SOIL SURVEY OF BERKS COUNTY, PENNSYLVANIA.

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DESCRIPTION OF THE AREA.

Berks County is located in the southeastern part of Pennsylvania, and comprises an area of 586,240 acres, or 916 square miles. It is diamond shape, with its longer dimension extending east and west. The northeast Lehigh boundary, 26 miles long, and the southwest

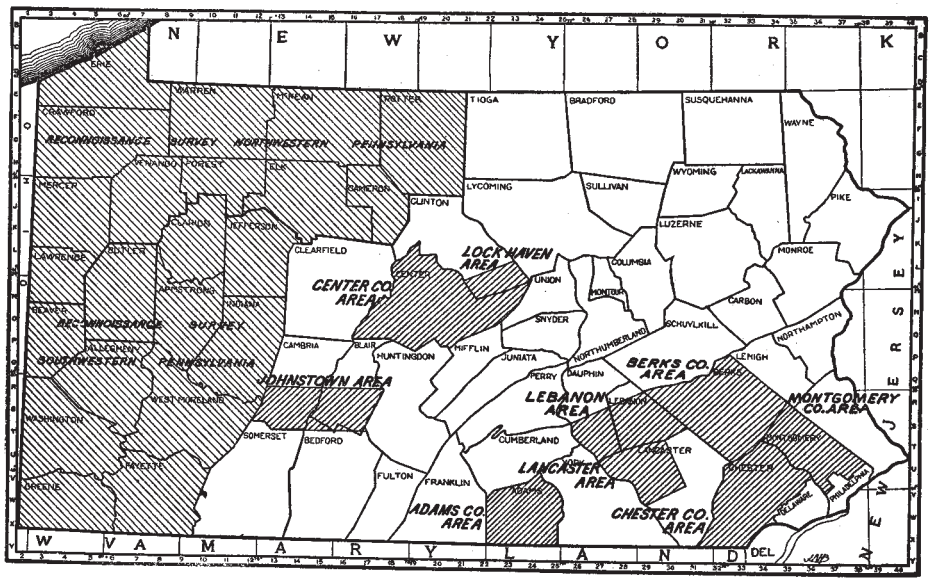

FIG. 4.—Sketch map showing location of the Berks County area, Pennsylvania.

Lebanon-Lancaster boundary, 39 miles long, are parallel lines 28 miles apart. The Montgomery-Chester boundary on the southeast forms nearly a straight line 28 miles in length, while the northwest Schuylkill County border follows the irregular crest of Blue Mountain for 37 miles. The area lies between 40° and 41° north latitude and 75° 30′ and 76° 30′ west longitude.

The topography of the county is variable. The Blue Mountain, which extends along the Schuylkill-Berks boundary line, with its crest everywhere about 1,500 feet above sea level, has slopes which are steep, rocky, and broken. Immediately to the south of this and extending across the entire county spreads out a large valley, which is a part of what is known to geologists as the "Great Valley," and which ranges in width from 12 to 18 miles. This is divided into two belts, one lying along the foot of the mountain has an elevation of from 500 to 800 feet, and in topography is hilly and broken, with rounded hills and U-shaped valleys, presenting a billowy appearance from distant points of view. The other belt lies from 100 to 400 feet lower, is more gently rolling, and forms the richest agricultural section of the area. To the south of the Great Valley are the South Mountains, which also extend across the county from east to west, with the exception of a break of about 10 miles from Reading westward. Through this gateway the valley extends farther south than at other points. The surface of the South Mountains is hilly and broken, and the included valleys are more sharply cut and the hills do not have the rounded appearance so characteristic of the hilly belt of the Great Valley. To the north of Boyertown the South Mountains have a width of about 12 miles and reach an elevation of from 800 to 1,200 feet above sea level. The Oley Valley, which is nearly surrounded by the South Mountains, is similar in topography to the lower portion of the Great Valley. South of the South Mountains on both sides of the Schuylkill the surface is rolling to hilly, with an average elevation of 600 feet.

The drainage systems of the county are well established and the natural drainage of the area is good. The Schuylkill River enters Berks County through a gap in Blue Mountain at Port Clinton, crosses the Great Valley to Reading, thence takes a southeasterly course through the southern part of the survey, passing between Chester and Montgomery counties to Philadelphia, where it empties into the Delaware. The Great Valley is drained from the northeast by Maiden Creek, which enters the Schuylkill about 6 miles above Reading, and from the northwest by the numerous branches of the Tulpehocken Creek, which enters the Schuylkill opposite Reading.

The South Mountains are drained northeastward by the headwaters of the Little Lehigh River, southward by the Manatawny, Monocacy, and other creeks which join the Schuylkill between Reading and Pottstown, and southeastward by the headwaters of the Perkiomen River. The southern part of the county is drained northward through Allegheny and Hay creeks and other small streams entering the Schuylkill below Reading. Owing to the topography

the streams are swift and afford excellent water power, which is employed in nearly all parts of the county.

The first settlement in this region was probably made by Swedes along the Manatawny Creek in Oley Valley, deeds for these lands having been given as early as 1682 by William Penn. This colony was augmented in 1708–1710 by Germans, and in 1813 by a company of Quakers. Among the other early settlers were English, Irish, and Welsh. As a rule the Germans settled in the limestone valleys, and their descendants have always preferred to farm on the limestone soils. People of other nationalities did not seem to feel so strongly in regard to the location of their early homes, and many settled in the hills even before the valley lands were all taken up. At the present time all parts of the county are thickly settled.

Berks County was established in 1752 from parts of Philadelphia, Lancaster, and Chester counties. It originally included one-tenth of the province of Pennsylvania, or five times its present area. Since its first organization 12 counties have been cut from it. The city of Reading was laid out in 1748, and later became the county seat. The first iron furnace in the State was built south of Boyertown in 1720, and the iron industry since that time has been second in importance only to agriculture. In 1851 there were 41 iron works in Berks, a larger number than in any other county in the United States. The rapidity with which ore was taken out greatly reduced the supply in the area, and only a few workable deposits remain. By far the greater part of the ore used in the seven large furnaces now in operation is brought in from other sections of this and other States.

Reading, with a population of about 96,000, is the largest city. It is situated on the Schuylkill River, near the center of the county, and has long been known for its importance in iron manufacturing. There are also factories for the manufacture of automobiles, motor cycles, carriages, paper, paint, brick, cement, and many other articles. Being close to the great Pennsylvania coal fields, the Atlantic seaboard, and near the large centers of population, it has much in its favor as a manufacturing district. It is also an important distributing center for farm implements, seeds, fertilizers, and provisions. Hamburg, Kutztown, Mertztown, Topton, Fleetwood, Leesport, Boyertown, Birdsboro, and Womelsdorf are thriving boroughs within the county. In addition to these there are numerous smaller towns and villages scattered over the county.

The first move in attempting to provide transportation for this section, aside from wagon roads, was the building of the Schuylkill Canal. The portion between Philadelphia and Reading was opened in 1824; later it was extended farther north through the county.

This provided direct connection with the Atlantic seaboard and greatly stimulated all industries tributary to it, especially the manufacture of iron and the mining of coal. The first railroad in the county was built between Reading and Pottstown and completed in 1837. In 1839 this line was extended to Philadelphia. Other lines were soon constructed and at present the county is well supplied with railroads. The main line of the Reading parallels the Schuylkill River through the county, as does also the Wilkes-Barre and Philadelphia branch of the Pennsylvania Railroad. The Lebanon Valley branch of the Reading extends from Reading to Harrisburg, and an eastern extension of this line, known as the "East Pennsylvania branch," goes to New York by way of Allentown. The Schuylkill Valley branch extends northward from Reading to Slatington. Another branch runs from Pottstown to Boyertown and north to Barto, in the extreme west end of the county. The Wilmington Northern, which is also a branch of the Reading, runs south from Birdsboro to Wilmington, Del.

The Reading-Allentown Traction Company has an electric line connecting these cities and passing through Temple, Blandon, Fleetwood, Lyons, and Kutztown. The Union Traction line extends from Reading eastward to Boyertown and westward to Womelsdorf. Another electric line runs southward from Reading to Lancaster. The wagon roads throughout the county are kept in excellent condition. The greater proportion of them are graded and crowned with crushed rock. A few toll roads still exist.

Reading affords a good market for large amounts of the farm products of the area. Philadelphia is but 59 miles from Reading, while New York can be reached by fast train in three hours and ten minutes. Being near the large centers of population, there is always a ready market for all the products of the farm.

CLIMATE.

The following table gives the normal monthly and annual temperature and precipitation for this section of Pennsylvania, together with the average date for the last killing frost in the spring and the first in the fall, as observed by the Weather Bureau station at Lebanon, Pa. These records are believed to be fairly representative of the conditions in Berks County.

Normal monthly, seasonal, and annual temperature and precipitation at Lebanon, Lebanon County, Pa.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.
	°F.	°F.	°F.	Inches.	Inches.	Inches.
December	33	68	1	3.6	4.1	2.2
January	28	66	−14	3.5	4.7	4.3
February	29	70	−16	3.6	.9	1.8
Winter	30	.....	.....	10.7	9.7	8.3
March	37	78	−10	3.9	2.5	3.4
April	50	95	17	3.2	5.1	5.5
May	60	96	30	5.2	1.8	5.5
Spring	49	.....	.....	12.3	9.4	14.4
June	70	98	38	3.6	1.9	4.3
July	73	104	43	4.5	2.1	8.7
August	72	103	40	4.5	2.0	3.1
Summer	72	.....	.....	12.6	6.0	16.1
September	65	98	33	3.0	1.3	3.4
October	53	92	22	3.8	2.3	4.5
November	42	76	13	3.5	2.0	10.0
Fall	53	.....	.....	10.3	5.6	17.9
Year	51	104	−16	45.9	30.7	56.7

Average date of first killing frost in autumn, October 25; average date of last killing frost in spring, April 25.

It will be seen from these data that the mean annual temperature is 51° F., that the average rainfall of 45.9 inches is usually well distributed throughout the year, and that there is a period of one hundred and eighty-three days during which there is but little danger from frost.

AGRICULTURE.

The agricultural development of what is now Berks County began the latter part of the seventeenth century, and the first settlement was probably made in the Oley Valley, a region of limestone soils. Among the early settlers who came into this region, the Germans, being in the majority, soon became the dominant factor. They were hard-working, conscientious, economical, industrious people, and their methods of farming, their language, and their conservative ideas became characteristic features of this section and influenced to a great extent the policy of public institutions. This is true not

only in Berks County, but throughout southeastern Pennsylvania, where the same conditions of early settlement and subsequent development prevailed.

In the selection of farms and the location of their first homes it may be said that the Germans confined themselves almost entirely to the limestone valleys as long as land could be secured there, and these original holdings of the pioneer settlers were handed down from father to son. Records available now show that a large proportion of these farms are in the possession of the descendants of the original owners. They have always recognized the superiority of the limestone soils, and the development of the valleys was therefore the most rapid. The rougher portions of the area were settled more slowly, but at present all parts of the county are quite thickly populated. The section most recently developed is the shale belt of the northern part of the survey, though even there many farms were opened long before the civil war.

Changes which have taken place in agricultural practices have been brought about slowly, but with the result that conditions were ultimately improved. Formerly a relatively larger amount of wheat was grown, and at a profit, until the development of the West and the extensive production of wheat on cheap land and at comparatively small cost made competition so keen that the eastern farmer was forced to alter his system and no longer depend on wheat as his main money crop. Decreased yields on lands continually cropped also helped to bring about a change. As the necessity for this reduction in acreage became apparent farm lands depreciated somewhat in value, but as farmers became adjusted to the new order of things conditions improved. The average size of farms decreased, the acreage devoted to wheat on each farm was also slowly reduced, and a system approaching intensive agriculture gradually developed. In the vicinity of Reading and near some of the small towns in the area there are a number of small farms, ranging in size from 5 to 20 acres, upon which the trucking industry has been developed; yet, considering the county as a whole, the general type of agriculture followed at present is more extensive than intensive. The chief crops grown are wheat, corn, oats, grass, and potatoes, while the dairy holds an important place on many of the farms.

Wheat is still an important crop, and while produced to best advantage on Hagerstown loam, Penn loam, Berks silt loam, and Chester stony loam, it is grown to some extent on practically all types of the area. The Chester stony loam is reported to produce a harder kernel than the limestone soils, though the yields are not so large. Fall wheat is grown exclusively.

The acreage devoted to corn exceeds the wheat acreage. Some of the farmers are paying more attention than formerly to the selection

of seed, planting, and cultivation, and as a result they are producing a better quality of corn and securing more satisfactory yields. The greater part of the corn is fed to stock on the farm.

A smaller acreage is given to oats than to corn or wheat, the crop forming the main portion of the grain ration fed to the work stock, and what is not required for feeding is sold. The acreage cut for hay far exceeds that of any other crop, and a considerable amount is sold. While Irish potatoes are grown for home use in all parts of the area, the industry is developed on a commercial scale only in the northern part of the county on the Berks shale loam, which type seems better adapted to potatoes than to any other crop. The principal varieties grown are Prince Henry, Sir Walter Raleigh, Carman No. 3, Dewey, and Vulcan. Rye is grown to a small extent in all parts of the area, and peas, beans, onions, sweet potatoes, and other vegetables are produced in limited quantities. The culture of tobacco is also limited, being confined largely to the southern part of the survey, most of it being grown on Penn loam. A few small fields of alfalfa were seen, but under the treatment given it here it has not proved a success.

The dairy industry is an important branch of agriculture in the county, and while there are comparatively few large dairies, practically every farmer keeps some cows, and many produce more milk and butter than is needed to supply the home. Reading affords an excellent market for all dairy products, and large quantities of milk are shipped in daily over the steam and electric roads which traverse the area. The milk dealers contract for the milk—the price for the first six months being 3½ cents per quart, and for the remainder of the year 4 cents per quart—the dealers paying the freight. There are also a number of creameries scattered about over the area which buy the cream from the farmer, paying according to butter-fat content as determined by the Babcock test. The individual owners or corporations dispose of their product in the markets of the large cities of the East.

The dairy stock throughout the county is composed largely of grade animals. Holstein blood seems to predominate, though there are some grade Jerseys, Shorthorns, and a few other breeds. Some farmers make a practice of fattening a few steers each winter. These are sold mostly to butchers, who slaughter them for the home market. Many of the steers are inferior for beef purposes, often of the dairy type, and the profits in feeding are small. Some hogs are raised on each farm, but specializing has not been practiced. The Chester White breed seems to be favored above others, though there are also some Berkshire, Poland China, and considerable grade stock. Sheep are raised only to a limited extent. Considering the large area of steep hillside land in the county, suitable for nothing but grazing,

it would seem that sheep could be raised profitably on a much larger scale. A few mules and horses are produced, either for local use or for sale.

While portions of the area are well adapted to the production of fruit, the industry has not been developed to any great extent. Apples are grown more largely than any other fruit, and nearly every farm supports a small orchard, which, aside from supplying the home, provides a varying surplus for market. Cider is made and apple butter is a common product of this region. Peaches are grown to a much less extent than apples, though, according to one grower, they are more profitable than any other fruit crop of this section. The commercial apple and peach orchards near Boyertown are worthy of special notice. Paragon, Mammoth Black Twig, Stayman Winesap, Smokehouse, Rambo, Rome Beauty, Grimes Golden, and Baldwin are among the varieties of apples best adapted to this section. The trees are set 25 feet apart each way and cultivated until they are five or six years old, when the orchard is allowed to grass over. Where the hillside is steep the land is terraced and the trees planted on the steep terrace walls, thus leaving a level driving space between the rows. The trees are trimmed low, so as to protect the trunk from sun scald.

Diseases and insect pests are not especially prevalent, but it is necessary to spray the trees in the winter season with a solution of lime and sulphur for the control of the San Jose scale and at least once or twice during the summer with Bordeaux mixture, containing Paris green or some other poison, for the control of the codling moth.

Among the varieties of peaches suited to this section, Greensboro, Carman, Champion, Iron Mountain, Belle of Georgia, Mathews Beauty, and Elberta seem to be the most popular. The trees are set 16 feet apart each way, and for best results cultivation should be practiced throughout the life of the orchard. Pruning and spraying must be thoroughly done each year. The application of commercial fertilizers is highly advisable for two or three years, while the trees are small.

Grapes thrive very well in the area, and are of fine quality and flavor. Niagara, Concord, and Delaware are among the varieties grown. Pears, plums, cherries, bush fruits, and berries are grown only to a limited extent.

The types best adapted to the production of fruit are Chester stony loam, Montalto stony loam, Berks shale loam, and Penn shale loam, and there is no reason why the fruit industry could not be greatly extended in Berks County.

A quite definite system of crop rotation is followed throughout the county. It consists of corn, oats, wheat, and grass. On the heavier soils of the area, and especially in the limestone valleys, some fall

plowing of sod is done for corn. On the lighter, rougher, and shaly soils spring plowing is considered best, since on the steep slopes the soil is apt to wash during the winter and early spring. Corn is usually drilled in so that the stalks stand 10 to 16 inches apart in rows 3½ feet apart. The fields are cultivated four or five times before being "laid by." Cutting is mostly done by hand, though a few harvesters are used, and the husking is done in the field. The following spring the cornfield is plowed for oats. After this crop is gathered the field is prepared for wheat. The next spring clover is seeded in the wheat and the following year the field is cut for hay. Hay may be cut two years or pastured the second, after which the sod is again plowed for corn. When rye is grown it may take the place of or follow wheat in the rotation.

Where potatoes are grown extensively on Berks shale loam a three-year rotation is followed, consisting of grass, potatoes, and wheat. In growing potatoes it is advisable to use commercial fertilizers liberally. A grade rated as 10–8–2 is sometimes applied at the rate of 1,200 pounds per acre, though the average application is considerably smaller. The tubers are planted 12 to 14 inches apart in rows, and the best plan seems to be to cultivate almost constantly. Under favorable conditions very satisfactory yields are obtained, while proper attention in unfavorable years will tend to prevent crop reductions.

A system quite generally followed in the use of fertilizers is to apply the stable manure to the sod before plowing for corn. It is also sometimes applied to corn stubble during the winter, to be plowed under in the spring for oats. Wherever possible it is advisable to haul the manure to the field as fast as it is made, since by allowing it to accumulate in the barnyard, where no special provision is made to save it, the most valuable part is allowed to leach out and escape into the drains. Few farmers seem to appreciate the value of the liquid manure, and some even provide drains for its escape. Most farmers plan to apply stable manure to each field about once in every five years and at the rate of from 6 to 15 two-horse loads per acre.

Commercial fertilizers are used quite extensively, and sometimes to supplement the stable manure. When applied in conjunction with the manure, from 150 to 200 pounds per acre is used. When used alone, from 200 to 400 pounds per acre is applied, and this is usually sown with the wheat. The commercial fertilizers commonly used are all rich in phosphoric acid, being rated about 8–2–1 and costing the farmer approximately $20 a ton. The limestone soils are well supplied with potash, and it is thought that practically all of the soils of the area contain enough to meet the demand of the crops

grown. Considerable nitrogen is secured through the application of stable manure. This supply of nitrogen could be further increased by green manuring, though this is practiced only to a very limited extent. Fertilizers high in phosphoric acid seem to give the best results, since all of the soils are deficient in this element.

The liming of the soil is a very common practice in Berks County and the beds of rock in the limestone valleys and the limestone outcrops in various parts of the area are within hauling distance of practically all of the farms. Many farmers have their own kilns, and in these burn lime for themselves and frequently for their neighbors. When the farmer burns his own lime, the cost, including coal and labor, is 6 or 7 cents a bushel. The selling price at the kiln is from 8 to 10 cents a bushel. In the limestone valley it is applied at the rate of 60 to 100 bushels per acre, while on other soils the applications are lighter, ranging from 40 to 75 bushels per acre. In some sections the soil is limed once during each rotation, while in others one liming in two rotations is considered enough. Where long hauls are necessary some farms are not limed at all. Opinions seem to differ as to the merits of lime, and in the limestone valleys some farmers have discontinued its use and seem to be satisfied with their experiment. Soils derived from limestone are frequently more deficient in the carbonate of lime than soils from other formations and larger applications may be necessary. Lime on heavy land tends to flocculate the fine particles, making the soil more porous and loamy in character. On all soils it counteracts acidity, thus sweetening the land. Considering the whole area it may be said that lime is used in too large amounts, and there is considerable waste of time and labor in its application. It would seem that from 2,000 to 3,000 pounds per acre, or about one-half the amount used at present, would be sufficient for any of the soils of the county.

The farm buildings throughout the area are substantial and as a rule are kept in good repair. Many houses and barns are constructed of stone, and a number were seen which were over 100 years old, yet in good condition. Considering various sections of the county the best buildings and improvements are found in the limestone valleys, though beautiful homesteads and well-kept places are by no means confined to the limestone soils. Farm implements are up to date, and most of the modern labor-saving machines are used, except where topography prevents.

The question of farm labor in Berks County is not as serious as in some sections, because many of the women and children work in the fields. On many small farms, therefore, no extra farm hands are needed. When employed for the entire year the wage for a man is usually about $15 a month, with board. When employed only for the summer, $20 a month is paid. Day labor can usually be secured

for $1 a day, with board, except during harvest time, when $1.25 is paid.

Farms range in size from 5 to 300 acres, while the average as given in the census of 1900 is 62.5 acres. The same census states that 59.1 per cent of the farms are operated by their owners. This percentage is gradually decreasing.

Where land is rented the share system is most often followed. When the owner furnishes half the seed, fertilizers, etc., the proceeds are equally divided. The tenant often pays the school and road taxes. When the tenant furnishes everything he usually gives one-third of the crop as rent.

Land values vary considerably, depending on the character of the soil, topography, location, and improvements. In the limestone valleys values range from $75 to $165 an acre, while in the rougher portions of the area prices range from $15 to $50 an acre. Values in general lie between these two extremes, except where nearness to some city enhances the value of land for other than agricultural purposes.

While the farmers are in a prosperous condition and agriculture has been developed to a high plane, there are still plenty of opportunities for improvement. It is suggested that the dairy industry be extended, better stock introduced, and more attention paid to cleanliness in caring for cows and in handling the milk, and that more silos be built, so that the dairy herd can be supplied with a succulent feed all the year through. If the stable manure is not taken to the field when made, the liquid, as well as solid parts, should be saved and protected from the weather and not allowed to leach out into the drains. The amount of lime applied should be reduced about one-half, and only such commercial fertilizers used as are known to contain the elements most needed by the soil. Phosphoric acid seems to be needed on all of the soils much more than potash.

The trucking industry could be profitably extended, and more poultry should be raised for the eastern markets. In the northern part of the area, on Berks shale loam, potato growing could be more extensively developed. There are also excellent opportunities for the extension of the fruit industry in Berks County.

SOILS.

Berks County lies within that physiographic division of the United States known as the Piedmont plateau, but has some of the soils of the limestone valley and uplands, as the Piedmont is here interrupted by troughs of Shenandoah limestones and shales. Topographically there is considerable variation in the surface features, ranging from steep, rough, and mountainous along the northern

border to gently rolling and undulating throughout portions of the limestone valleys. Geologically the county presents an interesting study, since there are six distinct formations, each giving rise to from one to five soil types, all of which have peculiar characteristics by which they can be readily recognized. With the exception of a small extent of bottom land along the Schuylkill River and its tributaries and a few river terraces the soils of the area are all residual, having been derived directly, through weathering and decomposition, from the underlying rocks.

The most prominent and important topographic feature is what is known to geologists as the Great Valley, which crosses the northern part of the county in an easterly and westerly course, extending far beyond the limits of the area in both directions. This varies in width from 12 to 18 miles, and consists of two distinct divisions—one of limestone, the other of shale. The limestone section varies from 3 to 6 miles in width, is from 200 to 500 feet above sea level, and forms the richest agricultural section of the survey. The valley does not form the main drainage channel, but is crossed at right angles by the Schuylkill River, which receives practically all of the drainage waters of the county. The term "valley" is ordinarily used only in connection with the limestone section, since the shale is at a higher elevation and more rough and broken in character. As found here, the limestone gives rise to three soils—Hagerstown loam, Hagerstown stony loam, and Hagerstown clay loam.

The formation has been of considerable economic importance aside from its influence on the soils, as it contained many deposits of brown hematite iron ore, and these deposits were the foundation of the great iron industry which was built up in this section of Pennsylvania. Most of the ore which occurred in workable quantities has been taken out. The limestone also furnishes the lime used by farmers throughout this region, and at different points the rock is being crushed for the manufacture of cement and for road material.

The Hudson River shale, or slate belt, as it is sometimes called, occupies the northern portion of the Great Valley and extends part of the way up the slope of Blue Mountain. It is elevated from 100 to 300 feet above the limestone and from 400 to 800 feet above sea level. It extends far beyond the county limits, both east and west. A peculiar characteristic of this formation is the varied colors of the undecomposed shale. Yellow, brown, blue, purple, drab, and Indian-red shades are seen, and sometimes all of these will occur within the distance of a few yards. This wide variation is doubtless due to differences in hydration. The Hudson River shale gives rise to the Berks shale loam and the Berks silt loam. Interbedded with the shale are often found layers of brown sandstone. When these predominate the resulting soil is the Berks sandy loam.

The crest of Blue Mountain is capped with Medina and Oneida sandstone, and on account of the steep, rocky character of the land is of no agricultural value. It has been classed as Rough stony land. This same condition is encountered in various other parts of the county, especially on the hilltops and steep slopes of the South Mountains. The Hudson River shale, as a formation, dips northward under the sandstone of Blue Mountain, and the limestone of the Great Valley dips northward under the shale.

Immediately to the south of the Great Valley, in the eastern part of the county, is a low, mountainous region, known as the South Mountains or Reading Hills. These are composed principally of Laurentian gneiss, covered in patches with Potsdam sandstone and quartzite. Some beds of magnetic iron ore have been found in the gneiss formation, but most of these have been worked out. The general elevation of the gneiss region is from 600 to 1,200 feet above sea level, and the surface is hilly and broken. The decomposition and weathering of these igneous rocks give rise to the Chester loam and the Chester stony loam. The Potsdam sandstone weathers to form the Dekalb loam and Dekalb stony loam.

The bed rock over the southern part of the county is chiefly the New Red (Triassic) sandstone and shale of Mesozoic age, and the topography is hilly and rough, in marked contrast to the topography of the Penn soils as found elsewhere. The tops of the hills, being nearly on a level, indicate that as originally laid down the surface was nearly flat, but the streams have cut deep channels through it and weathering has progressed to such an extent that the surface features have undergone marked changes. The average elevation above sea level is about 600 feet, while the range in elevation is from 200 to 1,100 feet. The beds of sandstone and shale outcrop in many places, while in other places the covering of soil varies in depth from 1 to 5 or more feet. The weathering of the Triassic formation in Berks County gives rise to the Penn loam, Penn shale loam, Penn stony loam, and Penn clay loam. Where the Triassic conglomerate, consisting of quartz gravel embedded in a sandstone matrix, occurs, the resulting soil is the Penn gravelly sandy loam. The characteristic color of the soils derived from this formation is a deep Indian red. Where the Triassic sandstone has been metamorphosed, it is of a grayish color, and in weathering gives rise to the Lansdale silt loam and the Lansdale stony loam. The entire formation is underlain by limestone, which sinks beneath its north border to reappear at the extreme south of the county. In some of the small, poorly drained depressions throughout this region and also in the Hudson River shale belt, the type, Lickdale clay loam, has been mapped. Along the north boundary of the Triassic are a number of dikes of trap rock and a peculiar conglomerate called Potomac marble. The

trap rock gives rise to Montalto stony loam, and the Potomac marble to a type called Athol loam, locally known as "All sorts."

The alluvial material along the Schuylkill River, which occurs as first bottom, has been classed as Schuylkill fine sandy loam. The soil of the second bottom or terraces, which has been influenced by the river in the past, has been mapped as Birdsboro silt loam. The poorly drained low-lying areas along the smaller streams of the county have been included in one type called Meadow.

The following table gives the actual and relative extent of the several soils of the county. The distribution of these soils over the county is shown by means of colors in the map accompanying this report.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Berks shale loam	172,800	29.5	Hagerstown stony loam	7,488	1.3
Rough stony land	80,000	13.6	Lansdale silt loam	4,224	.7
Hagerstown loam	71,680	12.2	Athol loam	3,968	.7
Chester stony loam	64,000	10.9	Birdsboro silt loam	3,840	.7
Dekalb stony loam	40,320	6.8	Lansdale stony loam	3,648	.6
Meadow	24,640	4.2	Schuylkill fine sandy loam	2,880	.5
Penn shale loam	18,752	3.2	Hagerstown clay loam	2,240	.4
Berks silt loam	17,600	3.0	Chester loam	2,112	.4
Penn gravelly sandy loam	17,344	2.9	Lickdale clay loam	1,600	.3
Penn loam	13,824	2.4	Penn clay loam	896	.2
Penn stony loam	12,032	2.1	Dekalb loam	768	.1
Berks sandy loam	10,560	1.8			
Montalto stony loam	9,024	1.5	Total	586,240	

HAGERSTOWN LOAM.

The surface soil of the Hagerstown loam consists of a brown or slightly yellowish-brown silt loam or heavy loam with a high silt content extending to an average depth of 10 inches. The subsoil consists of a yellow or yellowish-red silty clay loam, clay loam, or clay extending to a depth of 36 inches or more. The upper portion of the subsoil contains a relatively high percentage of silt, and at about 18 inches usually grades into a rather heavy clay loam or clay.

While most of the type is uniform, there are minor variations worthy of note. On slopes or on the tops of low hills and ridges, where the surface has been eroded, or where the underlying rock comes near the surface, the texture is very heavy, and where large enough these spots have been mapped as clay loam. There are many, however, too small to be indicated in the map. Along the edges of the limestone valley bordering the Potsdam formation there are a number of sandstone rocks upon the surface, and the material of the Dekalb stony loam is often mixed with the soil, making it somewhat lighter in both texture and color. Where stones are sufficiently

numerous to interfere with cultivation the type has been mapped as the Hagerstown stony loam. Where the agricultural value has been materially reduced by the overwash from the Dekalb it has been mapped as the Dekalb stony loam, although the deep subsoil is derived from limestone. To the north of Reading a portion of the type has upon its surface a number of somewhat rounded sandstone rocks. While these are hardly sufficient to make a stony loam, it is a distinct phase. The texture of the soil material does not differ from the true type, and therefore no separation was made.

The Hagerstown loam is quite easily cultivated. When clods are turned up by the plow under unfavorable moisture conditions they pulverize readily under the roller, and but little difficulty is experienced in securing a good seed bed.

The Hagerstown loam is the most highly developed and important soil in the area, though not the most extensive. The largest development is in the southern part of the Great Valley. Entering the county to the east of Topton the area extends a little south of west, Lyons, Blandon, and Fleetwood being along its southern border, and Kutztown and Leesport near its northern limit. A short distance north of Temple this belt swings south to Reading and then westward again, becoming narrower until at a point 1 mile south of Wernersville it dies out entirely. Extending west from Womelsdorf and reaching over into Lebanon County is an area of considerable size. Another development of importance is found in the Oley Valley, occupying the greater part of Oley Township. In the extreme southern part of the county there is also a small area.

The topographic features of this type are those of a gently to moderately rolling valley. The elevations as obtained by the United States Geological Survey range from 200 to 500 feet above sea level. There are but few steep slopes, and practically all of the type is cultivated. Owing to the favorable topography, adequate surface drainage obtains. The texture of the soil is such as to maintain an ample supply of moisture for growing crops.

The soil is derived from the pure, massive limestone of the Cambro-Silurian age. At many of the outcrops kilns have been erected for burning the rock. This affords an ample and abundant supply of lime at moderate cost to the farmers, though many do the burning on their own farms.

The Hagerstown loam, as found here, is devoted almost exclusively to general farming. It is considered to be the strongest and most productive soil found in the county, and the farm improvements, taken as a whole, are better than on any of the other types. Corn, oats, wheat, and hay are the principal crops, and the dairy industry is developed to considerable extent. Corn yields from 40 to 80 bushels per acre, with an average of 50 bushels; the oat yield ranges

from 30 to 60 bushels, with an average of 45 to 50 bushels; and wheat runs from 20 to 30 bushels, with an average of 25 bushels per acre. Yields of 35 bushels have been obtained, but these are exceptional. Hay will average 1½ tons per acre. Rye is grown to a limited extent, and the yield ranges from 18 to 25 bushels per acre. Potatoes are grown chiefly for home use, and yield from 75 to 150 bushels per acre.

The most common rotation followed is to plow sod for corn and follow with oats. Wheat comes next in turn, and clover is seeded in the wheat in the spring. Hay may be cut for two years, or the field may be pastured for one year before plowing for corn. Stable manure is used extensively, and an effort is made to give each field an application once during each rotation. Commercial fertilizers are used and mostly applied to wheat ground. Fertilizers high in phosphoric acid give best results, and a grade costing $20 a ton is applied at the rate of from 200 to 400 pounds per acre. Most of the farmers lime this type freely, often putting on as much as 100 bushels per acre about once in two rotations.

Farms on this type range in value from $75 to $175 an acre, depending on location and improvements. Near Reading prices are higher, but this is due to the fact that many locations are suitable for suburban extensions and not because of the real agricultural value.

The following table gives the average results of mechanical analyses of the soil and subsoil of the Hagerstown loam:

Mechanical analyses of Hagerstown loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21852, 21854.....	Soil.....	1.1	2.3	1.5	3.3	15.8	52.3	23.6
21853, 21855.....	Subsoil.....	1.7	2.2	1.5	3.5	8.4	31.7	50.8

HAGERSTOWN STONY LOAM.

The surface soil of the Hagerstown stony loam, where typically developed, consists of a brown or yellowish-brown silty loam to a depth of 8 to 10 inches. The subsoil is a yellow or yellowish-red silty clay loam grading into a clay loam or clay at 16 to 20 inches. The silty upper subsoil may be lacking at times, and the surface soil then grades directly into the clay loam. Fragments of broken limestone are often found in the subsoil, and the bed rock may be encountered at 2 to 6 feet below the surface. Upon the surface of this type limestone fragments occur in sufficient quantities to interfere to some extent with cultivation.

The type is limited in extent and subject to considerable variation. The most typical area lies about 4 miles northwest from Reading

and comprises approximately 1 square mile. A long, narrow strip extends from Greshville to about 1 mile northwest of Earlville. A similar strip reaches from Shamrock to a point 1½ miles southwest of Lyons and another from Walnuttown nearly to Berkley Station. These areas occur at the foot of the South Mountains, and the wash from the Dekalb stony loam and the Chester stony loam has influenced it in some measure. There are but few limestone fragments on the surface, the stones being mainly Potsdam sandstone and in a few cases gneiss. The surface soil is lighter in color and texture than the typical soil, but the subsoil is of limestone origin. When this overwash it sufficient materially to change the value of the land, it has been mapped Dekalb stony loam.

The type has the same origin as Hagerstown loam, except where it has been influenced by wash from adjoining types. On account of the large amount of stones on the surface it is not as desirable as the loam. The same crops are grown and the same agricultural practices followed as on the loam, but the yields are lower, especially in areas modified by the overwash.

The following table gives the results of mechanical analyses of samples of the soil and subsoil:

Mechanical analyses of Hagerstown stony loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21850	Soil	3.7	5.1	2.1	3.9	11.9	44.8	28.4
21851	Subsoil	4.9	3.2	1.8	2.9	4.0	69.5	13.7

HAGERSTOWN CLAY LOAM.

The Hagerstown clay loam consists of a brown or reddish-brown silty clay loam, with an average depth of 6 inches, underlain by a red or yellowish-red clay loam or clay. A few small limestone fragments are found in the subsoil, and the bed rock is usually encountered at 2 to 4 feet below the surface. It is the heaviest soil in the area, and some difficulty is at times experienced in securing a good seed bed, but the clods turned up by the plow usually work down readily under roller and harrow.

The most extensive area is found in Lower Heidelberg Township, extending to the northeast from Wernersville for a distance of about 4 miles. Other small patches occur throughout the limestone valleys, usually along the crests or slopes of ridges where the surface has been eroded. Many other little spots were too small to be shown in the map.

The natural drainage is good, and the heavy soil retains a large supply of moisture for growing crops. The type is derived from the weathering of the underlying limestone. As compared with the Hagerstown loam, it is equally productive, and farms on the type have practically the same agricultural value.

The following table gives the results of mechanical analyses of the soil and subsoil of the Hagerstown clay loam:

Mechanical analyses of Hagerstown clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21856	Soil	4.3	3.6	1.9	3.0	6.0	51.3	29.6
21857	Subsoil	1.1	2.2	1.3	2.5	8.0	36.7	48.2

PENN STONY LOAM.

The Penn stony loam has a light-brown to dark reddish brown loam or sandy loam surface soil about 10 inches deep. The sand content of this top soil is often of rather coarse texture, and the surface is covered with sandstone fragments and gravel varying in size from less than an inch to over a foot in diameter. This stony material commonly constitutes from 30 to 60 per cent or more of the surface material. As the gravelly sandy loam is approached the type contains a great deal of small gravel in both surface soil and subsoil, but there is always a rather large percentage of either sandstone fragments or gravel 2 to 6 inches in diameter, and often both occur. In the timbered areas the surface is covered with an inch or two of rich, black leaf mold.

The subsoil is usually somewhat heavier than the surface soil, but is always very stony in character. It is of a brownish-red or Indian-red color, in most cases, and has either a loam or clay loam texture.

Areas of the Penn stony loam are found only in the southern part of the county, being confined to the Triassic formation, from which the type has been derived. The most extensive areas occur southwest of Reading, in Cumru and Brecknock townships, and southeast of Reading, in the southern part of Robeson and the northern part of Union townships.

This soil type presents a hilly to mountainous surface and is consequently well drained. Fully 75 per cent of its area is too rough for farming purposes and has been left in native forest of chestnut and oak. The surface seldom erodes seriously, and as a rule is of heavy enough texture to retain sufficient moisture for successful cropping, except in unusually dry seasons.

The Penn stony loam has been derived from the red sandstones and conglomerates of the Triassic formation. These have disintegrated in situ, but as yet the disintegration is not complete, and consequently the soil is of a stony character.

The more level and less stony areas are being successfully farmed. This phase is adapted to the general farm crops of the area, and corn, wheat, oats, hay, potatoes, and tobacco are the most extensively grown. The yields vary considerably according to the variation of the sand and stone content of the soil. On the more tillable phase wheat yields from 12 to 20 bushels, oats 25 to 35 bushels, corn 20 to 40 bushels, potatoes 75 to 150 bushels, and clover one-half to 1 ton per acre. Larger yields are sometimes obtained, particularly on the less stony and sandy areas.

Lime is extensively used on this type, while light applications of commercial fertilizers are commonly made annually. The frequent growing of clover is of great value in maintaining the productivity.

The rough phase is valued at from $8 to $12 an acre, while that adapted to cultivation is held at from $20 to $50, depending upon improvements.

The following table gives the results of mechanical analyses of the soil and subsoil:

Mechanical analyses of Penn stony loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21866	Soil	6.2	24.1	14.3	13.2	3.7	24.8	13.5
21867	Subsoil	6.1	19.7	12.4	16.4	7.5	21.5	16.5

PENN GRAVELLY SANDY LOAM.

The surface soil of the Penn gravelly sandy loam consists of a red-brown to Indian-red gravelly sandy loam about 10 inches deep. The subsoil is of a dark Indian-red color and is invariably heavier than the surface soil. It is either a gravelly loam or gravelly clay loam to a depth of 24 inches, but below this depth it can frequently be classed as a gravelly sandy clay. The gravel, which constitutes from 20 to 60 per cent of both surface soil and subsoil, consists largely of rounded quartz pebbles, most of which are less than 2 inches in diameter and many so small that they give a gritty feel to the type. This quartz gravel is found forming a continuous covering over the surface, and when thoroughly dry it gives a gray appearance to cultivated fields. Varying amounts of red sandstone gravel are also found, the fragments of which are as a rule larger than the quartz gravel.

The Penn gravelly sandy loam occurs south of Reading and is confined largely to Brecknock, Cumru, and Robeson townships, though small areas are found in Spring, Lower Heidelberg, and Union townships.

The topography is rolling to hilly, and the greater part of the type is under cultivation. The surface drainage is always well established, while the porous structure of the surface and upper subsoil permits rapid absorption of rainfall, so that serious erosion seldom occurs, even on the steeper slopes.

The type is derived from conglomerates of Triassic age. The quartz gravel composing the coarser part of these conglomerates has withstood the forces of weathering, while the softer ferruginous sandstone forming the matrix has broken down into a red loam soil. Undecomposed fragments of this conglomerate and even extensive outcrops of it occur here and there throughout the type.

Like the Penn stony loam this type was originally timbered with oak and chestnut. It is not an especially desirable type for general farming purposes. The greater part of it is so loose and porous that crops suffer in droughty seasons. The general farm crops, including corn, wheat, and clover, are grown. The yields in all cases are rather light, especially in dry seasons. Various grades of complete commercial fertilizer are in common use, while lime is frequently applied. The growing of leguminous crops and the application of barnyard manure greatly assist in maintaining the productiveness of the soil.

The Penn gravelly sandy loam is largely under cultivation and many of the farms on it are well improved. It is valued at $25 to $50 an acre, depending largely upon the distance from market and the class of farm improvements.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Penn gravelly sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21868	Soil	9.1	18.4	12.7	13.5	3.1	31.0	12.0
21869	Subsoil	5.7	18.2	12.7	14.4	5.3	29.5	14.0

PENN CLAY LOAM.

The Penn clay loam has a brownish-red surface soil with an average depth of about 8 inches. In texture it varies from a heavy loam or silt loam to a clay loam or even clay. Typically, however, it is a distinct clay loam. The subsoil to a depth of 36 inches is a dark

Indian-red clay. It is very plastic and has a distinctly "greasy" feel.

The type is of very limited extent and occurs scattered through the Penn loam and the Penn shale loam. The more extensive areas are found in Brecknock, Robeson, Amity, and Exeter townships. It has been formed by the decomposition of Triassic shale, fragments of which are occasionally found on the surface. The topography is rolling to hilly.

In crop adaptation the Penn clay loam resembles the Penn loam, and the yields secured are about the same on both types. Naturally the clay loam is somewhat harder to handle because of its heavier texture and closer structure, but it has the advantage of being more resistant to drought than the loam, and consequently of producing better crops in dry seasons.

PENN LOAM.

The Penn loam consists of about 10 inches of reddish-brown surface soil underlain by an Indian-red heavy loam, clay loam, or even clay subsoil. In some cases the surface soil is a heavy sandy loam, in others it is very silty, and in still others where erosion has been severe it is a clay loam. The latter phase has been separated and shown as a distinct soil type wherever the areas were large enough. Sandstone conglomerate fragments are often found on the surface and may constitute from 5 to 20 per cent of the surface soil. Where the type is in part derived from the red shale, fragments of this rock are often found disseminated throughout the soil profile. In most cases the surface is somewhat stony, but the quantity of coarse material is not usually sufficient to warrant classifying the soil as a stony loam. The subsoil, like that of the clay loam, has a somewhat "greasy" feel, which becomes more pronounced as the structure becomes heavier.

This type occurs scattered throughout the region occupied by the Triassic formation. The more important areas are found in Brecknock, Union, and Exeter townships. The topography is generally rolling, though it often becomes very hilly. The area south of the Allegheny Valley, in Brecknock Township, is practically all rather rough for farming purposes. The type is always rolling enough to have good natural drainage, and the slopes in the cultivated fields are seldom steep enough to erode seriously.

The Penn loam has been derived from the red Triassic sandstone and shales, and fragments of these rocks are found mixed with the soil and subsoil, but in most cases decomposition has reached such depths that the original bed rock is not exposed even in the road cuts.

The type is practically all cleared and in cultivation. It is considered one of the best soils of the county, though it is not as productive as the Hagerstown soils. Corn, wheat, oats, and clover are all successfully produced. The sandier phases are being utilized for the production of truck crops. Tobacco is also a common crop on this type in the Allegheny Valley. Corn produces from 25 to 50 bushels, wheat 15 to 25 bushels, oats 30 to 45 bushels, and clover between 1 and 2 tons per acre.

PENN SHALE LOAM.

The surface soil of the Penn shale loam consists of a brownish-red, rather heavy loam, silt loam, or clay loam with a depth of about 10 inches. The subsoil is dark Indian red in color and varies from a heavy loam to silty clay loam in texture, being almost always heavier than the surface soil. It is never of very great depth, as almost invariably the undecomposed shale rock is encountered at a depth of 24 inches or less. In fact, it is occasionally found directly under the surface soil. This variability in depth of soil material is related to the topography—the shale being nearer the surface on the slopes, where the finer material has been removed by wash, and deeper on the more level expanses, where there may even have been an accumulation from higher areas. It is seldom possible to bore deeper than 15 or 20 inches below the surface, and the average depth of the soil is probably about 18 inches.

Shale fragments form from 10 to 60 per cent of the surface soil. On the more level areas there is comparatively little shale, but on the steep slopes and ridges the surface appears to be made up solely of rock fragments. The shale content increases with depth, and, as a rule, the more shaly the surface the nearer is the undecomposed bed rock.

The Penn shale loam occurs as a broad rolling upland north of the Schuylkill River in Douglass, Amity, and Exeter townships. It has the appearance of an old level table-land, through which streams have carved broad, rounded valleys, giving rise to a billowy topography. This furnishes good surface drainage, but where the underlying beds of shale are horizontal water can not pass down, and unless the surface is very rolling the soil becomes too wet in rainy seasons. However. the shale has in most cases been more or less tilted, so that the excess water passes rapidly through it. The type is very droughty, however, since the shale prevents the rise of capillary water and the soil is of insufficient depth to retain enough water to supply crops through any extended period of light rainfall. In years of normal rainfall well distributed through the growing season the Penn shale loam is a fairly productive soil.

This type is practically all under cultivation, and it supports very good farm improvements. Almost all the staple crops of the section are grown. It appears better adapted to small grains and hay than to corn, potatoes, and tobacco, since the former crops can generally be matured before the dry season sets in. Corn and potatoes are likely to fail in very dry seasons. In the cultivation of this soil its droughty nature should be kept constantly in mind and every means possible taken to conserve moisture.

Considerable commercial fertilizer is used and very often lime is applied. Barnyard and green manures always prove beneficial. The yields of crops are variable, since so much depends on the rainfall. Eliminating the occasional very dry years, when the crops are practically all failures, the yields are approximately: Corn, 30 bushels; oats, 30 bushels; wheat, 15 bushels; potatoes, 100 bushels; and hay, 1¼ tons per acre.

The following table gives the results of mechanical analyses of the soil and subsoil:

Mechanical analyses of Penn shale loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21874	Soil	1.9	7.8	3.3	3.1	4.1	55.7	24.0
21875	Subsoil	.0	3.9	3.0	3.5	3.9	53.1	32.4

BERKS SHALE LOAM.

The Berks shale loam, to a depth ranging from 6 to 10 inches, consists of a heavy loam or silty loam containing from 40 to 70 per cent of shale fragments, and varying in color from a brown to yellowish-brown, with occasional areas of red.[a] The brown shale predominates, the red shale occurring only in small patches surrounded by the brown.

The subsoil is generally lighter in color than the surface soil, and varies in texture with the topography. On the steep slopes and narrow ridges, where erosive agencies are especially active, it is likely to be very shallow and to consist of a mass of broken shale fragments, resting directly upon the unbroken shale at a depth of from 18 to 24 inches. On the more level hilltops and on gentle slopes the process of disintegration has proceeded farther and the subsoil consists of numerous shale fragments embedded in a heavy loam or clay loam, resting at 24 to 30 inches upon the unbroken shale.

[a] The areas of red soil are derived from red shales, and represent occurrences of Penn shale loam too small or too intricately associated with the predominant brown soil to be shown on the map.

Above the 500-foot elevation sandy shales and a flaggy sandstone are sometimes found interbedded with the argillaceous shale, and in some cases they predominate sufficiently to affect the texture of the soil. Where such areas carry the required content of sand and are large enough to be shown in the map they were mapped as Berks sandy loam.

The Berks shale loam, being composed so largely of small shale fragments, may be worked very early in the spring and even when quite wet with little danger of impairing its physical condition. And inasmuch as the shale fragments are soft and easily broken the soil is easy to cultivate and wears very little on the agricultural implements employed.

In Berks County this type occurs in an area bounded on the south by the great limestone valley which extends from Kutztown to Womelsdorf and on the north by Blue Mountain. It ranges in width from 8 to 16 miles and extends in an east and west direction entirely across the northern part of the county. Its topography varies from billowy to rather hilly, with the tops of the ridges and hills well rounded and from 50 to 150 feet higher than the intervening valleys.

In general the drainage is good, depending upon the character of the subsoil. Where the subsoil consists mainly of a mass of broken shale fragments, the soil is inclined to be droughty, but where the subsoil is further disintegrated and these shale fragments are embedded in a heavy loam the water-holding capacity of the soil is much better. In some places on level areas near the headwaters of streams ridging, furrowing, and open-ditching is necessary to aid drainage, but such instances are few.

The Berks shale loam is of residual origin, being derived from the Hudson River shales, which vary in color from brown, yellow, gray, and olive to red. Alternate beds of these different colors will often be found within a few feet of each other. In some places the shale has apparently been metamorphosed and hardened, and where this has occurred the soil contains a number of irregular rock fragments, which tend to increase the difficulty of cultivation. This phase occurs for the most part on the summits of the higher ridges.

Limestone outcrops occur throughout this soil area, and while their effect upon the soil was in no case large enough to be shown, they are important as furnishing the rock for burning lime and for building and road construction.

The topography and texture of the Berks shale loam make it especially liable to damage by erosion, and considerable care in management is necessary to prevent this.

The soil was formerly covered with a growth of chestnut, oak, and some walnut. While most of the land has been cleared for agricultural purposes, good growths of this timber are found frequently.

The soil seems well adapted to general farming, and during favorable seasons good yields are secured, but continued drought results in an almost total failure. The yields of different crops on this type vary considerably, the productiveness of the soil seeming to increase with the greater disintegration and depth of the subsoil. While the yields will generally range from 15 to 30 per cent less than on the Hagerstown soils, under favorable conditions by the use of heavy applications of manure almost equally good results have been secured. Corn will yield from 20 to 60 bushels per acre, wheat 15 to 30 bushels, and oats 25 to 50 bushels. Grass does not do so well, a yield of 1¼ tons per acre being considered fairly good.

The soil is preeminently adapted to potatoes, and from 200 to 250 bushels per acre can be secured by heavy manuring and the use of commercial fertilizers high in phosphoric acid and containing some potash. Applications of from 400 to 500 pounds are common, though sometimes as much as 1,200 pounds is used. The growing of vegetables, small fruits and orcharding should prove successful on this type.

The rotations practiced on Berks shale loam are: Corn, oats, and wheat, each one year, and timothy and clover one or two years, and potatoes, wheat, and grass each one year. Most of the plowing is done in the spring, and very little land is allowed to lie fallow over winter.

In some places indications of a depletion of the nitrogen content of the soils exist. Heavy applications of stable manure or the plowing under of some legume would tend to correct this deficiency and prevent loss by erosion.

Farm improvements on this type are generally good, and the soil ranges in value from $30 to $65 an acre, depending upon improvements, topography, and location.

The following table gives the results of mechanical analyses of samples of soil and subsoil of this type:

Mechanical analyses of Berks shale loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21824	Soil	8.5	9.5	3.5	5.1	5.7	51.1	16.5
21825	Subsoil	5.8	6.4	2.5	4.1	9.7	47.6	23.2

BERKS SILT LOAM.

The surface soil of the Berks silt loam consists of a brown or yellowish-brown silt loam or heavy loam with high silt content extending to an average depth of 10 inches. It is underlain by a heavy

yellow silt loam, which grades into a silty clay loam at 16 to 20 inches, this in turr resting upon undecomposed shale at depths ranging from 30 inches to 4 feet. The subsoil has a smooth, greasy feel. There are on the surface a few shale fragments, and the subsoil may contain from 10 to 25 per cent of such coarse material. A large proportion of the type is underlain by limestone, and outcrops of this rock frequently occur, though this formation usually lies from 4 to 10 feet below the surface and does not affect the soil to any appreciable extent.

The largest and most typical body of the Berks silt loam is found in Marion Township, directly north from Womelsdorf and Stouchsburg. Other small areas occur at intervals throughout the Hudson River shale belt and also where this formation borders the limestone. Such border areas are found near Wernersville, Leesport, South Evansville, and Kutzton. The patches along the Schuylkill River to the south of Hamburg have upon the surface and mixed with the soil a number of rounded sandstone fragments varying in diameter from 1 inch to 4 inches. The appearance of these areas is that of a second bottom or terrace, and the soil has doubtless been affected to some extent by the action of the river. The texture is not quite so silty as in other places, but this variation covers so small an area that it hardly warranted the establishing of a new type. The area to the north of Friedensburg also has upon the surface a number of small sandstone rocks, and the subsoil does not have the greasy feel characteristic of the type as a whole.

The Berks silt loam has the same origin as the Berks shale loam, having been derived from the weathering and disintegrating of the Hudson River shale, though it differs from that type in that the processes of weathering and decomposition have reached a more advanced stage. In topography the surface is gently rolling to rolling, while a few small areas are nearly level. The natural drainage is good, except in a few places near the heads of streams. These are lighter in color and somewhat heavier, and where the difference is sufficiently marked they were mapped as Lickdale clay loam. The type seldom suffers from drought, since the subsoil is quite heavy and retains a sufficient supply of moisture to carry crops over dry periods of ordinary duration.

This type is devoted to general farming and is considered a strong soil. The greater part of it compares favorably with the Hagerstown loam and is considered to have nearly the same agricultural value. Corn, oats, wheat, and grass are grown in rotation in the order named, and the methods of farming are practically the same as on other types described. Rye and potatoes are also grown to a limited extent. Lime is applied, from 50 to 75 bushels per acre being used. All stable manure made is ordinarily spread on sod land before plow-

ing for corn. When commercial fertilizers are used, a grade rich in phosphoric acid seems to give best results. Under favorable conditions the ordinary farm crops give average yields as follows: Corn, 45 bushels; oats, 40 bushels; wheat, 22 bushels; and hay, 1½ tons per acre. Farms on this soil range in value from $50 to $125 an acre.

The following table gives the average results of mechanical analyses of samples of this soil and subsoil:

Mechanical analyses of Berks silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21828, 21830.....	Soil.....	1.7	2.9	1.5	2.4	5.6	54.1	31.7
21829, 21831.....	Subsoil.....	1.2	2.9	1.7	2.8	5.9	52.6	32.9

BERKS SANDY LOAM.

The surface soil of the Berks sandy loam consists of a medium to fine light-brown sandy loam, with a depth of 6 to 8 inches. There is present upon the surface and mixed with the soil sandstone fragments, often in sufficient quantities to interfere with cultivation and to give the type the characteristics of a stony sandy loam.

The subsoil consists of a yellowish-brown rather heavy medium to fine sandy loam, often containing sufficient silt and clay to make it quite compact. Sandstone fragments are also numerous, and it is often impossible to bore more than 15 inches below the surface. Shale fragments occur upon the surface and through the soil section, and where these are plentiful enough to change the texture the Berks shale loam results.

The largest area of this type is found in the southern part of Upper Bern and Upper Tulpehocken townships, while numerous small patches occur throughout the shale belt, where it is always closely associated with Berks shale loam. By far the greater proportion of the type lies above the 500-foot contour. In origin this soil is derived from the disintegration and weathering of a rather fine grained, flaggy sandstone which is found interbedded with the shale in sufficiently large quantities to give a decidedly sandy character to the resulting soil.

In topography the surface is rolling to hilly, and a few slopes are too steep to be cultivated. Some of these are wooded with chestnut, which was the original timber growth. The natural drainage is good, and the soil often suffers from drought during long-continued dry periods. In such seasons crops are often a total failure, while in years when the rainfall is well distributed fair yields are secured.

As compared with the Berks shale loam, the Berks sandy loam is more difficult to cultivate and the average yields are somewhat lower. It is not so well adapted to potatoes, and is therefore less desirable from an agricultural standpoint. Corn, oats, wheat, rye, grass, and a few potatoes are grown, but the soil is not especially adapted to any of these crops. Probably the best results can be secured by allowing it to remain in grass for pasture.

Farms on this type range in value from $15 to $45 an acre, depending on location, topography, and improvements.

CHESTER STONY LOAM.

The surface material of the Chester stony loam consists of a brown medium loam, extending to an average depth of 8 inches and containing varying amounts of small rock fragments which impart a gritty feel to the soil. Along the lower slopes of the hills and ridges the soil has accumulated to a greater depth and is usually finer in texture than elsewhere, owing to the wash from higher levels, while on the upper slopes and on top of the hills the surface covering is shallow and often coarse in texture. In a few instances on the high elevations the soil was found to be a coarse sandy loam. These areas, however, were never of sufficient size to be shown in a map of the scale used in the survey. The surface of the type is thickly strewn with bowlders and angular rock fragments ranging in size from 2 inches to 6 feet or more in diameter. Where the large bowlders occur the small stones are not usually very plentiful and where the small rocks cover the ground there are seldom any bowlders. There are exceptions, however, where stones of all sizes will be found in the same field. Many of the stones have been removed from the fields and used in the construction of fences, houses, barns, and other farm buildings. Where the slopes are very steep and the stones, bowlders, and rock outcrops render the land unfit for agricultural purposes, Rough stony land was mapped. Along the line of contact between this type and the Dekalb soils the surface is usually lighter in color and often more sandy in texture.

The subsoil to a depth of 36 inches consists of a yellowish-brown to reddish-brown extremely gritty clay loam, which in some localities contains sufficient sand to be classed as sandy clay loam. Both soil and subsoil are often filled with rock fragments to such an extent that it is impossible to bore to depths greater than 15 inches, and it is seldom possible to bore to a depth of 3 feet. Where the bed rock comes to within 2 or 3 feet of the surface the subsoil is often nothing more than a mass of crumbled rock, and the surface in such places may contain from 30 to 50 per cent of similar material.

Over practically the whole type rocks are sufficiently numerous to interfere with cultivation. Many fields have been under the plow for over one hundred years and large quantities of stones have been removed, but only a very few fields have been entirely cleared.

The Chester stony loam is confined to that portion of the county occupied by the South Mountains. The main body lies east of Reading and south of the East Pennsylvania branch of the Philadelphia and Reading Railway. The continuity of the type is broken by numerous areas of Dekalb stony loam and Rough stony land. Another area occurs along the west county line south of Robesonia.

In topography the surface is hilly and broken and in a few places mountainous. Some of the slopes are too steep to be cultivated and are of value only for pasture. The natural drainage is thorough, and where the subsoil is composed largely of rock fragments the crops are apt to suffer from drought. The type as a whole, however, retains moisture fairly well and during years of normal rainfall very satisfactory yields are secured.

The Chester stony loam is derived from the igneous and metamorphic rocks of the South Mountains, principally gneiss, with some granite. Originally the region was covered with forests of chestnut, oak, hickory, and some sycamore.

Although the surface is broken and hilly and often very stony, a large proportion of the type is under cultivation and quite highly developed. The steeper slopes are sometimes washed and eroded in times of heavy rains, but little damage results from this source, since the soil is open and readily takes up the water as it falls. If land is plowed in the fall the danger from washing is greater than if plowed in the spring. Wheat grown upon this soil is reported to be harder than that grown on the limestone soils, and all other products are of correspondingly good quality. This type is not as productive as the limestone soils and is more difficult to cultivate on account of the stones and hills. The yields of the ordinary farm crops are as follows: Corn, from 25 to 50 bushels per acre, with an average of about 40 bushels; oats, from 25 to 50 bushels, with an average of 40 bushels; wheat, 18 bushels; and hay, from three-fourths to 1 ton per acre; rye gives from 16 to 25 bushels, and potatoes from 75 to 150 bushels per acre. Stable manure is applied to the soil and commercial fertilizers are used to a considerable extent. The methods of cultivation are practically the same as on other types of the area.

The Chester stony loam is well adapted to apples, peaches, and grapes, and the fruit industry should be developed to a much greater extent than at present. There are excellent opportunities for investment in fruit lands on this type, and the nearness of large markets is an added advantage to those wishing to take up the growing of

orchard fruits. Farms on this soil range in value from $25 to $70 an acre, depending on location and improvements.

The following table gives the average results of mechanical analyses of samples of this type:

Mechanical analyses of Chester stony loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21834, 21836.....	Soil.....	7.6	14.7	7.7	12.8	6.1	30.6	20.5
21835, 21837.....	Subsoil.....	9.4	13.4	6.2	9.3	5.6	30.9	25.1

CHESTER LOAM.

Where typically developed the surface soil of the Chester loam, to an average depth of 8 inches, consists of a brown, medium-textured, gritty loam containing a small quantity of rock fragments. The subsoil, to a depth of 36 inches or more, consists of a yellowish-brown or brownish-red gritty clay loam, or heavy gritty loam or sandy clay loam.

A few stones are found upon the surface and mixed with the soil, but these are never in sufficient numbers to interfere with cultivation. The texture of this type is practically the same as that of the fine-earth portion of the Chester stony loam, except that the latter is somewhat more gritty. The surface being nearly free from stones and the topography less rough and broken, it is a more desirable soil than the stony type. It occupies gently rolling areas or small table-lands scattered through the stony loam region. On account of its very limited extent, however, it is of relatively small importance.

One of the largest areas lies to the southwest of Stony Point; other smaller patches are found northwest of Friedensburg, northeast of Alsace, and along Antietam Creek just below Stony Creek Mills. This last-named area lies lower and is more stony than the type usually is, but on account of its level surface and agricultural value it was included with the loam.

The Chester loam has the same origin as the stony loam, having been derived from the weathering of the Laurentian gneiss of the South Mountains. Owing to its topography the natural drainage is rapid and complete, but during seasons of average rainfall crops do not suffer for lack of moisture.

The crops grown and agricultural practices followed do not differ from those on the Chester stony loam, but the yields as a rule are slightly larger. The value of farms consisting chiefly of Chester loam ranges from $45 to $75 an acre.

The following table gives the results of mechanical analyses of the soil and subsoil of the Chester loam:

Mechanical analyses of Chester loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21838	Soil	7.6	13.8	6.6	10.2	4.4	32.9	24.3
21839	Subsoil	4.5	9.5	6.2	10.3	8.6	32.8	28.1

DEKALB STONY LOAM.

The surface soil of the Dekalb stony loam, to a depth of 6 to 10 inches, consists of a gray, drab, or light-brown, fine to medium slightly gritty loam. On the tops of many of the hills and ridges the soil is a fine to medium sandy loam, while on the lower slopes, where the fine material has washed down and accumulated to considerable extent, the texture is often that of a silty loam or fine loam.

There is considerable variation in the subsoil. Where typically developed it consists of a brownish-yellow or yellow light clay loam. Where the surface consists of a sandy loam the subsoil may also be a heavy medium to fine sandy loam or a very sandy clay loam. In a few areas of small extent the subsoil was found to be a brownish-red gritty clay loam.

The surface of the type is strewn with sandstone and quartzite fragments varying from 2 inches to 2 feet in diameter, though most of the pieces are from 4 to 10 inches in diameter. The soil and subsoil are so completely filled with rock fragments that it is seldom possible to bore more than 15 inches. In many places the bed rock comes close to the surface and along the steep slopes and on the hilltops there are numerous outcrops. The type is commonly spoken of as chestnut gravelly land, the original timber growth having been chiefly chestnut. The stones interfere materially with cultivation, and many have been removed and used in building stone fences.

The Dekalb stony loam is found scattered over the South Mountains and along the slopes bordering the Great Valley on the north and the Oley Valley on the south. It is derived from the Potsdam sandstone—a formation closely associated with the gneiss. Sandstone fragments are often found scattered over the Chester material and gneiss fragments over the Dekalb soils, and along the boundary lines the finer soil materials are also mixed to considerable extent.

An extensive area of the Dekalb stony loam is found along the north slope of the South Mountains, extending down to the Hagerstown loam of the Great Valley. The main body extends from Blandon, a little to the south of Fleetwood and Lyons and on eastward to the county line. It is broken in places by areas of Chester

stony loam. A continuation of this same area extends around the west end of the South Mountains, passing east of Frush Valley. Smaller patches occur to the north of Boyertown and throughout the South Mountain region. A broken, irregular strip is also found extending westward from Shillington to the Lebanon County line.

In topography the areas are hilly, rough, and broken, though there are a few with a surface only moderately rolling. Sometimes quite gentle slopes are found, and a few table-lands were seen where the surface was nearly level and quite free from stones. Such areas, when large enough, were mapped as Dekalb loam. On account of the uneven topography and the quantity of rock fragments and sand in the soil and subsoil, the natural drainage is free and the type often suffers from drought.

The Dekalb stony loam occupies about the same relative position as the Chester stony loam and is similar in topography. In color and texture it is lighter, while in agricultural value it is decidedly inferior. One can usually tell from the general appearance of the growing crop upon which soil the field is located. The buildings and farm improvements on this type are, as a rule, inferior to those in other parts of the area, and it is safe to say that this is the poorest soil now under cultivation in Berks County. The same crops are grown as on other soils, but yields are much lower and often very unsatisfactory. The steep stony slopes should have been left in forest. Some of these might be reforested, while others should be seeded and used as pasture land. Corn yields from 12 to 35 bushels per acre, with an average of about 20 bushels. This season (1909) the crop is almost a total failure. The yield of oats averages 20 to 25 bushels; wheat, 12 to 16 bushels; and hay, one-half to three-fourths ton per acre. Some rye is also grown and yields from 12 to 18 bushels per acre. Farms on this type range in value from $15 to $45 an acre.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Dekalb stony loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21842	Soil	2.3	8.2	5.4	12.3	9.2	37.9	24.4
21843	Subsoil	4.0	9.1	5.2	10.5	13.1	31.4	26.5

DEKALB LOAM.

The Dekalb loam to a depth of 8 to 10 inches consists of a brown or grayish-brown medium to fine loam, underlain by a yellow, slightly gritty clay loam. On exposed positions, where the soil has been

somewhat eroded, there is usually a larger percentage of gritty material present, and this gradually increases with depth until at 24 to 30 inches an extremely gritty sandy clay loam is found. There are present on the surface and mixed with the soil a few sandstone and quartzite fragments, but these are not sufficiently numerous to interfere with cultivation.

The type is of very limited extent, the largest development being in the vicinity of New Jerusalem. Other smaller patches, closely associated with the Dekalb stony loam, are scattered about over the South Mountains. It has the same origin as the Dekalb stony loam, having been derived from fine-grained Potsdam sandstone.

In topography it is more nearly level than the stony loam, occupying as it does small gently to moderately rolling table-lands. The natural drainage is good, but the soil is not nearly so droughty as the stony loam type. In crop value it is markedly better than the Dekalb stony loam, but is not considered quite as good as the Chester soils.

Few if any farms are made up entirely of the type, but a fair estimate would place the value of such land at from $30 to $50 an acre.

The following table gives the results of mechanical analyses of the soil and subsoil of the Dekalb loam:

Mechanical analyses of Dekalb loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21844	Soil	2.6	7.3	6.1	11.9	6.5	45.5	19.9
21845	Subsoil	5.1	6.0	3.5	8.6	9.1	41.6	25.4

LANSDALE SILT LOAM.

The Lansdale silt loam consists of a drab, slate-colored, or reddish-gray silt loam, with an average depth of 8 inches, underlain by a drab or pale-yellow silty clay loam. The type is subject to considerable variation, though of small extent, and is hardly typical of this soil as found elsewhere.

It is confined to the southeastern part of the county lying north of the Schuylkill River along the Montgomery County line. Some of the areas mapped extend into the adjoining county, where the type is much more extensively developed. The Lansdale silt loam is closely associated with the Penn soils and a definite boundary line is sometimes difficult to establish.

In origin this soil is residual, being derived from metamorphosed Triassic sandstone and shale. Some rock fragments occur upon the surface and mixed with the soil, and where these are sufficiently

numerous to interfere with cultivation Lansdale stony loam was mapped. The surface is gently to moderately rolling.

The Lansdale silt loam is well adapted to the general farm crops of the area and with proper treatment can be made very productive. Where the soil is typical and correctly handled the following average yields are secured: Corn, 45 bushels; oats, 30 bushels; wheat, 18 bushels; and hay, 1 ton per acre.

The following table gives the results of mechanical analyses of fine-earth samples of the soil and subsoil:

Mechanical analyses of Lansdale silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21860	Soil	4.9	8.3	6.4	8.2	16.6	34.1	21.4
21861	Subsoil	1.2	3.3	3.1	3.4	7.3	56.4	26.0

LANSDALE STONY LOAM.

The soil of this type, to an average depth of 8 inches, consists of a drab, slate-colored, or gray silty loam or silt loam. The surface is strewn with fragments of metamorphosed Triassic sandstone, the quantity being so great that they interfere with cultivation, and reduce the agricultural value of the land. Similar material occurs throughout the soil section and it is often impossible to bore more than 15 inches. The subsoil consists of a slate-colored or gray heavy silty loam grading into a silty clay loam. Stones are abundant and the bed rock may be encountered at a depth of 2 to 4 feet below the surface.

The type is of only limited extent in Berks County. Three small areas occur close together about 3½ miles south of Reading. Small patches are also found in the extreme southern corner of the county and along the Montgomery County line. The Lansdale stony loam closely resembles the Penn stony loam, differing from it only in color.

This soil has a rolling to hilly surface and good natural drainage. In times of continued dry spells the crops suffer for want of water, especially where the subsoil is for a large part composed of rock fragments. The soil is derived from the metamorphosed Triassic sandstone.

Originally the areas were covered with a growth of chestnut, and while much of the type is cultivated, some of the steep stony places are still wooded. Corn, wheat, oats, rye, and grass are grown, but the yields are considerably lower than on the Lansdale silt loam.

The following table gives the results of mechanical analyses of fine-earth samples of the soil and subsoil:

Mechanical analyses of Lansdale stony loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21858	Soil	5.0	9.2	6.4	10.1	11.6	43.6	14.0
21859	Subsoil	3.4	4.3	3.0	5.0	5.1	57.1	21.8

LICKDALE CLAY LOAM.

The surface soil of the Lickdale clay loam, to a depth of from 6 to 9 inches, consists of a dark-gray or drab clay loam or silty clay loam, underlain by a mottled yellow and gray or drab heavy clay loam or clay containing a comparatively high percentage of silt.

The type is of small extent, including one area to the south of Friedensburg, several small patches in Bethel Township, in the northwestern part of the county, and a few scattered areas in the southern part of the county. It occupies flat, low-lying lands in small depressions about the heads of streams or along stream channels, and is very poorly drained. In the southern part of the county it is derived from the Triassic sandstone and shale, while in the northern part it comes from the Hudson River shale. The wash from adjoining slopes has added to the soil material.

Land of this character of soil must be artificially drained before it can be used to advantage for cultivated crops. It is not especially valuable for any of the crops now produced, but can be used to the best advantage for hay and pasture. Where adequately drained fair crops of hay, corn, and oats are obtained.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Lickdale clay loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21862	Soil	0.1	0.8	2.0	3.3	5.9	58.9	28.8
21863	Subsoil	.1	.8	1.6	5.0	11.5	51.2	29.8

BIRDSBORO SILT LOAM.[a]

The surface soil of the Birdsboro silt loam consists of a yellowish-brown silty loam extending to an average depth of 10 inches. In

[a] In the soil survey of Montgomery County, which adjoins the area on the east, the Birdsboro silt loam did not occur in as large bodies and was described as a phase of the Lansdale silt loam. See Montgomery report, Field Operations of the Bureau of Soils, 1905, p. 105.

local areas there is sufficient fine sand present to give the characteristics of a fine sandy loam, while in some instances the soil is a loam, though taken as a whole there is usually sufficient silt present to impart a smooth feel. Under cultivation it works up readily into a mellow seed bed.

The subsoil consists of a yellow or yellowish-brown silty clay loam usually growing more silty with depth and sometimes having in the lower depths a slightly greasy feel. Scattered about on the surface and mixed with soil and subsoil are a few rounded stones and some small gravel.

All of the areas of this type occur along the Schuylkill River below Reading and between Klapperthall and the county line. It is a second bottom or terrace soil and has been partially formed or largely influenced by the river at some past time. It does not occupy plain-like terraces; in fact, at first glance it does not have the appearance of being a second bottom soil, on account of the uneven sloping surface configuration. The presence of waterworn stones and the general character of the material fix its origin as reworked alluvium, and there is no doubt as to the correctness of the classification as second bottom. Through this portion of the area the Triassic formation occurs on both sides of the river and material from this source has doubtless contributed largely to the making of the type under consideration. The surface is level or gently rolling and usually has a gentle slope toward the river. The natural drainage is good and none of the type is subject to overflow.

This is a fairly good general farming soil. Some trucking is also done upon it, and it would seem that this industry could be profitably extended. The Birdsboro silt loam has practically the same agricultural value as the Lansdale silt loam in this area.

The following table gives the results of mechanical analyses of the soil and subsoil of this type

Mechanical analyses of Birdsboro silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21832	Soil	0.6	1.7	1.4	3.1	15.2	56.9	21.0
21833	Subsoil	.0	.5	.8	1.3	2.4	72.9	22.1

MONTALTO STONY LOAM.

The surface soil of the Montalto stony loam consists of a light-brown to reddish-brown loam to heavy loam, extending to an average depth of 8 inches. The soil often has a rusty appearance and the cultivated fields have a characteristic brown or yellowish-red color. Over a portion of the type some difficulty is experienced in plowing,

as the soil has a tendency to stick to the moldboard. On some of the hillsides where erosion has taken place, the surface is quite heavy, approaching a clay loam, while on more level tracts the silt content is more pronounced. The soil frequently contains sufficient small rock fragments to impart a gritty feel. Upon the surface and mixed with the soil are from 20 to 40 per cent of trap rock fragments, which are locally called ironstone, from which the type received the local name "Ironstone land."

The subsoil consists of a reddish or yellowish-brown or dull red, heavy, gritty loam to clay loam, usually resting on bed rock at from 2 to 6 feet. The subsoil also contains numerous large and small rock fragments, so that it is often impossible to bore more than 15 inches below the surface.

The largest occurrence is in the southern part of Spring Township, while a smaller area is found in Cumru. In the central part of Exeter Township, just south of Jacksonwald, and in the southern part of Washington Township, near Bechtelsville, are two other patches. These four areas are practically all on a straight line drawn from Fritztown to a point 1 mile east of Bechtelsville.

In topography the areas are rolling to hilly, and the natural drainage is usually good. The type is derived from the weathering of dikes of trap rock, though in two places diorite was found to be the parent rock. The resulting soils are very similar, and were mapped as the same type. All of these dikes were pushed up directly along the north border of the Triassic formation. A number of dikes aside from those mapped are found, but these are of such small extent that the resulting soil areas could not be shown on the map.

The Montalto stony loam is devoted to general farming, though there are some portions of the type which are too steep to be cultivated. It is considered a strong soil, and in the more favored localities the corn yields average about 40 bushels per acre; wheat, 18 bushels; oats, 35 bushels; and hay, 1¼ tons per acre. The type is well adapted to apples, peaches, and grapes, and the fruit industry should be extended. Farms on the Montalto stony loam range in value from $20 to $65 an acre, depending on location, topography, and improvements.

The following table gives the average results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Montalto stony loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21846, 21848.....	Soil.....	4.2	7.4	3.5	7.1	5.9	53.9	17.4
21847, 21849.....	Subsoil.....	1.7	8.2	5.8	11.7	13.3	34.9	24.6

ATHOL LOAM.

The Athol loam consists of a brownish-red to light-brown medium loam, with an average depth of 10 inches, underlain by a red, reddish-brown, yellowish-red, or even a yellow clay loam or sandy clay. It has some of the characteristics of both the Penn loam and the Hagerstown loam. In the localities where it exists it is recognized as a distinct type, and the soil as well as the rock from which it is derived is commonly called "all sorts."

Under cultivation the Athol loam is easy to handle and works up readily into a mellow seed bed. Numerous rock outcrops throughout the type and a few stones upon the surface in places interfere somewhat with cultivation, but practically all of the type is under the plow.

The Athol loam is of only limited extent. The largest area, which covers several square miles, is found in the northern part of Amity Township. Another area extends eastward from Klapperthall for about 3 miles and westward across the Schuylkill River for about 1½ miles. Another small body occurs between these two.

The soil is derived from the weathering of a breccia known as Potomac marble. It is composed of waterworn fragments of limestone, Cambrian sandstone, and Triassic sandstone embedded in a matrix of Triassic material. The proportion of limestone is enough to warrant burning the rock for lime. This peculiar rock occurs along the northern edge of the New Red formation bordering the limestone. The surface is gently to moderately rolling and the natural drainage is good.

All the crops common to this region are successfully grown upon the Athol loam, and it is considered a good general farming soil. It is held by some to be nearly equal to the Hagerstown loam, but on account of numerous rock outcrops the yields are somewhat lower. Wheat yields from 12 to 28 bushels per acre, with an average of about 20 bushels; corn, from 30 to 50 bushels; while oats will average about 38 bushels per acre. It is reported that on a portion of the type clover does not do especially well, but timothy thrives and yields from 1 to 1½ tons per acre. The farms on this type range in value from $60 to $100 an acre.

The following table gives the results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Athol loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21884	Soil	1.7	2.9	2.0	4.6	12.3	59.3	16.4
21885	Subsoil	.8	2.3	1.6	4.0	17.0	48.5	25.8

SCHUYLKILL FINE SANDY LOAM.

The surface soil of the Schuylkill fine sandy loam consists of a brown, dark-brown, or black fine sandy loam to light loam, with an average depth of about 10 inches. Where the soil is a loam the texture is rather fine, owing to the high fine sand content. The black color over a part of the type is due to an accumulation of fine coal particles which have been carried down by the Schuylkill River from the coal regions above and deposited in times of high water. Immediately along the river on the lowest places where even moderately high water causes an overflow there is an excess of coal particles, but farther back where only extremely high water overflows the land there is less coal and the brown color prevails.

The subsoil consists of a light-brown fine sandy loam to reddish-brown fine loam extending to a depth of 36 inches or more. In some places a yellowish or grayish color prevails. The subsoil also frequently contains some mica and between 24 and 36 inches small gravel often occurs.

The Schuylkill fine sandy loam occurs as first bottom along the Schuylkill River and is of only limited extent. The largest occurrence extends from a point about 1½ miles south of Shoemakersville to practically the same distance north of Hamburg. In no place does the first bottom exceed one-half mile in width.

The type is alluvial in origin, having been carried down and deposited by the Schuylkill River in times of high water. The surface is nearly level, with a slight descent toward the stream. At the present time a portion of the type is overflowed each year and crops in the lowlands are sometimes damaged.

A large proportion of the Schuylkill fine sandy loam is under cultivation, being used chiefly for the regular farm crops of the area, and good yields are obtained. On account of its sandy nature it is easily tilled, early, and well adapted to truck growing, which industry could be profitably extended upon it. Near Reading the material from the sewage-disposal plant furnishes a fertilizer which could be used to advantage on this and other soils, though at present it is applied only to a very limited extent.

There are few, if any, farms located entirely upon this type. The land ranges in value from $40 to $150 an acre, depending on the location and improvements.

The following table shows the results of mechanical analyses of samples of the soil and subsoil of this type:

Mechanical analyses of Schuylkill fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
21882	Soil	0.2	0.7	1.9	23.1	19.7	38.0	16.4
21883	Subsoil	.0	.4	1.7	18.8	23.5	35.1	20.5

ROUGH STONY LAND.

Included under the head of Rough stony land are areas so steep, rocky, and broken that they are of little if any value for agricultural purposes. Several distinct soil formations are found within this type, but the similarity of conditions existing throughout these rocky regions warrants their classification under one head.

The largest area is found on the crest and extending down the slopes of Blue Mountain, which forms the northern boundary of the county. Here the rocks are chiefly Medina and Oneida sandstone and the slopes are very steep and rocky and wholly unfit for cultivated crops. The mountain is timbered chiefly with chestnut and should be permitted to remain in forest. Scattered over the South Mountains are a number of small areas of Rough stony land occupying the steep slopes and capping many of the hills and ridges. On some of the slopes the bowlders are from 6 to 10 feet in diameter, while on others there will be only a mass of small rocks. In places the bed rock may also outcrop. Over the South Mountains the rocks consist of gneiss, granite, and Potsdam sandstone, and the soil corresponds to that of the Chester stony loam and Dekalb stony loam types, but the topography is so broken and the surface so stony that its agricultural value is decidedly inferior to either of these types.

In the southern part of the county are other large areas of Rough stony land, and there the rock formation is the Triassic sandstone.

A few areas of Rough stony land have been cleared in various parts of the county and utilized for pasture, but most of the type is in forest, for which purpose it is best adapted and in which condition it should be allowed to remain.

MEADOW.

The areas mapped as Meadow occur as narrow strips of first bottom land along the smaller streams of the area, are subject to overflow in times of high water, and on account of poor drainage can seldom be used for cultivated crops.

In color and texture the soil is so variable that it could not be classed with any of the other types mapped. Along the streams in the Triassic formation of the south part of the county it has a tendency to be red in color, varying from a reddish gray to a dark brown. In texture it is usually somewhat sandy or gravelly, though in places it is very heavy. Throughout the limestone valleys the Meadow areas are more silty in texture and a more uniform brown color, though in extent very limited. Along the streams in the South Mountains the soil is often a medium loam containing considerable gritty material and the surface is often stony. Throughout the shale belt in the northern part of the county the soil is usually a brown silty or fine sandy loam. Here it sometimes has a slightly greasy feel, owing to the shale from which the material has been washed.

The material composing the Meadow is alluvial and colluvial in origin, having been washed down from the various formations through which the streams pass.

There is only a very little Meadow along the Schuylkill River. The texture of the first bottom land along this stream is more uniform, and has been mapped as Schuylkill fine sandy loam. No large areas of Meadow occur in the county, but most of the streams throughout a part of their course are bordered by narrow bands of such land. Most of the type is used for pasture, for which purpose it is best adapted.

SUMMARY.

Berks County lies in the southeastern part of Pennsylvania within the Piedmont Plateau and Limestone Valley provinces. It comprises an area of 586,240 acres, or 916 square miles. Reading, a city of about 96,000 population, 59 miles northwest of Philadelphia, is the county seat and an important manufacturing center.

In topography the county varies from broken and mountainous along the north border to gently and moderately rolling in the limestone valleys. Elevations range from 200 to 1,500 feet above sea level.

The Schuylkill River crosses the county from northwest to southeast and receives practically all the drainage waters.

The first settlement was made the latter part of the seventeenth century. Swedes, Germans, English, Irish, and Welsh were the nationalities represented, but the Germans predominated. Reading was laid out in 1748, and the county was established in 1752.

The county is now well supplied with railroads. Reading offers a good market for a large amount of produce, and the great centers of population of the East are within easy reach of this place.

The mean annual temperature is 51°, the average rainfall is 45.9 inches, and there is an average growing season of 183 days, practically free from killing frosts.

Agriculture is well developed and practically all parts of the area are thickly settled. General farming is practiced, the crops being corn, oats, wheat, and grass, and the farmers are in a prosperous condition. In the northern part of the county potatoes are grown extensively. Tobacco, rye, peas, and beans are produced in limited amounts.

Commercial fertilizers are used freely and those high in phosphoric acid give best results. Stable manure is also applied. Lime is used at the rate of from 50 to 100 bushels an acre, but from observations made it would seem that this amount should be reduced one-half.

Some cows are kept on all farms and dairying is an important industry, though it could be improved and developed to a much greater extent.

There are but few commercial orchards, yet portions of the county are well adapted to fruit growing, and there are excellent opportunities for the profitable extension of this industry. A small amount of trucking is done.

The average size of farms is 62½ acres. About 59 per cent of the farms are worked by their owners. The wage of farm labor ranges from $15 to $20 a month or from $1 to $1.25 a day.

Farm buildings are substantial and kept in good repair. There are many stone houses and barns, and the general appearance of the homesteads is that of thrift and prosperity.

Six soil series already established, one new series, and a number of miscellaneous soils were mapped in the county. In all, a total of 24 distinct types occur.

In the Hagerstown series, the soils of which are derived from limestone, we have the Hagerstown loam, clay loam, and stony loam. The loam forms the richest agricultural land of the county, while the other two are of but little importance, because of limited extent.

The Triassic sandstone and shale formations in the southern part of the county give rise to the Penn series, to which belong the Penn loam, clay loam, shale loam, gravelly sandy loam, and stony loam.

Where this formation has been metamorphosed the resulting soils are Lansdale silt loam and stony loam.

The Hudson River Shale, with the interbedded sandstone belt in the northern part of the area, weathers down into Berks shale loam, silt loam, and sandy loam.

In poorly drained depressions of this and the Triassic formation, Lickdale clay loam is found.

Over the region of the South Mountains there are two series: The Chester, coming from the gneiss rocks, giving Chester stony loam and Chester loam, and the Dekalb, derived from the Potsdam sandstone, giving rise to Dekalb stony loam and Dekalb loam.

Along the northern border of the Triassic formation a number of trap-rock dikes are found, and the soil from this source is Montalto stony loam, commonly called "Ironstone land."

The Potomac marble, also of limited extent, weathers down into the Athol loam.

The second bottom or terrace land was mapped Birdsboro silt loam, and the first bottom Schuylkill fine sandy loam.

The narrow areas of poorly drained land along the minor streams of the county were mapped as Meadow.

Rough, steep, and rocky areas, found in various parts of the survey, were classed as Rough stony land.

While general farming is practiced on all of the soils, the Hagerstown loam, Penn loam, and Berks silt loam may be considered the best for ordinary farm crops. The Berks shale loam is especially adapted to potatoes. For the developing of the fruit industry Chester stony loam, Montalto stony loam, Berks shale loam, and Penn shale loam are considered superior to other types found in Berks County.

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