shale fragments.
IIB22t	23–30 inches, yellowish-brown (10YR 5/4) shaly loam; weak medium subangular blocky structure; friable; few roots; thin patchy dark-brown (7.5YR 4/4) clay films; 30 percent shale fragments, few mica flakes and FeMn concretions.

Watershed 192

The soils in this watershed developed from the same residual parent material as those in watershed 185 with which it shares a common upper boundary. The silty, loesslike deposit overlying the weathered bedrock is thinner in this northwest sloping watershed, resulting in shallower soils containing more shale fragments. The bedrock is sandstone at the top of the watershed, grading to sandy shale and siltstone in the lower parts. Middle and Lower Kittanning clays outcrop in the lower part of the watershed, causing seepy spots to persist during and after wet periods. These seeps may have been tile drained by early farmers, but no functioning outlets have been found. Brookville clay lies 51 feet below the flume.

Cropping history for this watershed follows:

1938	meadow to corn	1943	wheat to meadow
1939	oats to wheat	1944	meadow
1940	wheat to meadow	1945	meadow
1941	meadow	1946	continue in a 4-year rotation of C-W-M-M
1942	meadow to corn		

Runoff records began in August 1939. Prevailing practices (table 3) were followed throughout the period of record. Corn was cut, shocked, husked, and stover removed up to 1946. Since, corn has been picked mechanically and stover disked before planting wheat in October.

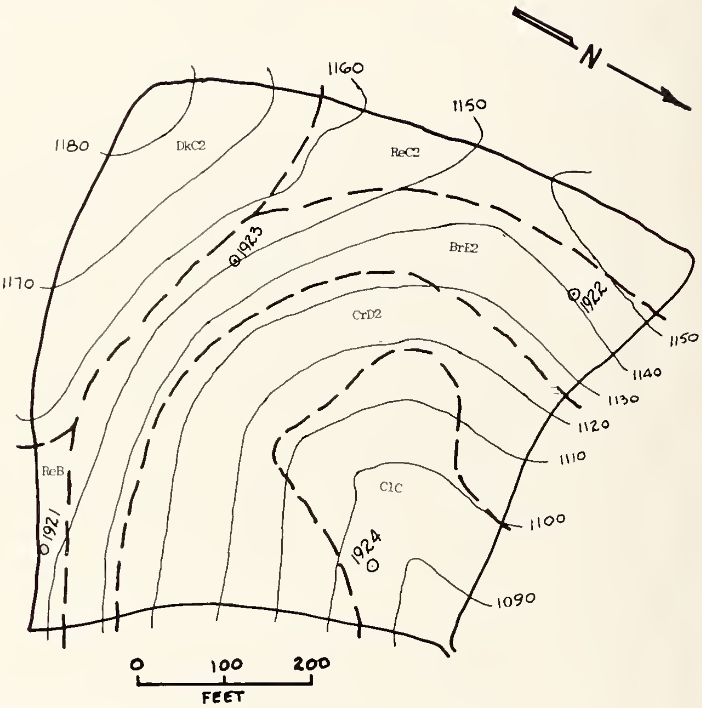

FIGURE 58.—Map of watershed 192, 7.59 acres: DkC2—Dekalb channery sandy loam, 6 to 12 percent slopes, moderately eroded; ReC2—Rayne silt loam, 6 to 12 percent slopes, moderately eroded; BrE2—Berks shaly silt loam, 18 to 25 percent slopes, moderately eroded; CrD2—Coshocton-Rayne silt loams, 12 to 18 percent slopes, moderately eroded; ReB—Rayne silt loam, 2 to 6 percent slopes; and ClC—Clarksburg silt loam, 6 to 12 percent slopes.

TABLE 36.—*Description of soil by horizons at core sites in watershed 192*

Profile classification, site, and horizon	Description
Berks silt loam[1]:	
1921:	
Ap	0–8 inches, dark-brown (10YR 4/3) silt loam; weak fine subangular blocky structure parting to moderate fine granular structure; friable; many roots; 10 percent sandy shale fragments.
B21	8–15 inches, yellowish-brown (10YR 5/6) shaly loam; weak medium subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 20 percent sandy shale fragments.
IIB22t	15–29 inches, yellowish-brown (10YR 5/4) very shaly sandy loam; weak medium subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 65 percent sandy shale fragments.
Berks shaly loam[2]:	
1922:	
Ap	0–8 inches, dark-brown (10YR 4/3), dark yellowish-brown (10YR 4/4) crushed shaly loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 15 percent sandy shale fragments.
B21t	8–16 inches, strong brown (7.5YR 5/6) heavy loam; moderate medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 10 percent sandy shale fragments.
IIB22t	16–30 inches, yellowish-brown (10YR 5/4) very shaly heavy loam; platy rock structure; friable; few roots; thin patchy dark-brown (7.5YR 4/4) clay films; 80 percent sandy shale fragments.
Dekalb channery loam[3]:	
1923:	
Ap	0–7 inches, dark-brown (10YR 3/3, 10YR 4/3) crushed channery loam; weak fine subangular blocky structure parting to moderate fine granular structure; friable; many roots; 15 percent sandstone and sandy shale fragments.
B21	7–15 inches, yellowish-brown (10YR 5/4) channery loam; weak medium subangular blocky structure; friable; common roots; 45 percent sandstone and sandy shale fragments.
B22	15–24 inches, yellowish-brown (10YR 5/4) very channery sandy loam; platy rock structure; friable; few roots; thin very patchy dark-brown (7.5YR 4/4) clay films; 85 percent sandstone and sandy shale fragments.
Clarksburg channery silt loam[4]:	
1924:	
Ap	0–7 inches, dark grayish-brown (10YR 4/2) channery silt loam; weak fine granular structure; friable; common roots; 20 percent sandstone and shale fragments.
B1	7–14 inches, brown (10YR 5/3) channery loam; weak fine and medium subangular blocky structure; friable; common roots; 20 percent sandstone and shale fragments.
B21t	14–22 inches, gray (10YR 6/1) channery heavy silt loam; many medium distinct yellowish-brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few roots; thin patchy brown (10YR 5/3) clay films; 20 percent sandstone and shale fragments.
B22xt	22–31 inches, dark yellowish-brown (10YR 4/4) channery loam; common medium distinct light brownish-gray (10YR 6/2) mottles; massive; very firm; few roots; thin patchy brown (7.5YR 5/4) clay films; 20 percent sandstone and shale fragments; few FeMn concretions.

[1] Sand content in IIB22 is greater than allowed in the Berks Series. Berks soils are a common inclusion in Rayne mapping units.

[2] A common inclusion in Berks mapping units, it has more clay films in the subsoil than is allowed in the Berks Series.

[3] A common inclusion in Berks mapping units.

[4] Profile has grayer colors in the subsoil than is allowable in the Clarksburg Series. Spots of slightly wetter soils are commonly included in Clarksburg mapping units.

APPENDIX B

Profiles, physical and chemical data for hydrology sites

Hydrologic characteristics were determined from soil samples taken from pits at eight sites (fig. 59). Information for two profiles at each site (tables 37 to 68) consists of descriptions which include:

1. Physical data from each site:
   a. Equilibrium water content at 0.1, 0.3, 0.6, 3, and 15 bars tension, determined on loose aggregate samples (not crushed or sieved) and reported in percent by dry weight (first line) and percent by volume (second line).
   b. Bulk density reported at 0.3 bar water tension (first line) and ovendry (second line).
   c. Total porosity is given in percent by volume computed by assuming specific gravities equal to 2.65 for all samples at 0.3 bar tension (first line) and ovendry (second line).
   d. Saturated conductivity obtained from duplicate undisturbed samples.
2. Particle size distribution of soil components (expressed in percent) and chemical data from each site:
   a. Values for pH determined in 1:1 soil:water ratio.
   b. Organic carbon content (percent dry weight basis); multiply by 1.72 to convert to organic matter content.
   c. Sum of exchangeable cations reported as milliequivalents of H, Ca, Mg, and K per 100 grams soil.
   d. Base saturation is the percent of the exchangeable cations comprised of Ca, Mg, and K.

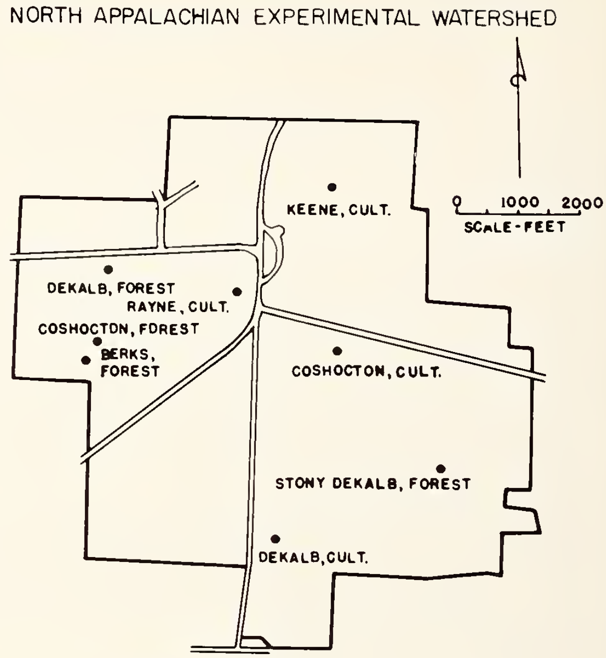

FIGURE 59.—Location of soil sampling sites.

Berks silt loam,[1] forest, sample 1

Location: 45 ft. W. of lane and 70 ft. S. of watershed 132 flume, SE¼SW¼NW¼ sec. 5, White Eyes T., N.A.E.W., Coshocton County
Vegetation and land use: Woods; white oak
Topography: Rolling upland, middle slope, 14 percent slope (elevation 1,045 ft)
Drainage: Well drained
Parent material: Silty shale
Described and sampled by: G. E. Kelley and G. P. Lawless, April 13, 1965

Horizon	*Description*
01	1½ to ½ inch, deciduous leaf litter.
02	½ to 0 inch, organic material decomposed beyond recognition.
A1	0 to 1 inch, dark-brown (10YR 3/3) silt loam; moderate fine granular structure; friable; many roots; 5 percent shale fragments less than 3 inches in diameter; pH 4.5; clear wavy boundary.
A2	1 to 9 inches, light yellowish-brown (10YR 6/4) silt loam; weak medium and fine subangular blocky structure; friable; many roots; 5 percent shale fragments less than 3 inches in diameter; pH 4.1; clear smooth boundary.
B1	9 to 15 inches, yellowish-brown (10YR 5/6) silt loam; weak medium and fine subangular blocky structure; friable; common roots; thin very patchy yellowish-brown (10YR 5/4) clay films; 10 percent shale fragments less than 3 inches in diameter; pH 4.2; clear smooth boundary.
B21t	15 to 25 inches, yellowish-brown (10YR 5/6) shaly light silty clay loam; weak to moderate medium subangular blocky structure; friable; common roots; thin patchy yellowish-brown (10YR 5/6) and dark-brown (7.5YR

[1] This profile is an intergrade between the Berks and Rayne Series. It does not satisfy the requirements of either series. This is a common inclusion in the Berks mapping units.

TABLE 37.—*Physical characteristics of soil profile, site 1, Berks silt loam, forest*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	41.07	37.57	30.28	26.54	11.85	0.83	68.68	----
	34.09	31.18	25.13	22.03	9.84	----	-----	----
1	25.89	22.36	21.49	16.66	7.32	1.42	46.42	3.44
	36.76	31.75	30.52	23.66	10.39	1.49	43.77	.47
9	22.13	20.68	20.25	17.48	13.21	1.51	43.02	.31
	33.42	31.23	30.58	26.39	19.95	1.61	39.25	.41
15	23.10	21.17	20.25	18.24	14.33	1.49	43.77	.24
	34.42	31.54	30.17	27.18	21.35	1.64	38.11	.55
25	19.93	18.27	15.57	14.47	11.02	1.67	36.98	.72
	33.28	30.51	26.00	24.16	18.40	1.82	31.32	.14
32	16.84	15.05	13.96	12.21	10.31	1.48	44.15	----
	24.92	22.27	20.66	18.07	15.26	----	-----	----

[1] For explanation of table format, see above.

TABLE 38.—*Particle size distribution and chemical characteristics of soil profile, site 1, Berks silt loam, forest*[1]

Size and characteristic	A1 0–1	A2 1–9	B1 9–15	B21t 15–25	B22t 25–32
	Horizon and depth (inches)				
Particle size distribution:					
Sand (millimeters):					
Very fine, 0.05–0.1 ____ percent	12.2	11.7	10.4	9.5	5.8
Fine, .1–.25 ____ do	3.3	3.3	3.4	2.9	2.8
Medium, .25–.5 ____ do	.8	1.1	1.3	2.5	6.6
Coarse, .5–1 ____ do	1.5	2.2	2.5	3.4	1.8
Very coarse, 1–2 ____ do	.8	1.8	2.0	1.3	.7
Total sand, .05–2 ____ do	18.6	20.1	19.6	19.6	17.7
Silt (microns):					
Fine, 2–20 ____ percent	44.0	42.6	33.4	30.2	38.1
Coarse, 20–50 ____ do	23.7	23.1	23.3	22.5	19.1
Total silt, 2–50 ____ do	67.7	65.7	56.7	52.7	57.2
Clay (microns):					
Fine, <.2 ____ percent	3.4	2.3	6.6	12.1	7.1
Coarse, .2–2 ____ do	10.3	11.9	17.1	15.6	18.0
Total clay, <2 ____ do	13.7	14.2	23.7	27.7	25.1
Textural class	sil	sil	sil	sicl	sil
pH	4.5	4.1	4.2	4.6	4.6
Organic carbon ____ percent	3.2	.7	.4	.3	.3
Exchangeable cations:					
H ___ milliequivalents per 100 grams	13.9	7.7	9.7	11.8	12.2
Ca ____ do	1.6	.1	.2	.2	.2
Mg ____ do	.6	.2	.2	1.8	2.4
K ____ do	.36	.13	.22	.10	.24
Total exchangeable cations ____ do	16.5	8.1	10.3	13.9	15.0
Total exchangeable bases (Ca, Mg, K) ____ do	2.6	.4	.6	2.1	2.8
Base saturation[2] ____ percent	16	5	6	15	19

[1] For explanation of table format, see p. 112.
[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

4/4) clay films; 15 percent shale fragments less than 3 inches in diameter; pH 4.6; gradual boundary.

B22t — 25 to 32 inches, yellowish-brown (10YR 5/6) very shaly heavy silt loam; gray (10YR 6/1) coatings on some shale fragments; weak fine and medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 85 percent shale fragments less than 3 inches in diameter; pH 4.6; gradual boundary.

R — 32 to 60 inches +, light olive-brown (2.5Y 5/4) silty shale with some fines and occasional roots extending down cracks.

Berks silt loam, forest, sample 2

Location: 65 ft. W. of lane and 70 ft. S. of watershed 172 flume, SE¼SW¼NW¼ sec. 5, White Eyes Tp., N.A.E.W., Coshocton County

Vegetation and land use: Woods; red and white oak

Topography: Rolling upland, middle slope, 21 percent slope (elevation 1,035 ft)

Drainage: Well drained

Parent material: Siltstone and silty shale

Described and sampled by: G. E. Kelley and G. P. Lawless, April 13, 1965

Horizon	*Description*
01	1½ to ½ inch, deciduous leaf litter.
02	½ to 0 inch, organic material decomposed beyond recognition.
A1	0 to 1 inch, very dark grayish-brown (10YR 3/2) silt loam; moderate fine granular structure; friable; many roots; 7 percent shale fragments less than 3 inches in diameter; pH 4.3; clear smooth boundary.
A2	1 to 9 inches, light yellowish-brown (10YR 6/4) silt loam; weak medium and fine subangular blocky structure; friable; many roots; 5 percent shale fragments less than 3 inches in diameter; pH 4.2; clear smooth boundary.
B1	9 to 15 inches, yellowish-brown (10YR 5/6) silt loam; weak medium and fine subangular blocky structure; friable; common roots; thin very patchy yellowish-brown (10YR 5/4) clay films; 10 percent shale fragments less than 3 inches in diameter; pH 4.4; clear smooth boundary.
B2	15 to 31 inches, strong brown (7.5YR 5/6) shaly heavy silt loam; weak coarse subangular blocky structure; friable; common roots; thin very patchy brown (7.5YR 5/4) clay films; 45 percent shale fragments with pockets ranging up to 70 percent; fragments range up to 6 inches in diameter; pH 4.5; gradual irregular boundary (depth to rock ranged from 27 to 36 inches.)

TABLE 39.—*Physical characteristics of soil profile, site 2, Berks silt loam, forest*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	38.57	38.16	29.94	23.91	11.36	0.86	67.57	
	33.17	32.82	25.75	20.56	9.77			
1	24.84	23.39	20.97	15.17	6.56	1.51	43.02	[illegible]
	37.46	35.32	31.66	22.91	9.91	1.58	40.38	[illegible]
9	21.53	19.69	19.15	15.74	9.77	1.65	37.74	.07
	35.52	32.49	31.60	25.97	16.12	1.75	33.96	[illegible]
15	18.84	18.15	16.37	14.56	12.28	1.73	34.72	[illegible]
	32.59	31.40	28.32	25.19	24.24	1.90	28.30	1.34
31	16.57	15.66	13.88	12.55	9.54	1.47	44.53	
	24.36	23.02	20.40	18.45	14.02			

[1] For explanation of table format, see p. 112.

R 31 to 55 inches +, fractured yellowish-brown (10YR 5/8) siltstone and light olive-brown (2.5Y 5/4) silty shale with some fines and occasional roots extending down cracks to about 50 inches.

TABLE 40.—*Particle size distribution and chemical characteristics of soil profile, site 2, Berks silt loam, forest*[1]

Size and characteristic	Horizon and depth (inches) A1 0–1	A2 1–9	B1 9–15	B2t 15–31
Particle size distribution:				
Sand (millimeters):				
Very fine, 0.05–0.1 ... percent	13.0	12.7	9.5	9.4
Fine, .1–.25 ... do	4.5	4.3	5.0	5.4
Medium, .25–.5 ... do	1.3	1.6	1.3	4.9
Coarse, .5–1 ... do	2.0	2.2	1.5	3.1
Very coarse, 1–2 ... do	2.4	2.1	1.3	1.6
Total sand, .05–2 ... do	23.2	22.9	18.6	24.4
Silt (microns):				
Fine, 2–20 ... percent	39.7	39.5	39.1	30.3
Coarse, 20–50 ... do	24.8	23.8	22.3	19.8
Total silt, 2–50 ... do	64.5	63.3	61.4	50.1
Clay (microns):				
Fine, <.2 ... percent	2.7	1.5	3.2	7.0
Coarse, .2–2 ... do	9.6	12.3	16.8	18.5
Total clay, <2 ... do	12.3	13.8	20.0	25.5
Textural class	sil	sil	sil	sil
pH	4.3	4.2	4.4	4.5
Organic carbon ... percent	3.8	1.1	.5	.4
Exchangeable cations:				
H ... milliequivalents per 100 grams	16.1	8.6	10.4	12.3
Ca ... do	1.4	.2	.2	.3
Mg ... do	.4	.2	.1	.8
K ... do	.28	.19	.17	.19
Total exchangeable cations ... do	18.2	9.2	10.9	13.6
Total exchangeable bases (Ca, Mg, K) ... do	2.1	.6	.5	1.3
Base saturation[2] ... percent	11	6	4	9

[1] For explanation of table format, see p. 112.

[2] Base saturation = total exchangeable base ÷ total exchangeable cations.

Coshocton silt loam, cultivated, sample 1

Location: 170 ft S. of T. Rd. 171d and 50 ft W. of farm lane, SW¼NW¼ sec. 4, White Eyes T., N.A.E.W., Coshocton County

Vegetation and land use: Meadow crop

Topography: Rolling upland, upper slope, 10 percent (elevation 1,120 ft.)

Drainage: Moderately well

Parent material: Gray clay shale

Described and sampled by: H. W. Black, G. E. Kelley, G. P. Lawless, March 19, 1965

Remarks: This site is the representative profile for the Coshocton Series. Description given on pages 21–24.

TABLE 41.—*Physical characteristics of soil profile, site 1, Coshocton silt loam, cultivated*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	28.15	26.06	24.01	19.17	9.56	1.46	44.91	0.48
	41.10	38.05	35.05	27.99	13.96	1.55	41.51	.25
7	26.10	24.90	22.77	21.00	15.23	1.47	44.53	.19
	38.37	36.60	33.47	30.87	22.39	1.59	40.00	.18
10	28.33	26.05	24.43	21.07	15.86	1.46	44.91	.20
	41.36	38.03	35.67	30.76	23.16	1.59	40.00	.30
14	26.40	24.13	23.30	20.54	15.46	1.57	40.75	.10
	41.45	37.88	36.58	32.25	24.27	1.75	33.96	.28
17	20.70	19.27	18.67	16.46	12.53	1.72	35.09	.10
	35.60	33.14	32.11	28.31	21.55	1.84	30.57	.13
27	15.83	15.24	14.45	13.11	10.38	1.55	41.51	----
	24.54	23.62	22.40	20.32	16.09	----	-----	----
46	20.35	17.96	17.39	15.96	12.82	1.53	42.26	----
	31.14	27.48	26.61	24.42	19.61	----	-----	----
58	15.70	13.88	13.73	10.83	6.19	1.67	36.98	----
	26.22	23.18	22.93	18.09	10.34	----	-----	----

[1] For explanation of table format, see p. 112.

TABLE 42.—*Particle size distribution and chemical characteristics of soil profile, site 1, Coshocton silt loam, cultivated*[1]

Size and characteristic		Horizon and depth (inches) Ap 0–7	B1 7–10	B21t 10–14	IIB22t 14–17	IIB23g 17–27	IIB3 27–46	IIC 46–58
Particle size distribution:								
Sand (millimeters):								
Very fine, 0.05–0.1	percent	6.4	4.4	6.1	12.7	11.5	20.3	7.6
Fine, .1–.25	do	2.5	1.5	1.8	3.7	1.9	3.9	1.7
Medium, .25–.5	do	1.0	.7	.7	.9	.6	.7	.9
Coarse, .5–1	do	1.4	1.2	1.4	1.2	.8	1.6	2.1
Very coarse, 1–2	do	1.0	.7	1.3	.8	.4	1.3	1.5
Total sand, .05–2	do	12.3	8.5	11.3	19.3	15.2	27.8	13.8
Silt (microns):								
Fine, 2–20	percent	45.5	41.4	36.3	30.8	31.6	30.4	38.3
Coarse, 20–50	do	24.9	25.7	23.9	19.9	20.7	18.9	19.9
Total silt, 2–50	do	70.4	67.1	60.2	50.7	52.3	49.3	58.2
Clay (microns):								
Fine, <.2	percent	3.8	9.0	11.7	10.7	11.8	6.3	7.4
Coarse, .2–2	do	13.5	15.4	16.8	19.3	20.7	16.6	20.6
Total clay, <2	do	17.3	24.4	28.5	30.0	32.5	22.9	28.0
Textural class		sil	sil	sicl	sicl	sicl	l	sicl
pH		5.8	5.1	4.6	4.5	4.5	4.5	4.5
Organic carbon	percent	1.1	.3	.2	.2	[illegible]	[illegible]	[illegible]
Exchangeable cations:								
H	milliequivalents per 100 grams	5.3	6.2	10.9	12.2	12.1	8.9	8.3
Ca	do	6.2	4.4	2.5	1.6	1.0	1.2	1.8
Mg	do	.6	1.2	2.0	3.4	4.1	4.0	5.4
K	do	.20	.17	.20	.21	.22	.19	.19
Total exchangeable cations	do	12.3	12.0	15.6	17.1	17.4	14.3	15.7
Total exchangeable bases (Ca, Mg, K)	do	7.0	5.8	4.7	5.2	5.3	5.4	7.4
Base saturation[2]	percent	57	48	30	30	31	38	47

[1] For explanation of table format, see p. 112.

[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Coshocton silt loam, cultivated, sample 2

Location: 215 ft S. of T. Rd. 171d and 20 ft W. of farm lane, SW¼NW¼ sec. 4, White Eyes T., N.A.E.W., Coshocton County
Vegetation and land use: Meadow crop
Topography: Rolling upland, upper slope, 10 percent (elevation 1,120 ft)
Drainage: Moderately well
Parent material: Gray clay shale
Described and sampled by: G. E. Kelley and G. P. Lawless, March 23, 1965

Horizon	*Description*
Ap	0 to 6 inches, dark-brown (10YR 4/3) silt loam; weak medium granular structure; friable; many roots; 2 percent shale fragments; pH 6.4; abrupt smooth boundary.
B21t	6 to 10 inches, yellowish-brown (10YR 5/4) heavy silt loam; common fine and medium distinct pale brown (10YR 6/3) and yellowish-brown (10YR 5/8) mottles; weak fine subangular blocky structure; friable; common roots; thin very patchy light yellowish-brown (10YR 6/4) clay films; 5 percent shale fragments less than 3 inches in diameter; pH 6.8; clear wavy boundary.
IIB22tg	10 to 24 inches, yellowish-brown (10YR 5/4) shaly clay loam; many (75 percent of ped surfaces) coarse prominent light olive gray (5Y 6/2) and common medium distinct dark yellowish-brown (10YR 4/4) mottles; moderate fine and medium angular and subangular blocky structure; firm; few roots; thin patchy light yellowish-brown (10YR 6/4) clay films; 15 percent shale fragments less than 6 inches in diameter; pH 4.5; clear wavy boundary (horizon thickness ranges from 6 to 18 inches across the pit face).
IIB23tg	24 to 37 inches, yellowish-brown (10YR 5/4) heavy shaly loam; few fine distinct yellowish-brown (10YR 5/8) and light brownish-gray (10YR 6/2) and many medium distinct dark brown (10YR 4/3) mottles; moderate fine and medium angular blocky structure; very firm; few roots; thin continuous pale olive (5Y 6/3) clay films on vertical ped surfaces and patchy on horizontal ped surfaces; common dark concretions; 20 percent shale fragments less than 3 inches in diameter; pH 4.3; gradual smooth boundary.
IICg	37 to 49 inches +, light olive-brown (2.5Y 5/4) very shaly loam; many (50 percent of ped surfaces) coarse distinct light olive-gray (5Y 6/2) and common fine distinct yellowish-brown (10YR 5/6) mottles; massive; thin patchy pale olive (5Y 6/3) clay films on stone surfaces; 60 percent shale fragments less than 3 inches in diameter which increases to 90 percent shale at a depth of 45 inches; a stone line with stones up to 6 inches in diameter occurs at 37 inches, pH 4.3.

TABLE 43.—*Physical characteristics of soil profile, site 2, Coshocton silt loam, cultivated*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	30.76	26.99	23.99	15.54	7.82	1.41	46.79	0.13
	43.37	38.06	33.83	21.91	11.03	1.50	43.40	.38
6	26.58	24.36	22.76	19.25	12.71	1.53	42.26	.46
	40.67	37.27	34.82	29.45	19.45	1.69	36.23	.32
10	26.52	24.22	21.47	16.12	13.41	1.60	39.62	.54
	42.43	38.75	34.35	25.79	21.46	1.79	32.45	.77
24	18.53	17.71	16.61	15.07	11.33	1.78	32.83	.00
	32.98	31.52	29.57	26.82	20.17	1.87	29.43	.04
37	15.87	15.06	14.42	13.55	10.96	1.80	32.08	.00
	28.57	27.11	25.96	24.39	19.73	1.88	29.06	.06
49	14.04	12.94	12.23	11.27	7.48	1.79	32.45	----
	25.13	23.16	21.89	20.17	13.39	----	-----	----

[1] For explanation of format, see p. 112.

TABLE 44.—*Particle size distribution and chemical characteristics of soil profile, site 2, Coshocton silt loam, cultivated*[1]

Size and characteristic	Horizon and depth (inches): Ap 0–6	B21t 6–10	IIB22g 10–24	IIB23 24–37	IIC 37–49
Particle size distribution:					
Sand (millimeters):					
Very fine, 0.05–0.1 ... percent	5.5	7.8	17.2	17.1	20.0
Fine, .1–.25 ... do	2.3	1.7	3.7	5.2	5.5
Medium, .25–.5 ... do	1.1	.6	.6	1.3	1.2
Coarse, .5–1 ... do	1.6	.8	1.3	2.4	1.7
Very coarse, 1–2 ... do	1.6	.4	.8	1.4	.9
Total sand, .05–2 ... do	12.1	11.3	23.6	27.4	29.3
Silt (microns):					
Fine, 2–20 ... percent	47.2	37.7	28.2	29.7	31.0
Coarse, 20–50 ... do	25.6	25.3	20.9	16.1	16.3
Total silt, 2–50 ... do	72.8	63.0	49.1	45.8	47.3
Clay (microns):					
Fine, <.2 ... percent	2.5	7.0	8.7	7.5	5.4
Coarse, .2–2 ... do	12.6	18.7	18.6	19.3	18.0
Total clay, <2 ... do	15.1	25.7	27.3	26.8	23.4
Textural class	sil	sil	cl	l	l
pH	6.4	6.8	4.5	4.3	4.3
Organic carbon ... percent	1.3	.3	.2	.2	—
Exchangeable cations:					
H ... milliequivalents per 100 grams	3.6	5.0	11.6	11.0	6.9
Ca ... do	11.4	9.2	2.6	1.0	1.4
Mg ... do	.5	.6	1.6	3.5	3.6
K ... do	.14	.17	.19	.17	.17
Total exchangeable cations ... do	15.6	15.0	16.0	15.7	12.1
Total exchangeable bases (Ca, Mg, K) ... do	12.0	10.0	4.4	4.7	5.2
Base saturation[2] percent	77	67	27	30	43

[1] For explanation of table format, see p. 112.

[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Coshocton silt loam,[1] forest, sample 1

Location: 25 ft E. of lane and 35 ft N. of Coshocton silt loam, forest, sample 2, SE¼SW¼NW¼ sec. 5, White Eyes T., N.A.E.W., Coshocton County

Vegetation and land use: Forest; red and white oak

Topography: Rolling upland, 23 percent slope (elevation 1,060 ft)

Drainage: Moderately well

Parent material: Gray clay shale

Described and sampled by: G. E. Kelley and G. P. Lawless, April 12, 1965

Horizon	*Description*
01	1½ to ½ inches, deciduous leaf litter.
02	½ to 0 inches, organic material decomposed beyond recognition.
A1	0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate fine granular structure; friable; many roots; 2 percent shale fragments; pH 4.2; clear wavy boundary.
A2	3 to 10 inches, yellowish-brown (10YR 5/4) silt loam; fingers of dark grayish-brown (10YR 4/2); weak medium and fine subangular blocky structure; friable; many roots; many small pores; 2 percent shale fragments; pH 4.2; clear smooth boundary.
B1	10 to 15 inches, yellowish-brown (10YR 5/4) heavy silt loam; weak fine and medium subangular blocky structure; friable; many roots; many pores in ped interiors; thin very patchy light yellowish-brown (10YR 6/4) clay films; 5 percent shale fragments; pH 4.3; clear smooth boundary.
IIB21t	15 to 21 inches, yellowish-brown (10YR 5/6) shaly silty clay loam; moderate medium subangular blocky structure; friable; common roots; thin patchy light yellowish-brown (10YR 6/4) clay films; 15 percent shale and sandstone fragments less than 8 inches in diameter; pH 4.5; clear smooth boundary.
IIB22gt	21 to 27 inches, yellowish-brown (10YR 5/6) shaly silty clay loam; many (50 percent of ped surfaces) coarse prominent light brownish-gray (2.5Y 6/2) and common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium angular and subangular blocky structures; firm; common roots; thin patchy light yellowish-brown (10YR 6/4) clay films; 15 percent shale and sandstone fragments less than 3 inches in diameter; pH 4.5; clear smooth boundary.
IIB23gt	27 to 40 inches, strong brown (7.5YR 5/6) shaly silty clay loam; many (50 percent of ped surfaces) coarse prominent gray (5Y 6/1) mottles; moderate medium angular and subangular blocky structure; firm; few roots; thin patchy light yellowish-brown (10YR 6/4) clay films; 15 percent shale and sandstone fragments less than 3 inches in diameter; pH 4.4; gradual boundary.
IIIB3t	40 to 52 inches, dark grayish-brown (10YR 4/2) shaly silty clay loam; few fine distinct yellowish-brown (10YR 5/6) and light brownish-gray (10YR 6/2) mottles; weak thick platy structure parting to weak fine angular and subangular blocky structure; very firm; few roots; thin patchy light yellowish-brown (10YR 6/4) clay films; 20 percent shale and sandstone fragments less than 3 inches in diameter; pH 4.3; abrupt smooth boundary.
IVCg	52 to 72 inches +, light gray (N 7/0) heavy silty clay loam; common medium prominent red (2.5YR 5/8) and few fine distinct brownish-yellow (10YR 6/8) mottles; massive; few slickensides; faces of slickensides are brown (10YR 5/3) grading to light brownish-gray (2.5Y 6/2) below 62 inches; few roots; 10 percent shale fragments less than 3 inches in diameter; pH 4.0.

[1] Base saturation in the 52- to 72-inch depth is slightly higher than most Coshocton soils.

TABLE 45.—*Physical characteristics of soil profile, site 1, Coshocton silt loam, forest*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	46.11	39.86	37.12	31.92	13.16	0.79	70.19	----
	36.43	31.49	29.32	25.22	10.40	----	-----	----
3	26.31	24.87	22.55	21.13	7.90	1.57	40.75	0.75
	41.31	39.05	35.40	33.17	12.40	1.62	38.87	.71
10	23.74	22.56	21.61	19.92	10.89	1.46	44.91	.45
	34.66	32.94	31.55	29.08	15.90	1.59	40.00	.18
15	25.72	23.72	22.83	21.61	15.21	1.52	42.64	.54
	39.09	36.05	34.70	32.85	23.12	1.67	36.98	.42
21	24.89	23.57	21.49	18.38	15.01	1.61	39.25	.74
	40.07	37.95	34.60	29.59	24.17	1.76	33.58	.28
27	24.19	23.30	20.35	20.20	14.67	1.58	40.38	.17
	38.22	36.81	32.15	31.92	23.18	1.75	33.96	.07
40	21.50	20.96	18.27	16.09	12.87	1.67	36.98	.06
	35.90	35.00	30.51	26.87	21.49	1.76	33.58	.14
52	20.54	18.95	15.46	13.52	11.57	1.50	43.40	----
	30.81	28.42	23.19	20.28	17.36	----	-----	----

[1] For explanation of format, see p. 112.

TABLE 46.—*Particle size distribution and chemical characteristics of soil profile, site 1, Coshocton silt loam, forest*[1]

Size and Characteristic		Horizon and depth (inches)							
		A1 0-3	A2 3-10	B1 10-15	IIB21t 15-21	IIB22g 21-27	IIB23g 27-40	IIIB3 40-52	IVCg 52-72
Particle size distribution:									
Sand (millimeters):									
Very fine, 0.05-0.1	percent	9.9	9.2	7.0	7.0	9.1	13.1	9.2	14.6
Fine, .1-.25	do	3.0	2.6	2.0	1.9	2.2	3.2	2.0	1.8
Medium, .25-.5	do	.9	.9	.7	.6	.5	.7	.7	.1
Coarse, .5-1	do	1.8	1.6	1.3	1.2	1.0	1.3	1.4	.1
Very coarse, 1-2	do	1.7	1.8	1.2	1.1	.8	1.0	.7	.0
Total sand, .05-2	do	17.3	16.1	12.2	11.8	13.6	19.3	14.0	16.6
Silt (microns):									
Fine, 2-20	percent	43.7	46.8	44.7	37.8	34.8	31.1	38.1	27.7
Coarse, 20-50	do	22.7	21.1	17.3	16.3	17.4	19.2	19.9	16.4
Total silt, 2-50	do	66.4	67.9	62.0	54.1	52.2	50.3	58.0	44.1
Clay (microns):									
Fine, <.2	percent	3.1	2.9	8.5	13.3	12.9	11.8	8.1	12.2
Coarse, .2-2	do	13.2	13.1	17.3	20.8	21.3	18.6	19.9	27.1
Total clay, <2	do	16.3	16.0	25.8	34.1	34.2	30.4	28.0	39.3
Textural class		sil	sil	sil	sicl	sicl	sicl	sicl	sicl
pH		4.2	4.2	4.3	4.5	4.5	4.4	4.3	4.0
Organic carbon	percent	3.5	1.0	.4	.3	.2	.2	.5	.1
Exchangeable cations:									
H	milliequivalents per 100 grams	15.3	9.4	11.9	13.0	11.4	11.4	11.7	3.5
Ca	do	.7	.2	.2	.3	.2	.3	.3	.7
Mg	do	.6	.4	.4	2.2	2.7	3.5	4.6	6.7
K	do	.26	.14	.24	.28	.22	.24	.19	.17
Total exchangeable cations	do	16.9	10.1	12.7	15.8	14.5	15.4	16.8	11.1
Total exchangeable bases (Ca, Mg, K)	do	1.6	.7	.8	2.8	3.1	4.0	5.1	7.6
Base saturation[2]	percent	9	7	7	18	21	26	30	68

[1] For explanation of table format, see p. 112.

[2] Base saturation = total exchangeable base ÷ total exchangeable cations.

Coshocton silt loam,[1] forest, sample 2

Location: 30 ft E. of lane and 10 ft N. of watershed 132 boundary, SE¼SW¼NW¼ sec. 5, White Eyes T., N.A.E.W., Coshocton County

Vegetation and land use: Forest; red and white oak

Topography: Rolling upland, middle slope, 22 percent (elevation 1,060 ft)

Drainage: Moderately well

Parent material: Gray clay shale

Described and sampled by: G. E. Kelley and G. P. Lawless, April 12, 1965

Horizon	*Description*
01	1½ to ½ inch, deciduous leaf litter.
02	½ to 0 inch, organic material decomposed beyond recognition
A1	0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam; moderate fine granular structure; friable; many roots; 2 percent shale fragments; pH 4.0; clear wavy boundary.
A2	2 to 9 inches, yellowish-brown (10YR 5/4) silt loam; weak fine and medium subangular blocky structure; friable; many roots; many small pores; 2 percent shale fragments; pH 4.2; clear smooth boundary.
B1	9 to 15 inches, yellowish-brown (10YR 5/6) silty clay loam; weak fine and medium subangular blocky structure; friable; common roots; many pores in ped interiors; thin very patchy yellowish-brown (10YR 5/4) clay films; 5 percent shale and sandstone fragments less than 6 inches in diameter; pH 4.4; clear smooth boundary.
IIB21t	15 to 22 inches, yellowish-brown (10YR 5/6) heavy silty clay loam; moderate fine and medium subangular blocky structure; friable; common roots; thin patchy light yellowish-brown (10YR 6/4) clay films; 10 percent shale and sandstone fragments less than 6 inches in diameter; pH 4.5; clear smooth boundary.
IIB22t	22 to 30 inches, yellowish-brown (10YR 5/6) shaly clay loam; common medium prominent yellowish-red (5YR 4/8) and light olive-gray (5Y 6/2) mottles; moderate fine and medium subangular and angular blocky structure; firm; common roots; thin patchy light yellowish-brown (10YR 6/4) clay films; 25 percent shale and sandstone fragments less than 3 inches in diameter; pH 4.4; gradual boundary.
IIB23gt	30 to 43 inches, brown (7.5YR 4/4) shaly silty clay loam; many (50 percent of ped surfaces) coarse prominent light olive-gray (5Y 6/2) and common medium distinct strong brown (7.5YR 5/8) mottles; weak coarse subangular and angular blocky structure; firm; few roots; thin patchy light yellowish-brown (10YR 6/4) clay films; 15 percent shale and sandstone fragments less than 3 inches in diameter, pH 4.4; clear smooth boundary.
IIIB3t	43 to 55 inches, brown (10YR 4/3) heavy shaly silt loam; few fine distinct light brownish-gray (10YR 6/2) and yellowish-brown (10YR 5/8) mottles; weak fine and medium angular and subangular blocky structure; firm; few roots; thin very patchy light yellowish-brown (10YR 6/4) clay films; 15 percent shale and sandstone fragments less than 3 inches in diameter; pH 4.4; abrupt smooth boundary.
IVCg	55 to 75 inches +, light gray (N 7/0) clay; common fine distinct brownish-yellow (10YR 6/8) mottles; massive with slickensides; faces of slickensides are brown (10YR 5/3) grading to light brownish-gray (2.5Y 6/2) below 65 inches; few roots; 10 percent shale and sandstone fragments less than 3 inches in diameter; pH 3.9.

[1] Base saturation in the 55- to 75-inch depth is slightly higher than most Coshocton soils.

TABLE 47.—*Physical characteristics of soil profile, site 2, Coshocton silt loam, forest*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	46.15	31.99	30.82	30.70	16.66	0.81	69.43	----
	37.38	25.91	24.96	24.87	13.49	----	-----	----
2	25.00	22.52	21.90	19.89	9.03	1.48	44.15	0.51
	37.00	33.33	32.41	29.44	13.36	1.54	41.89	.11
9	29.84	27.07	23.91	22.28	17.46	1.46	44.91	.07
	43.57	39.52	34.91	32.53	25.49	1.54	41.89	.42
15	24.53	23.13	22.35	20.00	14.98	1.53	42.26	.36
	37.53	35.39	34.20	30.60	22.92	1.70	35.85	.28
22	26.14	25.00	23.82	20.15	14.70	1.59	40.00	.24
	41.56	39.75	37.87	32.04	23.37	1.77	33.21	.00
30	24.37	23.52	20.35	18.00	14.42	1.62	38.87	.00
	39.48	38.10	32.97	29.16	23.36	1.80	32.08	----
43	22.16	20.73	17.59	15.56	12.11	1.66	37.36	.13
	36.79	34.41	29.20	25.83	20.10	1.77	33.21	.04
55	20.73	19.31	18.24	15.77	12.26	1.42	46.42	----
	29.44	27.42	25.90	22.39	17.41	----	-----	----

[1] For explanation of format, see p. 112.

TABLE 48.—*Particle size distribution and chemical characteristics of soil profile, site 2, Coshocton silt loam, forest*[1]

Size and characteristic	Horizon and depth (inches)							
	A1 0–2	A2 2–9	B1 9–15	B21t 15–22	IIB22t 22–30	IIB23g 30–43	IIIB3 43–55	IVCg 55–75
Particle size distribution:								
Sand (millimeters):								
Very fine, 0.05–0.1 .... percent	8.4	7.7	2.8	3.0	11.4	8.8	15.4	5.8
Fine, .1–.25 .... do	2.7	2.1	1.1	1.0	4.1	2.1	3.8	1.0
Medium, .25–.5 .... do	.7	.7	.6	.5	1.3	.8	.6	.1
Coarse, .5–1 .... do	1.4	1.3	.8	1.0	3.2	1.6	.9	.1
Very coarse, 1–2 .... do	1.8	1.4	.2	.6	2.3	1.0	.3	.0
Total sand, .05–2 .... do	15.0	13.2	5.5	6.1	22.3	14.3	21.0	7.0
Silt (microns):								
Fine, 2–20 .... percent	44.9	49.9	46.4	41.0	28.0	34.2	34.0	27.6
Coarse, 20–50 .... do	23.0	19.1	15.4	14.5	17.0	18.3	18.7	8.4
Total silt, 2–50 .... do	67.9	69.0	61.8	55.5	45.0	52.5	52.7	36.0
Clay (microns):								
Fine, <.2 .... percent	4.4	3.3	11.0	16.2	12.5	11.1	7.4	14.0
Coarse, .2–2 .... do	12.7	14.5	21.7	22.2	20.2	22.1	18.9	43.0
Total clay, <2 .... do	17.1	17.8	32.7	38.4	32.7	33.2	26.3	57.0
Textural class	sil	sil	sicl	sic	cl	sicl	sil	c
pH	4.0	4.2	4.4	4.5	4.4	4.4	4.4	3.9
Organic carbon .... percent	4.3	.8	.5	.4	.3	.4	.4	.2
Exchangeable cations:								
H .... milliequivalents per 100 grams	19.4	9.8	13.7	13.8	12.4	12.2	11.0	6.7
Ca .... do	.2	.2	.8	.8	.4	.5	.2	.9
Mg .... do	.6	.4	1.3	2.3	2.6	3.3	3.9	9.4
K .... do	.32	.13	.33	.41	.33	.28	.22	.22
Total exchangeable cations .... do	20.5	10.5	16.1	17.3	15.7	16.3	15.3	17.2
Total exchangeable bases (Ca, Mg, K) .... do	1.1	.7	2.4	3.5	3.3	4.1	4.3	10.5
Base saturation[2] .... percent	5	7	15	20	21	25	28	61

[1] For explanation of table format, see p. 112.

[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Dekalb channery fine sandy loam,[1] cultivated, sample 1

Location: 180 ft E. of T. Rd. 190a and 70 ft W. of top of knoll, SW¼SE¼SE¼ sec. 5, White Eyes T., N.A.E.W., Coshocton County
Vegetation and land use: Cropland (wheat)
Topography: Rolling upland, ridgetop, 10 percent slope (elevation 1,160 ft)
Drainage: Well drained
Parent material: Lower Freeport sandstone
Described and sampled by: G. E. Kelley and G. P. Lawless, March 25, 1965

Horizon	*Description*
Ap	0 to 8 inches, dark-brown (10YR 4/3) channery fine sandy loam; weak fine subangular blocky structure; very friable; many roots; 15 percent sandstone fragments less than 8 inches in diameter; pH 5.9; abrupt smooth boundary.
B21t	8 to 17 inches, yellowish-brown (10YR 5/6) channery fine sandy loam; weak fine and medium subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films on vertical ped surfaces; 15 percent sandstone fragments less than 8 inches in diameter, pH 4.7; clear smooth boundary.
B22t	17 to 29 inches, yellowish-brown (10YR 5/6) channery fine sandy loam, moderate medium subangular blocky structure; friable; common roots; thin very patchy dark-brown (7.5YR 4/4) clay films on vertical and horizontal ped surfaces, 15 percent sandstone fragments less than 8 inches in diameter; pH 4.5; clear wavy boundary.
B23t	29 to 40 inches, mixed yellowish-brown (10YR 5/6) and pale-brown (10YR 6/3) very channery fine sandy loam; weak medium subangular blocky structure; friable; few roots; thin patchy dark-brown (7.5YR 4/4) clay films on vertical and horizontal ped surfaces; 50 percent sandstone fragments less than 8 inches in diameter; pH 4.4; clear wavy boundary.
C	40 to 60 inches +, loose sand and very soft coarse-grained, dark-brown (7.5YR 3/2) sandstone; few roots; thin very patchy dark-brown (7.5YR 4/4) clay films on stone surfaces; pH 4.4.

[1] This profile has fewer stones in the upper layers and more clay films in the subsoil than allowable for the Dekalb Series. It is a common inclusion in the Dekalb mapping units in this area.

TABLE 49.—*Physical characteristics of soil profile, site 1, Dekalb channery fine sandy loam, cultivated*[1]

Depth	Water retained at tension (bars) of					Bulk density	Total pore space	Saturated conductivity
	0.1	0.3	0.6	3	15			
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	23.93	19.99	17.60	16.84	7.91	1.54	41.89	0.28
	36.85	30.78	27.10	25.93	12.18	1.63	38.49	.60
8	20.84	18.50	16.09	15.61	10.36	1.56	41.13	1.10
	32.51	28.86	25.10	24.35	16.16	1.63	38.49	.35
17	22.07	18.39	14.34	13.88	8.35	1.61	39.25	1.82
	35.53	29.61	23.09	22.35	13.44	1.68	36.60	1.00
29	22.16	19.06	13.91	13.61	7.43	1.57	40.75	1.04
	34.79	29.92	21.84	21.37	11.67	1.63	38.49	.69
40	18.59	15.55	14.84	13.38	6.23	1.44	45.66	----
	26.77	22.39	21.37	19.27	8.97	----	-----	----

[1] For explanation of format, see p. 112.

Table 50.—*Particle size distribution and chemical characteristics of soil profile, site 1, Dekalb channery fine sandy loam, cultivated*[1]

Size and characteristic	Horizon and depth (inches)				
	Ap 0–8	B21t 8–17	B22t 17–29	B23t 29–40	C 40–60
Particle size distribution:					
Sand (millimeters):					
Very fine, 0.05–0.1 percent	12.3	13.3	15.0	15.8	16.9
Fine, .1–.25 do	38.5	44.4	51.4	47.1	54.1
Medium, .25–.5 do	3.3	3.9	5.2	4.6	3.8
Coarse, .5–1 do	1.4	.5	.2	.8	1.4
Very coarse, 1–2 do	1.2	.1	.0	.1	.3
Total sand, .05–2 do	56.7	62.2	71.8	68.4	76.5
Silt (microns):					
Fine, 2–20 percent	21.6	16.3	12.1	15.0	9.3
Coarse, 20–50 do	6.5	6.0	4.6	4.6	3.5
Total silt, 2–50 do	28.1	22.3	16.7	19.6	12.8
Clay (microns):					
Fine, <.2 percent	4.1	7.1	5.4	5.7	5.6
Coarse, .2–2 do	11.1	8.4	6.1	6.3	5.1
Total clay, <2 do	15.2	15.5	11.5	12.0	10.7
Textural class	fsl	fsl	fsl	fsl	fsl
pH	5.9	4.7	4.5	4.4	4.4
Organic carbon percent	1.0	.2	.1	.2	----
Exchangeable cations:					
H milliequivalents per 100 grams	4.4	6.0	6.4	7.5	7.2
Ca do	3.4	1.6	.6	1.1	.6
Mg do	2.2	1.2	.7	1.0	1.1
K do	.24	.14	.13	.12	.11
Total exchangeable cations do	10.2	8.9	7.8	9.7	9.0
Total exchangeable bases (Ca, Mg, K) do	5.8	2.9	1.4	2.2	1.8
Base saturation[2] percent	57	33	18	23	20

[1] For explanation of table format, see p. 112.

[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Dekalb channery fine sandy loam,[1] cultivated, sample 2

Location: 180 ft E. of T. Rd. 190a and 15 ft S. of Dekalb channery fine sandy loam, cultivated, sample 1, SW¼SE¼SE¼ sec. 5, White Eyes T., N.A.E.W., Coshocton County

Vegetation and land use: Cropland (wheat)

Topography: Rolling upland, ridgetop, 10 percent slope (elevation 1,160 ft)

Drainage: Well drained

Parent material: Lower Freeport sandstone

Described and sampled by: G. E. Kelley and G. P. Lawless, March 29, 1965

Horizon	*Description*
Ap	0 to 8 inches, dark-brown (10YR 4/3) channery fine sandy loam; weak fine subangular blocky structure; very friable; many roots; 15 percent sandstone fragments less than 8 inches in diameter; pH 5.7; abrupt smooth boundary.
B21t	8 to 17 inches, yellowish-brown (10YR 5/6) channery fine sandy loam; weak medium subangular blocky structure; friable; common roots; thin very patchy dark yellowish-brown (10YR 4/4) clay films; 15 percent sandstone fragments less than 8 inches in diameter; pH 6.0; clear smooth boundary.
B22t	17 to 27 inches, yellowish-brown (10YR 5/6) channery fine sandy loam; with patches of light gray (2.5Y 7/2); moderate medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 15 percent sandstone fragments less than 8 inches in diameter; pH 5.0; clear wavy boundary.
B23t	27 to 35 inches, mixed yellowish-brown (10YR 5/6) and pale brown (10YR 6/3) very channery fine sandy loam; weak medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 50 percent sandstone fragments less than 8 inches in diameter; pH 4.9; clear wavy boundary.
B3	35 to 42 inches, mixed dark-brown (7.5YR 4/4) and strong brown (7.5YR 5/6) channery fine sandy loam; weak coarse subangular blocky structure; friable; few roots; thin patchy dark yellowish-brown (10YR 4/4) clay films on vertical ped surfaces; 45 percent sandstone fragments less than 8 inches in diameter; pH 4.7; gradual smooth boundary.
C	42 to 60 inches +, strong brown (7.5YR 5/6) changing to pale olive (5Y 6/4) below 57 inches, sand and very soft loose-grained sandstone; few roots; pH 4.5.

[1] This profile has less stones in the upper layers and more clay films in the subsoil than allowable for the Dekalb Series. It is a common inclusion in the Dekalb mapping units in this area.

TABLE 51.—*Physical characteristics of soil profile, site 2, Dekalb channery fine sandy loam, cultivated*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	24.81	20.60	16.66	16.66	8.76	1.58	40.38	0.50
	39.20	32.55	26.32	26.32	13.84	1.66	37.36	.42
8	21.98	17.93	15.91	15.13	11.07	1.65	37.74	1.10
	36.27	29.58	26.25	24.96	18.27	1.73	34.72	.96
17	20.29	16.19	12.03	11.88	7.32	1.66	37.36	.95
	33.68	26.88	19.97	19.72	12.15	1.74	34.34	.21
27	20.52	16.47	14.11	11.94	7.98	1.51	43.02	3.31
	30.99	24.87	21.31	18.03	12.05	1.56	41.13	.18
35	19.11	15.83	13.81	12.06	7.18	1.36	48.68	----
	25.99	21.53	18.78	16.40	9.76	----	-----	----
42	23.15	18.53	15.68	13.85	7.33	1.23	53.58	----
	28.47	22.79	19.29	17.04	9.02	----	-----	----

[1] For explanation of format, see p. 112.

TABLE 52.—*Particle size distribution and chemical characteristics of soil profile, site 2, Dekalb channery fine sandy loam, cultivated*[1]

Size and characteristic	Horizon and depth (inches)					
	Ap 0–8	B21t 8–17	B22t 17–27	B23t 27–35	B3 35–42	C 42–60
Particle size distribution:						
Sand (millimeters):						
Very fine, 0.05–0.1 ....percent	12.6	13.8	15.3	15.7	15.2	16.8
Fine, .1–.25 ....do	40.9	47.7	48.9	49.2	52.9	59.1
Medium, .25–.5 ....do	3.9	4.7	3.9	3.9	1.9	1.3
Coarse, .5–1 ....do	1.6	1.1	.6	.8	.9	.3
Very coarse, 1–2 ....do	1.6	.4	.1	.2	.3	.1
Total sand, .05–2 ....do	60.6	67.7	68.8	69.8	71.2	77.6
Silt (microns):						
Fine, 2–20 ....percent	18.8	13.4	12.5	12.2	8.6	6.2
Coarse, 20–50 ....do	5.8	3.8	4.7	3.9	4.7	3.9
Total silt, 2–50 ....do	24.6	17.2	17.2	16.1	13.3	10.1
Clay (microns):						
Fine, <.2 ....percent	3.9	6.6	6.3	7	7.5	6.9
Coarse, .2–2 ....do	10.9	8.5	7.7	7.1	8.0	5.4
Total clay, <2 ....do	14.8	15.1	14.0	14.1	15.5	12.3
Textural class	fsl	fsl	fsl	fsl	fsl	fsl
pH	5.7	6	5	4.9	4.7	4.5
Organic carbon ....percent	1.2	.3	2	2	.1	1
Exchangeable cations:						
H..milliequivalents per 100 grams	3.6	3.4	5.3	5.9	9.3	8
Ca ....do	3.7	2.6	2.3	2.4	2.4	1.2
Mg ....do	2.1	2.4	1.6	1.4	1.7	1.7
K ....do	.41	.14	.13	.13	.14	.14
Total exchangeable cations..do	9.8	8.5	9.3	9.8	13.5	11
Total exchangeable bases (Ca, Mg, K) ....do	6.2	5.1	4	3.9	4.2	3
Base saturation[2] ....percent	63	60	43	40	31	28

[1] For explanation of table format, see p. 112.

[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Dekalb channery sandy loam, forest, sample 1

Location: 265 ft S. of T. Rd. 188b and 120 ft W. of top of hill, SW¼NE¼NW¼ sec. 5, White Eyes T., N.A.E.W., Coshocton County

Vegetation and land use: Woods; red and white oak

Topography: Rolling upland, middle slope, 33 percent slope (elevation 1,225 ft)

Drainage: Well drained

Parent material: Lower Freeport sandstone

Described and sampled by: G. E. Kelley and G. P. Lawless, April 6, 1965

Remarks: This site is the representative profile for the Dekalb series. Description given on pages 24–26.

TABLE 53.—*Physical characteristics of soil profile, site 1, Dekalb channery sandy loam, forest*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	35.52	29.76	22.67	18.01	11.89	0.94	64.53	----
	33.39	27.97	21.31	16.93	11.18	----	-----	----
2	17.62	13.20	12.49	7.45	3.77	1.28	51.70	4.06
	22.55	16.90	15.99	9.54	4.83	1.36	48.68	11.90
6	13.01	9.86	8.82	5.17	2.12	1.73	34.72	----
	22.51	17.06	15.26	8.94	3.67	----	-----	----
14	11.76	10.42	8.79	7.03	2.97	1.77	33.21	1.49
	20.82	18.44	15.56	12.44	5.26	1.86	29.81	.44
24	9.33	7.65	4.99	4.80	2.37	1.74	34.34	.85
	16.23	13.31	8.68	8.35	4.12	1.78	32.83	.81
34	7.79	6.59	3.96	3.55	2.13	1.60	39.62	----
	12.46	10.54	6.34	5.68	3.41	----	-----	----

[1] For explanation of format, see p. 112.

Table 54.—*Particle size distribution and chemical characteristics of soil profile, site 1, Dekalb channery sandy loam, forest*[1]

Size and characteristic	Horizon and depth (inches)					
	A1 0–2	A2 2–6	B1 6–14	B2 14–24	B3 24–34	C 34–65
Particle size distribution:						
Sand (millimeters):						
Very fine, 0.05–0.1 ... percent	7.2	7.1	6.8	5.1	6.5	4.5
Fine, .1–.25 ... do	32	33.9	34.1	20.1	29.1	10.3
Medium, .25–.5 ... do	23.9	24.7	27.2	32.2	25.9	36.6
Coarse, .5–1 ... do	8.7	8.9	9.9	19.8	10.7	31.3
Very coarse, 1–2 ... do	1.8	.9	.7	.4	1.4	.2
Total sand, .05–2 ... do	73.6	75.5	78.7	77.6	73.6	82.9
Silt (microns):						
Fine, 2–20 ... percent	15.1	13	11.1	11	13	9.7
Coarse, 20–50 ... do	3.8	5.3	5.3	2.9	6	2.3
Total silt, 2–50 ... do	18.9	18.3	16.4	13.9	19	12
Clay (microns):						
Fine, <.2 ... percent	1.4	.9	.3	.6	.9	.4
Coarse, .2–2 ... do	6.1	5.3	4.6	7.9	6.5	4.7
Total clay, <2 ... do	7.5	6.2	4.9	8.5	7.4	5.1
Textural class	sl	sl	ls	sl	sl	lcs
pH	4.4	4.5	4.4	4.3	4.3	4.7
Organic carbon ... percent	2.6	.7	.2	.1	.1	.1
Exchangeable cations:						
H ... milliequivalents per 100 grams	12	5.3	1.8	3.2	2.5	1.8
Ca ... do	.4	.1	.1	0	.1	.2
Mg ... do	.3	.3	.2	.2	.2	.3
K ... do	.20	.13	.10	.08	.10	.08
Total exchangeable cations ... do	12.9	5.8	2.2	3.5	2.9	2.4
Total exchangeable bases (Ca, Mg, K) ... do	.9	.5	.4	.3	.4	[illegible]
Base saturation[2] ... percent	7	9	18	8	14	24

[1] For explanation of table format, see p. 112.

[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Dekalb channery sandy loam, forest, sample 2

Location: 295 ft S. of T. Rd. 188b and 120 ft W. of top of hill, SW¼NE¼NW¼ sec. 5, White Eyes T., N.A.E.W., Coshocton County

Vegetation and land use: Woods; oak, hickory, tulip

Topography: Rolling upland, middle slope, 33 percent slope (elevation 1,225 ft)

Drainage: Well drained

Parent material: Lower Freeport sandstone

Described and sampled by: G. E. Kelley and G. P. Lawless, April 6, 1965

Horizon	*Description*
01	2 to 1 inch, deciduous leaf litter.
02	1 to 0 inch, organic material decomposed beyond recognition.
A1	0 to 2 inches, very dark grayish-brown (10YR 3/2) channery sandy loam; moderate fine granular structure; very friable; many roots; 20 percent sandstone fragments less than 8 inches in diameter; pH 4.5; clear smooth boundary.
A2	2 to 7 inches, yellowish-brown (10YR 5/4) channery loamy sand; fingers of dark grayish-brown (10YR 4/2) and streaks of yellowish-brown (10YR 5/6); weak fine and medium subangular blocky structure; very friable; many roots; 15 percent sandstone fragments less than 8 inches in diameter; pH 4.5; clear smooth boundary.
B1	7 to 16 inches, light yellowish-brown (10YR 6/4) channery loamy sand; weak medium and fine subangular blocky structure; friable; many roots; 15 percent sandstone fragments less than 8 inches in diameter; animal hole approximately 4 inches in diameter at a depth of 15 inches; pH 4.4; gradual boundary.
B2	16 to 26 inches, light yellowish-brown (10YR 6/4) channery sandy loam; streaks of yellowish-brown (10YR 5/6); weak medium subangular blocky structure; friable; common roots; thin very patchy pale-brown (10YR 6/3) clay films bridging some sand grains; 25 percent sandstone fragments less than 8 inches in diameter; pH 4.6; gradual boundary.
B3	26 to 38 inches, mixed light yellowish-brown (10YR 6/4) and brownish-yellow (10YR 6/6) very channery sandy loam with pockets of sand; weak coarse subangular blocky structure; friable; common roots; thin very patchy pale-brown (10YR 6/3) clay films bridging some sand grains and on stone surfaces; 60 percent sandstone fragments less than 12 inches in diameter; pH 5.0; diffuse boundary.
R	38 to 60 inches +; fractured and partially disintegrated coarse-grained sandstone; few roots; pH 4.7.

TABLE 55.—*Physical characteristics of soil profile, site 2, Dekalb channery sandy loam, forest*[1]

Depth	Water retained at tension (bars) of					Bulk density	Total pore space	Saturated conductivity
	0.1	0.3	0.6	3	15			
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	33.33	25.56	18.96	15.26	8.82	0.92	65.28	----
	30.66	23.52	17.44	14.04	8.11	----	-----	----
2	14.00	11.33	9.11	5.72	2.47	1.20	54.72	13.91
	16.80	13.60	10.93	6.86	2.96	1.28	51.70	11.10
7	13.85	11.06	8.29	5.55	2.51	1.56	41.13	----
	21.61	17.25	12.93	8.66	3.92	----	-----	----
16	8.90	7.33	6.04	5.55	1.87	1.54	41.89	----
	13.71	11.29	9.30	8.55	2.88	----	-----	----
26	11.00	10.03	8.02	7.34	2.74	1.64	38.11	----
	18.04	16.45	13.15	12.04	4.49	----	-----	----
38	10.94	9.96	8.12	7.48	3.69	1.69	36.23	----
	18.49	16.83	13.72	12.64	6.24	----	-----	----

[1] For explanation of format, see p. 112.

Table 56.—*Particle size distribution and chemical characteristics of soil profile, site 2, Dekalb channery sandy loam, forest*[1]

Size and characteristic	Horizon and depth (inches)					
	A1 0–2	A2 2–7	B1 7–16	B2 16–26	B3 26–38	C 38–60
Particle size distribution:						
Sand (millimeters):						
Very fine, 0.05–0.1 .... percent	7.1	6.6	6.7	5.2	4.8	4.3
Fine, .1–.25 .... do	32.5	32.5	33.0	23.5	17.0	12.7
Medium, .25–.5 .... do	25.7	27.0	28.2	26.2	28.6	35.3
Coarse, .5–1 .... do	8.9	9.4	10.1	17.8	23.0	24.9
Very coarse, 1–2 .... do	.5	1.3	.5	.5	.2	.2
Total sand, .05–2 .... do	74.7	76.8	78.5	73.2	73.6	77.4
Silt (microns):						
Fine, 2–20 .... percent	12.5	12.2	11.6	11.6	11.1	9.9
Coarse, 20–50 .... do	4.9	4.9	4.0	8.1	7.6	5.3
Total silt, 2–50 .... do	17.4	17.1	15.6	19.7	18.7	15.2
Clay (microns):						
Fine, <.2 .... percent	1.6	.9	.5	.6	1.3	.5
Coarse, .2–2 .... do	6.3	5.2	5.4	6.5	6.4	6.9
Total clay, <2 .... do	7.9	6.1	5.9	7.1	7.7	7.4
Textural class	sl	ls	ls	sl	sl	csl
pH	4.5	4.5	4.4	4.6	5.0	4.7
Organic carbon .... percent	2.9	.6	.1	.1	.1	.1
Exchangeable cations:						
H .. milliequivalents per 100 grams	11.7	4.7	2.0	2.3	1.5	2.0
Ca .... do	.7	.1	.0	.2	.5	.3
Mg .... do	.6	.2	.2	.3	.4	.3
K .... do	.28	.17	.05	.10	.09	.06
Total exchangeable cations .. do	13.3	5.2	2.2	2.9	2.5	2.7
Total exchangeable bases (Ca, Mg, K) .... do	1.6	.5	.2	.6	1.0	.7
Base saturation[2] .... percent	12	9	11	21	40	25

[1] For explanation of table format, see p. 112.

[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Dekalb stony fine sandy loam, forest, sample 1

Location: 30 ft W. of farm lane and 100 ft S. of field corner, SW¼NE¼SW¼ sec. 4, White Eyes T., N.A.E.W., Coshocton County

Vegetation and land use: Woods; red and white oak

Topography: Rolling upland, upper slope, 25 percent slope (elevation 1,090 ft)

Drainage: Well drained

Parent material: Coarse-grained sandstone

Described and sampled by: G. E. Kelley and G. P. Lawless, March 24, 1965

Horizon	*Description*
01	2 to 1 inch, deciduous leaf litter.
02	1 to 0 inch, organic material decomposed beyond recognition.
A1	0 to 2 inches, very dark-gray (10YR 3/1) stony fine sandy loam; moderate fine granular structure; very friable; many roots; 50 percent sandstone fragments and sandstones up to 24 inches in diameter; pH 4.2; clear smooth boundary.
A2	2 to 8 inches, brown (10YR 5/3) stony fine sandy loam; weak fine granular structure; very friable; many roots; 50 percent fragments and sandstones up to 24 inches in diameter; pH 4.4; clear smooth boundary.
B2	8 to 20 inches, yellowish-brown (10YR 5/4) stony fine sandy loam; weak fine and medium subangular blocky structure; very friable; common roots; thin very patchy light yellowish-brown (10YR 6/4) clay films on vertical ped surfaces and tops of stones; 70 percent fragments and sandstones up to 24 inches in diameter; pH 4.4; gradual smooth boundary.
B3	20 to 27 inches, yellowish-brown (10YR 5/4) stony loamy fine sand; weak fine subangular blocky structure; very friable; common roots; 80 percent fragments and sandstones up to 24 inches in diameter; pH 4.3; gradual boundary.
C	27 to 40 inches, yellowish-brown (10YR 5/4) stony fine sand; single grain; loose; few roots; 90 percent fragments and sandstones up to 24 inches in diameter; pH 4.5; wavy boundary.
R	40 to 50 inches +; soft coarse-grained sandstones; pale-olive (5Y 6/3) broken rock.

TABLE 57.—*Physical characteristics of soil profile, site 1, Dekalb stony fine sandy loam, forest*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	29.31	29.21	18.79	17.71	7.23	1.15	56.60	----
	33.71	33.59	21.61	20.37	8.31	----	-----	----
2	21.89	18.26	15.93	14.07	4.91	1.44	45.66	----
	31.52	26.29	22.94	20.26	7.07	----	-----	----
8	16.45	9.88	8.66	9.40	2.88	1.63	38.49	----
	26.81	16.10	14.12	15.32	4.69	----	-----	----
20	10.50	8.92	6.79	5.96	2.69	1.60	39.62	----
	16.80	14.27	10.86	9.54	4.30	----	-----	----
27	9.73	6.72	4.21	3.41	2.28	1.63	38.49	----
	15.86	10.95	6.86	5.56	3.72	----	-----	----
40	13.72	11.34	8.49	6.62	3.31	1.60	39.62	----
	21.95	18.14	13.58	10.59	5.30	----	-----	----

[1] For explanation of format, see p. 112.

TABLE 58.—*Particle size distribution and chemical characteristics of soil profile, site 1, Dekalb stony fine sandy loam, forest*[1]

Size and characteristic	A1 0-2	A2 2-8	B2 8-20	B3 20-27	C 27-4[illegible]
	Horizon and depth (inches)				
Particle size distribution:					
Sand (millimeters):					
Very fine, 0.05-0.1 ....percent..	11.9	12.2	12.1	11.4	10.2
Fine, .1-.25 ....do...	38.3	40.6	42.3	60.5	62.5
Medium, .25-.5 ....do..	3.2	3.4	3.8	5.6	8.6
Coarse, .5-1 ....do..	1.1	1.5	1.8	1.7	4.7
Very coarse, 1-2 ....do...	1.6	1.0	1.0	.4	1.7
Total sand, .05-2 ....do..	56.1	58.7	61.0	79.6	87.7
Silt (microns):					
Fine, 2-20 ....percent..	28.4	26.9	23.0	11.5	6.3
Coarse, 20-50 ....do..	9.3	8.0	9.5	4.1	1.9
Total silt, 2-50 ....do..	37.7	34.9	32.5	15.6	8.2
Clay (microns):					
Fine, <.2 ....percent..	1.5	.6	.7	.9	.7
Coarse, .2-2 ....do..	4.7	5.8	5.8	3.9	3.4
Total clay, <2 ....do..	6.2	6.4	6.5	4.8	4.1
Textural class	fsl	fsl	fsl	lfs	fs
pH	4.2	4.4	4.4	4.3	4.5
Organic carbon ....percent..	5.0	1.3	.5	.2	
Exchangeable cations:					
H ....milliequivalents per 100 grams..	17.2	7.5	3.8	2.1	[illegible]
Ca ....do..	1.5	.1	.1	.1	.1
Mg ....do..	.6	.3	.2	.1	[illegible]
K ....do..	.28	.11	.08	.08	.08
Total exchangeable cations ....do..	19.6	8.0	4.2	2.[illegible]	[illegible]
Total exchangeable bases (Ca, Mg, K) ....do..	2.4	[illegible]	.4	[illegible]	[illegible]
Base saturation[2] ....percent..	12	[illegible]	10	[illegible]	[illegible]

[1] For explanation of table format, see p. [illegible]

[2] Base saturation [illegible] total exchangeable bases [illegible] total exchangeable cations.

Dekalb stony fine sandy loam, forest, sample 2

Location: 30 ft W. of farm lane and 100 ft N. of pine plantation, SW¼NE¼SW¼ sec. 4, White Eyes T., N.A.E.W., Coshocton County

Vegetation and land use: Woods; red and white oak

Topography: Rolling upland, ridge top, 11 percent slope (elevation 1,080 ft)

Drainage: Well drained

Parent material: Coarse-grained sandstone

Described and sampled by: G. E. Kelley and G. P. Lawless, March 25, 1965

Horizon	*Description*
01	2 to 1 inch, deciduous leaf litter.
02	1 to 0 inch, organic material decomposed beyond recognition.
A1	0 to 2 inches, very dark-gray (10YR 3/1) stony fine sandy loam; moderate fine granular structure; very friable; many roots; 65 percent fragments and sandstones up to 36 inches in diameter, pH 3.8; clear smooth boundary.
A2	2 to 7 inches, brown (10YR 5/3) stony fine sandy loam; weak fine subangular blocky structure; very friable; many roots; 65 percent fragments and sandstones up to 36 inches in diameter; pH 4.2; clear smooth boundary.
B1	7 to 14 inches, yellowish-brown (10YR 5/4) stony fine sandy loam; weak fine and medium subangular blocky structure; very friable; many roots; 65 percent fragments and sandstones up to 36 inches in diameter; pH 4.3; gradual smooth boundary.
B2	14 to 30 inches, yellowish-brown (10YR 5/4) stony fine sandy loam; weak medium subangular blocky structure; very friable; common roots; dark surface material extends down old root channels to a depth of 20 inches; thin very patchy pale-brown (10YR 6/3) clay films bridging sand grains and on tops of stones; 75 percent fragments and sandstones up to 24 inches in diameter; pH 4.3; gradual smooth boundary.
B3	30 to 35 inches, yellowish-brown (10YR 5/4) stony fine sandy loam; weak medium subangular blocky structure; very friable; common roots; thin very patchy pale-brown (10YR 6/3) clay films bridging sand grains and on tops of stones; 85 percent fragments and sandstones up to 24 inches in diameter, pH 4.2; wavy boundary.
R	35 to 50 inches +; soft coarse-grained sandstone underlain by an intermittent coal blossom; roots extend through the soft sandstone layer.

TABLE 59.—*Physical characteristics of soil profile, site 2, Dekalb stony fine sandy loam, forest*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	30.85	22.72	17.16	15.49	8.17	1.07	59.62	----
	33.01	24.31	18.36	16.57	8.74	----	-----	----
2	18.05	16.21	12.18	9.63	4.39	1.45	45.28	----
	26.17	23.50	17.66	13.96	6.37	----	-----	----
7	15.44	11.62	8.58	7.69	3.20	1.61	39.25	----
	24.86	18.71	13.81	12.38	5.15	----	-----	----
14	10.55	9.42	7.56	7.44	3.06	1.66	37.36	----
	17.51	15.64	12.55	12.35	5.08	----	-----	----
30	10.94	8.43	7.19	6.60	2.82	1.69	36.23	----
	18.49	14.25	12.15	11.15	4.77	----	-----	----
35	5.97	5.64	4.20	3.79	1.90	1.63	38.49	----
	9.73	9.19	6.85	6.18	3.10	----	-----	----

[1] For explanation of format, see p. 112.

TABLE 60.—*Particle size distribution and chemical characteristics of soil profile, site 2, Dekalb stony fine sandy loam, forest*[1]

Size and characteristic	Horizon and depth (inches) A1 0–2	A2 2–7	B1 7–14	B2 14–30	B3 30–35
Particle size distribution:					
Sand (millimeters):					
Very fine, 0.05–0.1 .... percent	4.1	6.3	6.1	6.1	6.0
Fine, .1–.25 .... do	35.9	44.9	44.7	44.9	45.7
Medium, .25–.5 .... do	12.2	10.7	11.3	11.9	13.2
Coarse, .5–1 .... do	9.6	5.6	6.4	6.3	7.3
Very coarse, 1–2 .... do	.4	.9	.8	.8	.6
Total sand, .05–2 .... do	62.2	68.4	69.3	70.0	72.8
Silt (microns):					
Fine, 2–20 .... percent	21.1	16.2	18.2	16.0	15.6
Coarse, 20–50 .... do	9.9	6.9	5.1	6.1	5.4
Total silt, 2–50 .... do	31.0	23.1	23.3	22.1	21.0
Clay (microns):					
Fine, <.2 .... percent	2.0	1.0	1.1	1.4	1.1
Coarse, .2–2 .... do	4.8	7.5	6.3	6.5	5.1
Total clay, <2 .... do	6.8	8.5	7.4	7.9	6.2
Textural class	fsl	fsl	fsl	fsl	fsl
pH	3.8	4.2	4.3	4.3	4 2
Organic carbon .... percent	6.1	1.3	.7	.3	----
Exchangeable cations:					
H ..milliequivalents per 100 grams	20.9	7.3	3.8	2.5	2 6
Ca .... do	1.3	.1	.0	.0	1
Mg .... do	.9	.3	.1	.1	.1
K .... do	.22	10	08	08	.08
Total exchangeable cations ... do	23.3	7.8	4.0	2.7	2.9
Total exchangeable bases (Ca, Mg, K) .... do	2 4	.5	.2	.2	3
Base saturation[2] .... percent	10	6	5	7	10

[1] For explanation of table format, see p. 112

[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Keene silt loam, cultivated, sample 1

Location: 50 ft S. of farm lane and 70 ft W. of lysimeter battery, SE¼SE¼SE¼ sec. 25, Crawford T., N.A.E.W., Coshocton County

Vegetation and land use: Meadow crop

Topography: Rolling upland, ridgetop, 4 percent slope (elevation 1,127 ft)

Drainage: Moderately well

Parent material: Gray clay shale and siltstone

Described and sampled by: G. E. Kelley and G. P. Lawless, March 29, 1965

Remarks: This site is the representative profile for the Keene Series. Description given on pages 27–28.

TABLE 61.—*Physical characteristics of soil profile, site 1, Keene silt loam, cultivated*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	32.90	29.96	28.75	25.90	13.29	1.31	50.57	1.02
	43.10	39.25	37.66	33.93	17.41	1.35	49.06	.94
9	28.41	25.51	24.78	23.52	13.10	1.32	50.19	.29
	37.50	33.67	32.71	31.05	17.29	1.37	48.30	.36
12	27.23	25.40	24.72	22.85	14.99	1.49	43.77	.43
	40.57	37.85	36.83	34.05	22.34	1.58	40.38	.42
15	27.41	27.03	25.19	23.88	16.94	1.41	46.79	1.00
	38.65	38.11	35.52	33.67	23.89	1.54	41.89	.56
20	27.19	24.37	23.23	22.36	17.32	1.55	41.51	.34
	42.14	37.77	36.01	34.66	26.85	1.66	37.36	.11
25	24.52	21.53	19.99	18.62	14.68	1.60	39.62	.04
	39.23	34.45	31.98	29.79	23.49	1.75	33.96	.03
39	21.63	18.77	17.09	14.88	10.56	1.70	35.85	.00
	36.77	31.91	29.05	25.30	17.95	1.84	30.57	----

[1] For explanation of format, see p. 112.

TABLE 62.—*Particle size distribution and chemical characteristics of soil profile, site 1, Keene silt loam, cultivated*[1]

Size and characteristic	Horizon and depth (inches)							
	Ap 0–9	A2 9–12	B1 12–15	B21t 15–20	B22t 20–25	IIB23g 25–39	IIB3g 39–52	IICg 52–6
Particle size distribution:								
Sand (millimeters):								
Very fine, 0.05–0.1 .... percent	2.9	2.3	2.4	2.9	4.5	5.9	11.5	11.8
Fine, .1–.25 .... do	2.2	1.0	1.1	1.2	2.0	1.7	2.4	4.5
Medium, .25–.5 .... do	1.2	.6	.6	.6	.7	.6	.6	.9
Coarse, .5–1 .... do	1.3	.8	.7	.7	.8	.8	1.1	1.6
Very coarse, 1–2 .... do	.6	.2	.2	.2	.3	.7	.7	1.2
Total sand, .05–2 .... do	8.2	4.9	5.0	5.6	8.3	9.7	16.3	20.0
Silt (microns):								
Fine, 2–20 .... percent	54.8	47.2	44.4	39.1	35.0	38.6	34.5	36.2
Coarse, 20–50 .... do	23.9	24.4	24.7	24.5	22.2	13.1	18.2	16.0
Total silt, 2–50 .... do	78.7	71.6	69.1	63.6	57.2	51.7	52.7	52.2
Clay (microns):								
Fine, <.2 .... percent	2.0	7.8	11.1	15.9	14.1	12.8	8.1	7.0
Coarse, .2–2 .... do	11.1	15.7	14.8	14.9	20.4	25.8	22.9	20.8
Total clay, <2 .... do	13.1	23.5	25.9	30.8	34.5	38.6	31.0	27.8
Textural class	sil	sil	sil	sicl	sicl	sicl	sicl	sicl
pH	6.0	5.0	4.8	4.8	4.7	4.5	4.5	5.1
Organic carbon .... percent	1.3	.4	.3	.2	.2	.2	.2	.2
Exchangeable cations:								
H .... milliequivalents per 100 grams	4.7	7.6	10.1	10.5	10.9	10.7	7.5	4.9
Ca .... do	6.0	2.8	3.3	3.5	2.8	2.2	2.2	3.4
Mg .... do	.9	1.4	2.3	3.6	4.0	4.2	4.6	5.4
K .... do	.24	.19	.19	.22	.22	.24	.22	.20
Total exchangeable cations .... do	11.8	12.0	15.9	17.8	17.9	17.3	14.5	13.9
Total exchangeable bases (Ca, Mg, K) .... do	7.1	4.4	5.8	7.3	7.0	6.6	7.0	9.0
Base saturation[2] .... percent	60	37	36	41	39	38	48	65

[1] For explanation of table format, see p. 112.

[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Keene silt loam,[1] cultivated, sample 2

Location: 45 ft N. of farm lane and 10 ft W. of electric pole, SE¼SE¼SE¼ sec. 25, Crawford T., N.A.E.W., Coshocton County

Vegetation and land use: Meadow crop

Topography: Rolling upland, ridgetop, 3 percent slope (elevation 1,131 ft)

Drainage: Moderately well drained

Parent material: Gray clay shale

Described and sampled by: G. E. Kelley and G. P. Lawless, March 29, 1965

[1] This profile contains less gray colors in the upper solum than most Keene soils.

TABLE 63.—*Physical characteristics of soil profile, site 2, Keene silt loam, cultivated*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	35.54	31.49	30.04	27.69	11.18	1.39	47.55	0.26
	49.40	43.77	41.76	38.49	15.54	1.47	44.53	1.11
8	25.22	24.53	23.92	21.73	15.73	1.48	44.15	.49
	37.33	36.30	35.40	32.16	23.28	1.56	41.13	.31
13	25.79	24.27	23.62	21.09	14.28	1.42	46.42	.84
	36.62	34.46	33.54	29.95	20.28	1.51	43.02	.56
19	24.44	22.72	21.38	20.86	15.25	1.56	41.13	.63
	38.13	35.44	33.35	32.54	23.79	1.68	36.60	.51
22	24.29	22.90	22.41	19.37	16.42	1.59	40.00	.14
	38.62	36.41	35.63	30.80	26.11	1.74	34.34	.10
26	23.77	22.67	20.92	20.83	14.09	1.68	36.60	----
	39.93	38.09	35.15	34.99	23.67	----	-----	----
30	19.93	16.83	16.15	14.23	9.91	1.68	36.60	.05
	33.48	28.27	27.13	23.91	16.65	1.88	29.06	.12

[1] For an explanation of format, see p. 112.

Horizon	*Description*
Ap	0 to 8 inches, brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; many roots; 2 percent shale fragments; pH 6.0; abrupt smooth boundary.
B1t	8 to 13 inches, yellowish-brown (10YR 5/6) heavy silt loam; weak fine and medium subangular blocky structure; friable; common roots; thin very patchy yellowish-brown (10YR 5/4) clay films; interiors of peds are very porous; pH 5.5; clear smooth boundary.
B21t	13 to 19 inches, yellowish-brown (10YR 5/6) light silty clay loam; moderate medium subangular blocky structure; friable; common roots; thin patchy yellowish-brown (10YR 5/4) clay films; pH 4.8; clear smooth boundary.
B22t	19 to 22 inches, yellowish-brown (10YR 5/6) light silty clay loam; many (40 percent of ped surfaces) medium distinct pale-brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; common roots; thin patchy light yellowish-brown (10YR 6/4) clay films; 10 percent shale fragments less than 6 inches in diameter; pH 4.6; clear smooth boundary.
IIB23t	22 to 30 inches, yellowish-brown (10YR 5/6) shaly silty clay loam; many (30 percent of ped surfaces) medium distinct pale-brown (10YR 6/3) and few fine and medium prominent strong brown (7.5YR 5/8) and gray (5Y 6/1) mottles; weak medium and coarse prismatic structure parting to moderate medium angular and subangular blocky structure; firm; few roots; moderate patchy light yellowish-brown (10YR 6/4) clay films; 25 percent shale fragments less than 6 inches in diameter; pH 4.4; gradual boundary.
IIB24gt	30 to 43 inches, light olive-gray (5Y 6/2) shaly silty clay loam; common medium faint gray (5Y 6/1) and common fine prominent yellowish-brown (10YR 5/6) mottles; moderate medium angular blocky structure; very firm; few roots; moderate patchy pale-brown (10YR 6/3) clay films; 15 percent shale fragments less than 6 inches in diameter; pH 4.3; gradual boundary.
IIB3gt	43 to 51 inches, light olive-gray (5Y 6/2) shaly silty clay loam; common medium faint gray (5Y 6/1) mottles; weak medium angular and subangular blocky structure; very firm; few roots; thin very patchy pale-brown (10YR 6/3) clay films; many dark concretions; 30 percent shale fragments less than 6 inches in diameter; pH 4.5; gradual boundary.
IICg	51 to 60 inches +, olive-gray (5Y 5/2) shaly silty clay loam; massive; 35 percent shale fragments less than 6 inches in diameter; many dark concretions; pH 4.7.

Table 64.—*Particle size distribution and chemical characteristics of soil profile, site 2, Keene silt loam, cultivated*[1]

Size and characteristic	Horizon and depth (inches)							
	Ap 0–8	B1 8–13	B21t 13–19	B22t 19–22	IIB23t 22–30	IIB24g 30–43	IIB3g 43–51	IICg 51–60
Particle size distribution:								
Sand (millimeters):								
Very fine, 0.05–0.1 ......percent	2.9	3.2	4.6	8.5	7.1	8.5	10.5	10.5
Fine, .1–.25 ......do	2.0	1.2	1.8	2.8	1.7	1.1	1.6	.8
Medium, .25–.5 ......do	1.1	.7	.9	1.2	1.3	.1	.5	.1
Coarse, .5–1 ......do	1.3	1.0	1.3	1.7	2.1	.3	1.0	.2
Very coarse, 1–2 ......do	.7	.4	.9	.8	1.4	.1	.5	.1
Total sand, .05–2 ......do	8.0	6.5	9.5	15.0	13.6	10.1	14.1	11.7
Silt (microns):								
Fine, 2–20 ......percent	53.1	43.0	35.2	32.7	31.8	38.0	36.3	38.8
Coarse, 20–50 ......do	22.8	25.8	26.0	22.9	16.0	17.1	18.3	19.1
Total silt, 2–50 ......do	75.9	68.8	61.2	55.6	47.8	55.1	54.6	57.9
Clay (microns):								
Fine, <.2 ......percent	2.1	7.8	12.4	10.6	14.1	10.4	8.5	8.0
Coarse, .2–2 ......do	14.0	16.9	16.9	18.8	24.5	24.4	22.8	22.4
Total clay <2 ......do	16.1	24.7	29.3	29.4	38.6	34.8	31.3	30.4
Textural class	sil	sil	sicl	sicl	sicl	sicl	sicl	sicl
pH	6.0	5.5	4.8	4.6	4.4	4.3	4.5	4.7
Organic carbon ......percent	1.2	.3	.2	.2	.3	.1	.2	.2
Exchangeable cations:								
H ......milliequivalents per 100 grams	5.2	7.0	10.8	10.4	13.5	9.1	5.3	4.1
Ca ......do	6.9	5.0	3.3	1.7	1.5	1.6	2.3	3.2
Mg ......do	1.1	1.3	2.4	3.1	4.1	4.6	5.4	5.9
K ......do	.28	.17	.20	.17	.24	.22	.24	.22
Total exchangeable cations ......do	13.5	13.5	16.7	15.4	19.3	15.5	13.2	13.4
Total exchangeable bases (Ca, Mg, K) ......do	8.3	6.5	5.9	5.0	5.8	6.4	7.9	9.3
Base saturation[2] ......percent	61	48	35	32	30	41	60	69

[1] For explanation of table format, see p. 112.

[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Rayne silt loam,[1] cultivated, sample 1

Location: 45 ft NE. of fence and 60 ft NW. of Rayne silt loam, cultivated, sample 2, SE¼NW¼NE¼ sec. 5, White Eyes T., N.A.E.W., Coshocton County
Vegetation and land use: Meadow crop
Topography: Rolling upland, middle slope, 10 percent slope (elevation 1,180 ft)
Drainage: Well drained
Parent material: Washingtonville shale
Described and sampled by: H. W. Black, G. E. Kelley, and G. P. Lawless, April 14, 1965

Horizon	*Description*
Ap	0 to 7 inches, dark-brown (10YR 4/3) silt loam; weak fine subangular blocky structure parting to weak fine granular structure; friable; many roots; 2 percent sandy shale fragments up to 3 inches in diameter; pH 5.6; abrupt smooth boundary.
B21t	7 to 15 inches, yellowish-brown (10YR 5/6) shaly loam; moderate medium subangular blocky structure; friable; common roots; thin patchy yellowish-brown (10YR 5/4) clay films; 25 percent sandy shale fragments up to 3 inches in diameter; pH 5.9; clear smooth boundary.
B22t	15 to 26 inches, yellowish-brown (10YR 5/4) shaly loam; weak fine and medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 40 percent sandy shale fragments up to 3 inches in diameter; pH 4.7; gradual boundary.

[1] This soil has a thinner solum and less clay in the subsoil than most Rayne soils.

TABLE 65.—*Physical characteristics of soil profile, site 1, Rayne silt loam, cultivated*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	26.82	23.85	19.72	18.86	8.83	1.42	46.42	1.25
	38.08	33.87	28.00	26.78	12.54	1.50	43.40	2.78
7	23.20	19.62	16.95	16.33	11.34	1.49	43.77	3.35
	34.57	29.23	25.26	24.33	16.90	1.58	40.38	1.73
15	26.27	22.49	18.04	17.27	11.91	1.50	43.40	.26
	39.40	33.73	27.06	25.90	17.86	1.60	39.62	.80
26	24.73	19.00	18.16	17.15	11.00	1.63	38.49	.58
	40.31	30.97	29.60	27.95	17.93	1.74	34.34	.00
34	17.07	15.19	14.68	12.09	7.12	1.52	42.64	----
	25.95	23.09	22.31	18.38	10.82	----	-----	----

[1] For explanation of format, see p. 112.

TABLE 66.—*Particle size distribution and chemical characteristics of soil profile, site 1, Rayne silt loam, cultivated*[1]

Size and characteristic	Horizon and depth (inches) Ap 0–7	B21t 7–15	B22t 15–26	B3t 26–34
Particle size distribution:				
Sand (millimeters):				
Very fine, 0.05–0.1 ------ percent	12.3	23.5	27.3	26.8
Fine, .1–.25 ------ do	6.6	18.0	11.4	9.5
Medium, .25–.5 ------ do	1.5	2.8	2.1	1.8
Coarse, .5–1 ------ do	1.5	1.4	2.3	2.3
Very coarse, 1–2 ------ do	1.3	.5	1.3	.9
Total sand, .05–2 ------ do	23.2	46.2	44.4	41.3
Silt (microns):				
Fine, 2–20 ------ percent	42.0	24.4	23.8	24.8
Coarse, 20–50 ------ do	18.4	11.0	15.0	15.2
Total silt, 2–50 ------ do	60.4	35.4	38.8	40.0
Clay (microns):				
Fine, <.2 ------ percent	2.8	5.6	5.7	6.4
Coarse, .2–2 ------ do	13.6	12.8	11.1	12.3
Total clay, <2 ------ do	16.4	18.4	16.8	18.7
Textural class	sil	l	l	l
pH	5.6	5.9	4.7	4.6
Organic carbon ------ percent	1.3	.8	.2	.2
Exchangeable cations:				
H -- milliequivalents per 100 grams	5.4	4.2	9.8	10.8
Ca ------ do	5.9	5.9	1.7	1.0
Mg ------ do	.5	.4	2.4	2.7
K ------ do	.28	.22	.14	.17
Total exchangeable cations ------ do	12.1	10.7	14.0	14.7
Total exchangeable bases (Ca, Mg, K) ------ do	6.7	6.5	4.2	3.9
Base saturation[2] ------ percent	55	61	30	26

[1] For explanation of table format, see p. 112.
[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

B3t	26 to 34 inches, yellowish-brown (10YR 5/4) very shaly loam; some platiness because of shale weathering in place; parting to weak medium subangular blocky structure; friable; common roots; thin patchy dark-brown (7.5YR 4/4) clay films; 60 percent sandy shale fragments less than 3 inches in diameter; pH 4.6; gradual boundary.
C	34 to 55 inches +, soft shale with thin patchy dark-brown (7.5YR 4/4) clay films on stone faces; some fines and occasional roots extend down cracks; pH 4.8.

Rayne silt loam, cultivated, sample 2

Location: 70 ft NE. of fence and 110 ft W. of electric pole, SE¼NW¼NE¼ sec. 5, White Eyes T., N.A.E.W., Coshocton County
Vegetation and land use: Meadow crop
Topography: Rolling upland, middle slope, 10 percent slope (elevation 1,175 ft)
Drainage: Well drained
Parent material: Washingtonville shale
Described and sampled by: H. W. Black, G. E. Kelley, and G. P. Lawless, April 14, 1965
Remarks: This site is the representative profile for the Rayne Series. Description given on pages 29–31.

TABLE 67.—*Physical characteristics of soil profile, site 2, Rayne silt loam, cultivated*[1]

Depth	Water retained at tension (bars) of 0.1	0.3	0.6	3	15	Bulk density	Total pore space	Saturated conductivity
Inches	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Grams per cubic centimeter*	*Percent*	*Inches per hour*
0	28.51	25.13	19.39	18.02	8.71	1.44	45.66	0.39
	41.05	36.19	27.92	25.95	12.54	1.52	42.64	.62
9	26.29	25.00	22.66	19.67	14.42	1.44	45.66	.20
	37.86	36.00	32.63	28.32	20.76	1.56	41.13	1.30
17	25.39	23.71	20.94	18.01	12.98	1.58	40.38	.62
	40.12	37.46	33.09	28.46	20.51	1.67	36.98	.45
27	22.96	21.66	17.94	15.38	12.00	1.61	39.25	.21
	36.97	34.87	28.88	24.76	19.32	1.72	35.09	.89
40	19.94	18.97	16.07	15.89	9.47	1.43	46.04	
	28.51	27.13	22.98	22.72	13.54			

[1] For explanation of format, see p. 112.

TABLE 68.—*Particle size distribution and chemical characteristics of soil profile, site 2, Rayne silt loam, cultivated*[1]

Size and characteristic	Horizon and depth (inches): Ap 0–7	B21t 7–15	B22t 15–26	B23t 26–34	C [illegible]
Particle size distribution:					
Sand (millimeters):					
Very fine, 0.05–0.1 ... percent	11.4	13.7	22.8	23.5	18.4
Fine, .1–.25 ... do	4.3	5.6	8.6	5.1	2.5
Medium, .25–.5 ... do	.9	1.0	1.4	.8	.7
Coarse, .5–1 ... do	1.2	1.0	1.5	1.6	1.4
Very coarse, 1–2 ... do	.7	.5	.5	.4	.8
Total sand, .05–2 ... do	18.5	21.8	34.8	30.8	25.8
Silt (microns):					
Fine, 2–20 ... percent	41.7	38.3	26.1	28.6	[illegible]
Coarse, 20–50 ... do	23.8	14.4	18.0	21.5	23.1
Total silt, 2–50 ... do	65.5	52.7	44.1	50.1	[illegible]
Clay (microns):					
Fine, <.2 ... percent	2.9	9.7	7.6	5.9	5.2
Coarse, .2–2 ... do	13.1	15.8	13.5	13.2	14.2
Total clay, <2 ... do	16.0	25.5	21.1	19.1	19.4
Textural class	sil	sil	l	sil	sil
pH	6.3	5.7	5.0	4.6	4.7
Organic carbon ... percent	1.0	.4	.2	.2	.2
Exchangeable cations:					
H ... milliequivalents per 100 grams	3.5	6.2	8.3	11.0	11.0
Ca ... do	7.7	6.0	2.5	[illegible]	[illegible]
Mg ... do	.4	1.5	2.8	2.2	2.4
K ... do	.14	.19	.17	.21	.2
Total exchangeable cations ... do	11.7	13.9	13.8	14.3	14.6
Total exchangeable bases (Ca, Mg, K) ... do	8.2	7.7	5.5	3.3	2.6
Base saturation[2] ... percent	70	55	40	23	21

[1] For explanation of table format, see p. 112.
[2] Base saturation = total exchangeable bases ÷ total exchangeable cations.

APPENDIX C

Profiles, particle size distributions, and chemical data for clay mineralogy sites

Appendix C contains data to supplement the clay mineralogy section of this report. Included are descriptions, particle size distributions, and chemical analyses of four of the profiles listed in table 13. Similar information describing the remaining two profiles in table 13 and a brief explanation of the chemical analytical procedures are given in appendix B.

Berks silt loam

Location: 15 ft S. of watershed 129 (South dike), 100 ft E. of fence, NE¼NE¼NW¼ sec. 5, White Eyes T.; ¼ mi W. of N.A.E.W. headquarters buildings

Vegetation and land use: Bluegrass pasture

Topography: Rolling upland, SE. 20 percent slope (elevation 1,240 ft)

Drainage: Well drained

Parent material: Silty shale and siltstone, unnamed strata associated with Lower Freeport sandstone, Allegheny Series, Pennsylvanian System

Described and sampled by: M. F. Bureau and G. E. Kelley, May 15, 1969

Remarks: This site is the representative profile for the Berks Series. Description is given on pages 18–19.

Table 69.—*Particle size distribution and chemical characterization of Berks silt loam*

Size and characteristic	Horizon and depth (inches)			
	Ap 0–5	B21 5–13	B22 13–19	B3 19–24
Particle size distribution				
Sand (millimeters):				
Very fine, 0.05–0.1 percent	9.5	11.3	13.6	12.1
Fine, .1–.25 do	4.7	4.3	5.8	5.2
Medium, .25–.5 do	1.4	.9	1.1	1.3
Coarse, .5–1 do	3.2	2.6	3.4	4.1
Very coarse, 1–2 do	5.0	5.1	4.8	6.3
Total sand, .05–2 do	23.8	24.2	28.7	29.1
Silt (microns):				
Very fine, 2–5 percent	13.6	11.9	11.5	12.7
Fine, 5–20 do	43.7	38.2	37.0	35.2
Coarse, 20–50 do	16.0	16.2	12.4	11.9
Total silt, 2–50 do	59.7	54.4	49.4	47.1
Clay (microns):				
Fine, <.2 percent	2.6	4.8	4.8	5.2
Coarse, .2–2 do	13.9	16.6	17.1	18.6
Total clay, <2 do	16.5	21.4	21.9	23.8
Textural class	sil	sil	l	l
pH	7.2	6.9	5.3	5.4
Organic carbon percent	2.0	.5	.4	.4
Exchangeable cations:				
H milliequivalents per 100 grams	4.5	4.5	8.3	8.9
Ca do	9.1	5.3	2.6	2.3
Mg do	.9	.9	1.6	3.1
K do	.77	.31	.24	.25
Total exchangeable cations do	15.3	11.0	12.7	14.6
Total exchangeable bases (Ca, Mg, K) do	10.8	6.5	4.4	5.7
Base saturation[1] percent	71	59	35	39

[1] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Clarksburg silt loam

Location: 25 ft N. of fence, 225 ft W. of line fence, SE¼NW¼NW¼ sec. 4, White Eyes T., ¼ mi E. of N.A.E.W. headquarters buildings

Vegetation and land use: Orchardgrass pasture

Topography: Rolling upland, site on lower, concave, N. 15 percent slope (elevation 1,010 ft)

Drainage: Moderately well drained

Parent material: Colluvium 4 to 10 ft thick over residual sandstone and shales

Described and sampled by: G. E. Kelley, October 14, 1965

Remarks: This site is the representative profile for the Clarksburg Series. Description is given on pages 20–21.

TABLE 70.—*Particle size distribution and chemical characterization of Clarksburg silt loam*

Size and characteristic	Horizon and depth (inches) Ap 0–8	A&B 8–14	B1t 14–21	B2t 21–28	Bx1t 28–40	Bx2t 40–61
Particle size distribution:						
Sand (millimeters):						
Very fine, 0.05–0.1 ..... percent	9.7	8.9	11.1	12.0	14.5	9.2
Fine, .1–.25 ..... do	6.0	6.7	8.7	9.6	11.1	4.9
Medium, .25–.5 ..... do	1.7	2.0	2.4	2.5	2.3	1.2
Coarse, .5–1 ..... do	2.7	3.3	4.8	4.5	3.5	2.5
Very coarse, 1–2 ..... do	1.9	3.2	4.0	3.5	2.7	2.0
Total sand, .05–2 ..... do	22.0	24.1	31.0	32.1	34.1	19.8
Silt (microns):						
Very fine, 2–5 ..... percent	14.5	11.8	8.3	8.2	8.9	12.7
Fine, 2–20 ..... do	45.4	40.8	31.2	28.1	27.4	40.0
Coarse, 20–50 ..... do	14.5	14.5	17.0	15.3	14.5	13.1
Total silt, 2–50 ..... do	59.9	55.3	48.2	43.4	41.9	53.1
Clay (microns):						
Fine, <.2 ..... percent	1.3	3.1	4.7	8.7	7.5	7.3
Coarse, .2–2 ..... do	16.8	17.5	16.1	15.8	16.5	19.8
Total clay, <2 ..... do	18.1	20.6	20.8	24.5	24.0	27.1
Textural class	sil	sil	l	l	l	sicl
pH	6.6	6.7	5.9	5.1	5.1	6.1
Organic carbon ..... percent	1.7	.6	.4	.3	.2	.2
Exchangeable cations:						
H..milliequivalents per 100 grams	6.7	4.6	5.5	7.3	6.9	3.1
Ca	6.9	4.1	3.7	3.5	3.0	5.7
Mg ..... do	2.1	1.6	2.0	3.0	3.1	5.4
K ..... do	.21	.16	.18	.25	.22	.21
Total exchangeable cations ..... do	15.9	10.5	11.4	14.0	13.2	14.4
Total exchangeable bases (Ca, Mg, K) ..... do	9.2	5.9	5.9	6.7	6.3	11.3
Base saturation[1] ..... percent	58	56	52	48	48	78

[1] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Dekalb fine sandy loam

Location: 75 yds S. of road, 26 yds NE. of watershed 131 instrument shelter, SE¼NW¼NW¼ sec. 5, White Eyes T.; 800 yds W. of N.A.E.W. headquarters buildings

Vegetation and land use: Forest; white and chestnut oak, hickory, cherry, and beech

Topography: Very steep upland, W. 37 percent slope (elevation 1,240 ft)

Drainage: Well to excessively well drained

Parent material: Sandy colluvium weathered from moderately indurated coarse-grained gray sandstone high in white mica; sandstone member of upper Allegheny Series, Pennsylvanian System

Described and sampled by: N. Holowaychuk and N. Reeder, February 15, 1957

Horizon	*Description*
01	2 to 0 inches; leaf litter—mainly oak leaves.
A1	0 to 3 inches; very dark grayish-brown (10YR 3/2) fine sandy loam; fine granular structure; friable when moist, soft and loose when dry; high in organic matter; many roots as a mat near the surface; clear smooth boundary.
A21	3 to 10 inches; yellowish-brown (10YR 5/6) fine sandy loam; some very faint light yellowish-brown (10YR 6/4) intermingling; very weak fine subangular blocky structure; friable; many roots; gradual boundary. (This horizon appears to have somewhat stronger chroma than solum below.)
A22	10 to 16 inches; light yellowish-brown (10YR 6/4) loamy fine sand; some yellowish-brown (10YR 5/6) intermingling; very weak fine subangular blocky structure; loose; common roots; gradual boundary.
B2	16 to 27 inches; light yellowish-brown (10YR 6/4) very channery loamy fine sand; weak fine subangular blocky structure; slightly firm, slightly hard when dry (this horizon shows somewhat more coherence than the A2 horizons above and the C horizon below); few roots; very patchy thin clay films bridging sand grains; 50 percent gray, somewhat horizontally oriented sandstone channery and flaggy fragments (these fragments show more yellowish-brown staining than those of the C horizon); gradual boundary.
C	27 to 42 inches; pale-brown (10YR 6/3) loamy sand; structureless, single grain; very patchy thin clay films bridging sand grains; irregular boundary. (The C horizon occurs as matrix or pocket filling between and around the sandstone fragments ranging from pebble to boulder size. The sandstone is light olive-gray (5Y 6/2) with very fine olive or yellowish-brown stains. It is coarse textured, crumbles readily, and contains considerable white mica as fine flakes.)

TABLE 71.—*Particle size distribution and chemical characterization of Dekalb fine sandy loam*

Size and characteristic	Horizon and depth (inches)						
	A1 0–3	A21 3–6	A21 6–10	A22 10–16	B2 16–21	B2 21–27	C 27–42
Particle size distribution:							
Sand (millimeters):							
Very fine, 0.05–0.1 ... percent	8.0	8.6	8.1	8.1	7.5	8.3	4.8
Fine, .1–.25 ... do	27.6	31.6	32.2	31.0	30.7	28.4	17.2
Medium, .25–.5 ... do	24.1	25.8	26.9	28.4	28.1	31.0	35.6
Coarse, .5–1 ... do	5.1	6.4	7.1	8.5	9.4	10.4	16.8
Very coarse, 1–2 ... do	1.7	1.6	2.0	2.2	1.8	2.0	3.2
Total sand, .05–2 ... do	66.5	74.0	76.3	78.2	77.5	80.1	77.6
Silt, total, 2–50 (microns) ... percent	25.8	18.0	17.2	15.6	15.7	13.4	16.6
Clay, total, <2 (microns) ... percent	7.7	8.0	6.5	6.2	6.8	6.5	5.8
Fine, <.2 (microns) ... do	.7	1.1	1.2	1.0	1.3	1.1	1.0
Fragments >2 (millimeters) ... percent	12.7	25.2	26.1	24.9	26.3	40.0	33.9
Textural class	fsl	fsl	fsl	lfs	lfs	ls	ls
pH	4.8	4.5	4.6	4.5	4.5	4.9	4.7
Organic matter ... percent	8.1	1.9	1.0	.3	.0	.0	.1
Exchangeable cations:							
H ... milliequivalents per 100 grams	15.4	7.0	4.4	3.4	3.0	1.8	2.6
Ca ... do	4.8	.3	.3	.3	.3	.7	.3
Mg ... do	.7	.0	.0	.0	.0	.1	.1
K ... do	.040	.005	.004	.005	.002	.004	.004
Total exchangeable cations ... do	21.3	7.4	4.7	3.8	3.3	2.6	3.0
Total exchangeable bases (Ca, Mg, K) ... do	5.9	.4	.3	.4	.3	.8	.4
Base saturation[1] ... percent	28	5	6	11	9	31	13

[1] Base saturation = total exchangeable bases ÷ total exchangeable cations.

Keene silt loam

Location: 35 yds W. of lysimeter Y-103A in the center of SW¼SW¼ sec. 24, Crawford T., ¼ mi NE. of N.A.E.W. headquarters buildings

Vegetation and land use: Red clover and grass meadow

Topography: Rolling, site on SW. 5 to 6 percent slope (elevation 1,130 ft)

Drainage: Moderately well drained

Parent material: Shallow (23 inches) silt mantle over shale and some thin sandstone lenses, occurring between Middle and Lower Kittanning coal, Allegheny Series, Pennsylvanian System

Described and sampled by: N. Holowaychuk, R. Meeker, and Don Urban, September 24, 1958

Horizon	*Description*
Ap	0 to 7 inches, dark grayish-brown (10YR 4/2); silt loam; weak to moderate fine granular structure; friable; common roots; pH 6.2; abrupt boundary.
A2	Brown (10YR 5/3) silt loam; weak very fine subangular blocky structure; friable; common roots; occurs as occasional patchy remnants up to 1 inch thick; clear boundary between A2 and A3.
A3	7 to 9 inches, yellowish-brown (10YR 5/4) silt loam; weak medium subangular blocky parting to very fine subangular blocky structure; friable; common roots; pH 5.2; clear boundary.
B1t	9 to 14 inches; dark yellowish-brown (10YR 4/4) silty clay with faint brown surfaces; weak to moderate fine subangular blocky structure; friable; common roots; thin discontinuous clay films in ped interiors; pH 4.9; gradual boundary.
B21t	14 to 21 inches; dark-brown (7.5YR 4/4) silty clay loam with brown (10YR 5/3) ped surfaces (the latter color is more noticeable in the lower 2 inches); moderate fine and medium subangular blocky structure; friable; common roots; thin discontinuous clay films; pH 4.9; clear boundary.

TABLE 72.—*Particle size distribution and*

Size and characteristic	Horizon and depth (inches)				
	Ap 0–7	A3 7–9	B1t 9–14	B21t 14–18	B21t 18–21
Particle size distribution:					
Sand (millimeters):					
Very fine, 0.05–0.1 percent	2.0	1.2	1.9	2.1	2.6
Fine, .1–.25 do	1.2	.7	1.0	1.1	1.1
Medium, .25–.5 do	1.0	.4	.4	.4	.8
Coarse, .5–1 do	1.1	.8	.8	1.1	1.3
Very coarse, 1–2 do	.6	.2	.2	.5	.4
Total sand, .05–2 do	5.9	3.3	4.3	5.2	6.2
Silt, total, 2–50 (microns) percent	77.8	71.7	66.2	62.5	62.8
Clay, total, <2 (microns) percent	16.3	25.0	29.5	32.3	31.0
Fine, <.2 (microns) do	3.1	8.1	12.5	15.5	15.9
Textural class	sil	sil	sic	sicl	sicl
pH	6.3	5.1	5.0	4.8	4.6
Organic matter percent	2.2	.4	.4	.1	.1
Exchangeable cations:					
H milliequivalents per 100 grams	5.2	7.3	8.6	9.8	10.1
Ca do	6.2	4.3	4.3	4.0	3.2
Mg do	.9	1.6	2.7	4.0	4.7
K do	.36	.21	.22	.25	.27
Total exchangeable cations do	12.7	13.4	15.8	18.1	18.3
Total exchangeable bases (Ca, Mg, K) do	7.5	6.1	7.2	8.3	8.2
Base saturation[1] percent	59	46	46	46	45

[1] Base saturation = total exchangeable bases ÷ total exchangeable cations.

B22t — 21 to 23 inches; yellowish-brown (10YR 5/4) silty clay loam with pale-brown (10YR 6/3) and light brownish-gray (10YR 6/2) mottles; moderate fine subangular blocky structure; friable; few roots; thin discontinuous clay films; pH 4.8; clear to abrupt boundary.

IIB23tg — 23 to 27 inches; dark yellowish-brown (10YR 4/4) silty clay; many fine distinct brown (10YR 5/3) mottles and light yellowish-brown (2.5Y 6/4) and light-gray (5Y 6/1) ped surfaces; weak fine and medium prismatic structure parting to weak medium subangular blocky structure; firm; few roots; thin discontinuous clay films; pH 4.7; gradual boundary.

IIB24tg — 27 to 39 inches; yellowish-brown (10YR 5/4, 5/6) silty clay; large distinct light brownish-gray (2.5Y 6/2), light-gray (2.5Y 7/2), and light yellowish-brown (2.5Y 6/4) mottles; (the prism faces are mainly light gray (2.5Y 7/2), and the angular peds are coated light brownish gray, light gray, and light yellowish-brown similar to the mottling of the ped interiors); weak medium prismatic structure parting to weak coarse angular blocky structure; peds very firm, dense, and massive in interiors [illegible] films on ped faces; 10 15 percent [illegible] of hard gray sandstone. pH 4.9; clear [illegible]

IIB31t — 39 to 42 inches; bands of yellowish-red [illegible] nous soil intermingled with light olive-br[illegible] silty clay loam; weak subangular blocky [illegible] few roots; occasional thin discontinuous clay films.

IIB32t — 42 to 51 inches; grayish-brown (2.5Y 5/2) silty cla[illegible] common distinct light yellowish-brown (2.5Y 6/4) [illegible] in interiors; weak very thick platy structure, firm [illegible] roots; some thin clay flows along horizontal faces.

IIC1 — 51 to 59 inches; auger sample. Silty clay loam mottled with an intermingling of yellowish brown (10YR [illegible]) and grayish brown (10YR 5/2); fragments of olive-brown sandstone present.

IIC2 — 59 to 75 inches; auger sample. Clay loam mottled with an intermingling of gray (10YR 5/1) and yellowish brown (10YR 5/6); small fragments of sandstone common; penetration by auger beyond 75 inches not possible because of either a large sandstone fragment or sandstone ledge.

chemical characterization of Keene silt loam

Horizon and depth (inches)—Continued								
B22t 21–23	IIB23tg 23–27	IIB24tg 27–33	IIB24tg 33–39	IIB31t 39–42	IIB32t 42–51	IIC1 51–59	IIC2 59–66	IIC[illegible] 66–75
2.0	4.5	4.9	5.6	11.5	6.4	8.6	7.4	13.5
1.7	1.8	1.5	.4	4.3	1.4	2.0	2.5	4.6
1.5	.7	.3	.3	1.2	.5	.5	1.1	1.8
1.3	.8	.7	.3	3.8	1.1	2.0	2.7	3.6
.6	.5	.3	.2	4.9	1.5	1.6	2.5	3.4
7.1	8.3	7.7	6.8	25.7	10.9	14.7	16.2	26.9
60.3	50.9	50.3	50.8	43.8	53.7	56.0	51.8	46.6
32.6	40.8	42.0	42.4	30.5	35.4	29.3	32.0	26.5
18.0	19.5	13.2	12.6	8.4	9.3	6.8	7.8	7.2
sicl	sic	sic	sic	sicl	sicl	sicl	sicl	cl
4.6	4.5	4.3	4.4	4.5	4.4	4.7	4.8	5.0
.1	----------	----------	----------	----------	----------	----------	----------	
12.6	13.3	8.7	7.0	6.4	5.5	5.8	4.8	4.7
2.8	2.6	2.1	2.3	2.1	2.7	3.2	3.3	2.0
5.5	6.3	5.4	5.6	4.9	6.4	6.5	6.6	5.2
.34	.34	.28	.27	.22	.21	.23	.23	.20
21.2	22.5	16.5	15.2	13.6	14.8	15.7	14.9	13.1
8.6	9.2	7.8	8.2	7.2	9.3	9.9	10.1	8.4
41	41	47	54	53	63	63	68	64

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