Geology and Ground-Water Resources of the Prestonsburg Quadrangle Kentucky

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By William E. Price, Jr.

ABSTRACT

The Prestonsburg quadrangle has an area of 60 square miles in the northern part of Floyd County, in the Eastern Kentucky Coal Field. Two industries, and probably all rural families, depend on ground water for part of their water supply. Two public water supplies are obtained from surface water.

Most wells in the area yield from 1 to 10 gpm (gallons per minute). Most shallow wells yield fresh water, but those drilled in certain areas may yield salty water. Well waters average 57°F in temperature. Shallow dug wells show a wider seasonal range of temperature than drilled wells.

Most wells in the Breathitt formation of Pennsylvanian age and in the valley alluvium of Quaternary age yield fresh water. Wells penetrating the Lee formation and other rocks older than the Breathitt formation, with one known exception in the Lee formation, have yielded only salty water.

The Breathitt formation consists mainly of sandstones, shales, and coal seams; and all yield water. Almost all drilled wells obtain water from the Breathitt formation, as it crops out in most of the area; however, it is concealed by alluvium along the Levisa Fork of the Big Sandy River and its tributaries. All the wells inventoried in the Breathitt formation were reported adequate for domestic use, but probably none would be adequate for large public or industrial supplies. The highest yielding wells obtain water from vertical and horizontal joints, which are most common in sandstone. Waters from the Breathitt formation differ greatly in chemical composition, but in most places they are suitable for domestic, stock, and certain industrial uses. Waters range from soft to hard, and all contain undesirable amounts of iron. Wells yielding salty water from the Breathitt formation are present throughout the area. Salty water at shallow depths is particularly troublesome to well owners in Auxier and in the valley of Middle Creek west of Prestonsburg.

Quaternary alluvium in the area consists mostly of clay, silt, and fine sand, although some medium to coarse sand and gravel are present. In most places dug wells in the alluvium supply enough water for domestic use, but they may fail during times of drought. The waters are generally softer than those from the Breathitt formation but may contain either greater or smaller amounts of iron. Water from the alluvium is suitable for domestic or stock use.

INTRODUCTION

SCOPE AND PURPOSE OF INVESTIGATION

The importance of ground water as a natural resource has been recognized now by the public. The growth of cities, rapid industrial expansion, use of supplemental irrigation, and modernization of homes have increased the demand on existing ground-water supplies

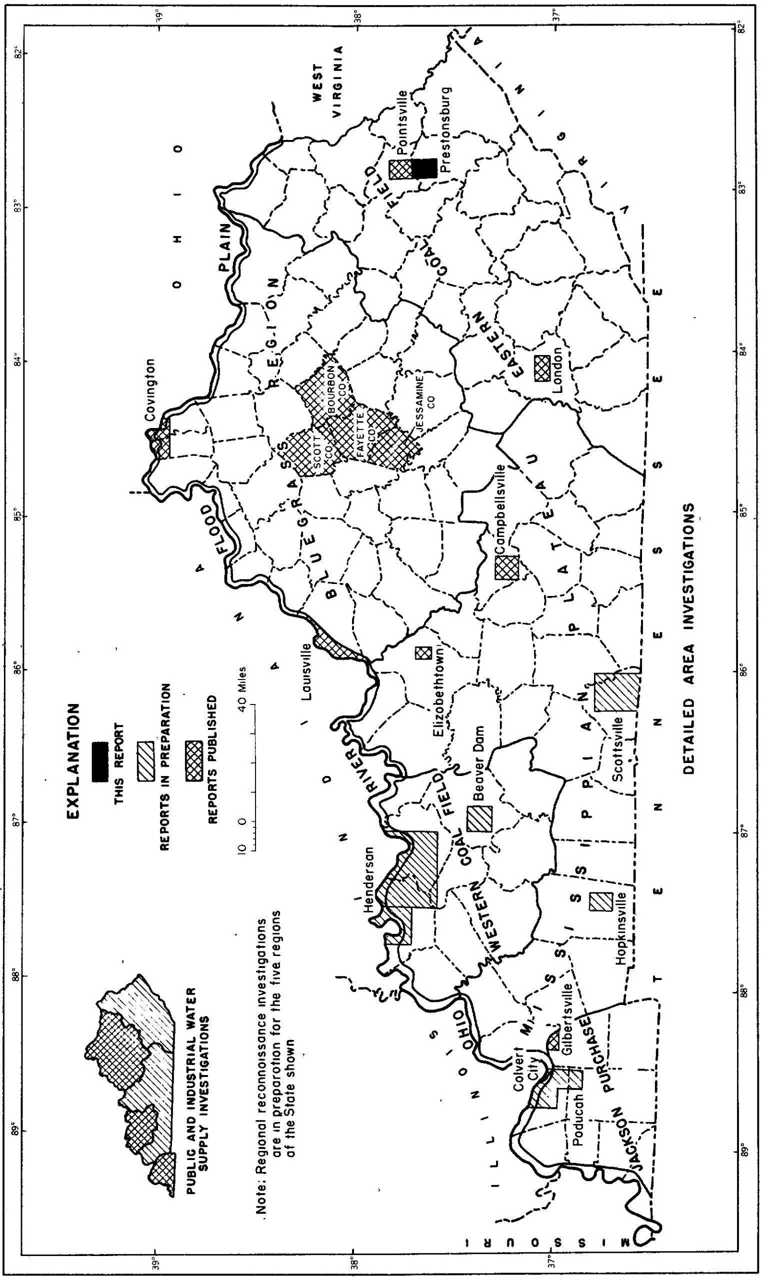

Figure 1. — Index map of Kentucky showing progress of ground-water investigations.

and have encouraged the development of new supplies. Because of the need for more information on the ground-water resources of the State, the Agricultural and Industrial Development Board of Kentucky and the United States Geological Survey established a cooperative program of ground-water investigations.

For convenience in making ground-water investigations Kentucky has been divided into five regions: Eastern Coal Field, Blue Grass Region, Mississippian Plateau, Western Coal Field, and Jackson Purchase. The boundaries of these regions, shown in figure 1, do not follow geologic divisions exactly but are made to coincide with county lines.

The purpose of the studies in the Prestonsburg quadrangle and the Paintsville area was to get detailed information on the occurrence, quantity, and quality of ground water in small areas typical of the Eastern Coal Field. This information will be of value not only to the people within the small areas studied but will serve as a basis for further ground-water investigations in the Eastern Coal Field.

The results of the study in the Paintsville area have been described in an earlier report (Baker, 1955).

Figure 1 shows the areas in Kentucky where ground-water reports have already been made and areas where work is in progress. The ground-water investigations are under the general direction of A. N. Sayre, chief of the Ground Water Branch of the U. S. Geological Survey. Work in Kentucky is under the management of M. I. Rorabaugh, district engineer, Louisville. Fieldwork was done under the supervision of E. H. Walker, geologist, Louisville, Ky., and the report was written under the supervision of G. E. Hendrickson, geologist, Louisville, Ky. Tests of rock samples were made under the guidance of A. I. Johnson, chief, Lincoln Hydrologic Laboratory, Lincoln, Nebr. Chemical analyses were made under the guidance of W. L. Lamar, district chemist, Quality of Water Branch, U. S. Geological Survey, Columbus, Ohio.

WELL-NUMBERING SYSTEM

Well, springs, and water-yielding coal mines inventoried by the U. S. Geological Survey in Kentucky are numbered according to a grid system of meridians 5 minutes apart and parallels 5 minutes apart. Numbers consist of three parts: the first four digits are the degrees and minutes of the meridian at the east side of the 5-minute quadrangle, the second four digits are the degrees and minutes of the parallel at the south side of the 5-minute quadrangle, and the third is the number assigned to the well, spring, or coal mine as each is inventoried. Thus, well 8245-3740-1 in the sketch (fig. 2) is the first well inventoried in the 5-minute quadrangle west of longitude 82°45' W. and north of latitude 37°40' N. The next well inventoried in that 5-minute quadrangle would be designated 8245-3740-2, and so on.

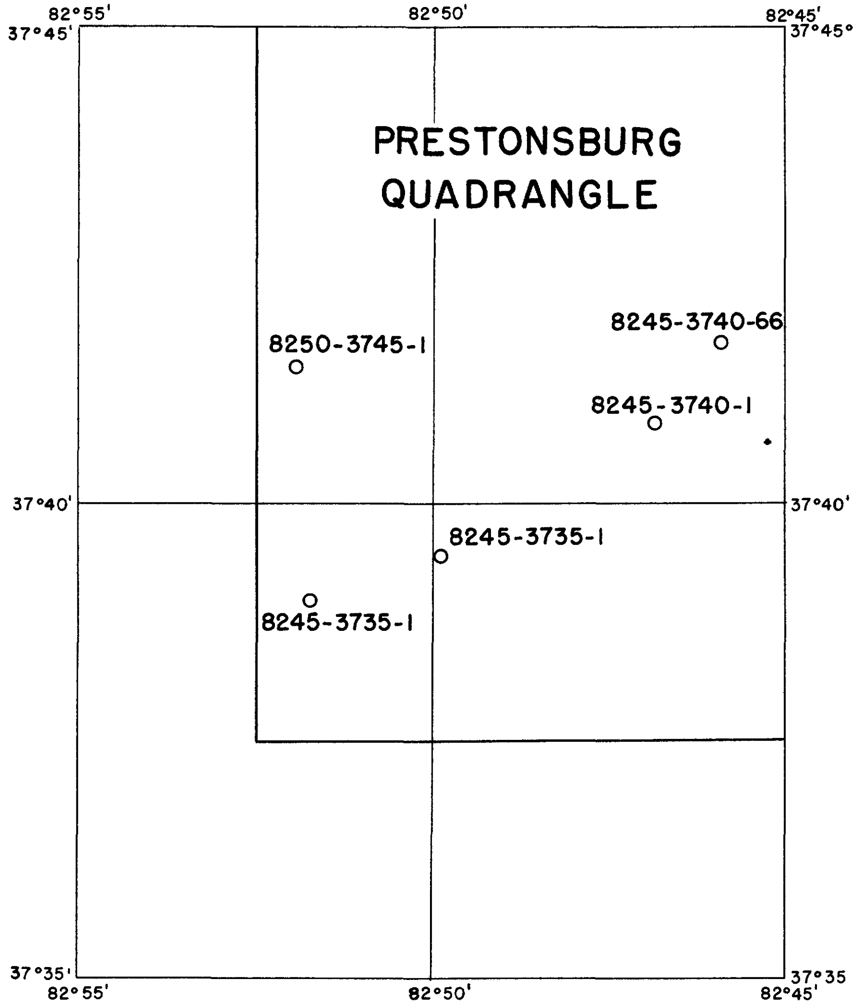

Figure 2.—Sketch showing well-numbering system.

METHODS OF STUDY

Fieldwork in the Prestonsburg quadrangle was begun in August 1950 and was completed in December 1952. The areal geology and the near-surface rock structure were mapped. Detailed information or lithology was obtained from two measured sections and from sample cuttings from several wells. Records of 157 deep gas, oil, and test wells were examined to determine the nature of the subsurface formations and their water-bearing properties; records of core holes and bridge-pier excavations provided additional information. An inventory was made of all drilled wells and some dug wells, springs, and coal mines yielding water. The inventory included 281 wells, springs, and mines. The location of these is shown on plate 1. The water levels of 8 observation wells were measured by a steel tape every 2 weeks. Recording gages made a continuous record of water-level fluctuations in 3 other wells. Transmissibility tests provided information on potential well yields. Sixty-one samples of water were collected for chemical analysis. Water temperatures were measured biweekly in 5 wells.

ACKNOWLEDGMENTS

The author acknowledges the help of residents and well drillers in the area who supplied much of the data about wells and springs. D. M. Young, formerly of the Kentucky-West Virginia Gas Co., Phillip Jenkins, of the Kentucky-West Virginia Gas Co., and R. N. Thomas, of the Inland Gas Corp., provided logs of gas wells and other subsurface information. Richard Davis, superintendent of the Prestonsburg gas and waterworks, supplied useful information on wells in the city and on municipal pumpage from the river. Claude Music, owner of the Auxier water supply, provided data on wells in the area and on the surface-water supply for that town.

GEOGRAPHY

LOCATION AND EXTENT OF AREA

The Prestonsburg quadrangle is in eastern Kentucky and lies between longitudes 82°45' and 82°52'30'' W. and between latitudes 37°37'30'' and 37°45' N. (fig. 1); its area is 60 square miles. Included in the quadrangle is a part of northern Floyd County and a wedge-shaped strip, 6 miles long and from ¼ to 2 miles wide, of southern Johnson County. Prestonsburg, the county seat of Floyd County, lies in the east-central part of the quadrangle where Middle Creek and Abbott Creek join the Levisa Fork of the Big Sandy River.

TOPOGRAPHY AND DRAINAGE

The topography of the Prestonsburg quadrangle is typical of the maturely dissected unglaciated Allegheny Plateau. The irregular surface has narrow winding ridges and deep steep-sided valleys. Most of the higher ridges are about 1,200 to 1,300 feet in altitude and represent the remnants of an old plateau surface. Virtually, the only flat land is in valley floors, which lie 600 feet to 700 feet above mean sea level. Altitudes range from 580 feet in the valley of the Levisa Fork at East Point to more than 1,450 feet on a hilltop 2 miles northeast of Prestonsburg.

The Prestonsburg quadrangle is drained by the Levisa Fork of the Big Sandy River and the fork's major tributaries, some of which are Bull Creek, Middle Creek, Abbott Creek, Little Paint Creek, and Johns Creek. The Levisa Fork flows northward along the eastern portion of the area and merges with the Tug Fork at Louisa, Ky., to form the Big Sandy River, a tributary to the Ohio River. Many small forks and branches emptying into the creeks of the area complete the dendritic drainage pattern.

CLIMATE

Records of nearby Weather Bureau stations indicate that the Prestonsburg quadrangle has a moderate, humid climate. The Weather Bureau has maintained precipitation gages at Dewey Dam, about 6 air-line miles northeast of Prestonsburg, since 1951; at Allen, about 5 air-line miles southeast of Prestonsburg, since 1940; and at Paintsville, about 10 air-line miles north of Prestonsburg, since 1933. Monthly temperatures have been recorded at Pikeville, about 19 air-line miles southeast of Prestonsburg, since 1936.

The average annual precipitation of 45.31 inches, recorded at Paintsville, is fairly well distributed throughout the year. The precipitation has varied from a minimum of 33.47 inches in 1941 to a maximum of 63.11 inches in 1950. October and November, which have average precipitations of 1.98 and 2.74 inches, respectively, are the two driest months of the year. July, the wettest month of the year, has an average of 4.89 inches of rainfall.

The average annual temperature at Pikeville is 57.8°F. The lowest temperature recorded was -5°F in January 1940 (and in two unrecorded months in 1900 and 1936), and the highest was 104°F in July 1952. The average length of the growing season is 175 days; the last killing frost occurs about April 25, and the first about October 15.

DEVELOPMENT

Prestonsburg has a population of 3,585 (1950 census) and is the largest town in the area. Smaller communities are East Point, Auxier, Bonanza, Myrtle, Dotson, and Watergap.

The region is served by a railway and surfaced roads. The Chesapeake & Ohio Railway Co. supplies regular passenger and freight service north and south along the valley of the Levisa Fork. A branch line runs southwestward from Prestonsburg to serve the Princess Elkhorn Coal Co. at David, Ky. Hard-surfaced roads in the area are U. S. Highway 23 which leads north to Paintsville and south to Pikeville and Kentucky Highway 114 which leads west to Salyersville. Gravel roads serve the small communities of Auxier, Bonanza, and Watergap. Barges once transported supplies along the Big Sandy River from Catlettsburg to Pikeville, but development of the railroad and improvement of roads made water transportation uneconomical.

Farming is on a subsistence basis, as cultivation is restricted to the valleys and the more gentle hillside slopes. Corn is the leading crop, and hay (alfalfa is the major variety) is second in importance. Other products are potatoes, small grains, and sorghum. Cattle are the principal livestock; but horses, hogs, sheep, poultry, and bees are also raised.

In addition to soil, natural resources of the area are timber, coal, gas, oil, claystone, sandstone, and water. Timber, predominantly second- and third-growth hardwoods, covers most hills. Small mills saw timber cut in this area and surrounding areas. Several coal seams have been mined, the most important of which is the Elkhorn No. 3 (Van Lear) coal. Production has declined over the years, and now only a little truck mining is carried on. The region is part of the Big Sandy gas field, and at least 170 gas, oil, and test wells have been drilled. Formations ranging in age from Silurian to Pennsylvanian produce gas, but most of the oil and gas has come from the Maxon sand (of drillers) of Mississippian age and the Brown shale (of drillers) of Devonian age. An oil well northeast of Prestonsburg is reported to produce 6 barrels of oil a day from the Mississippian Big Lime (of drillers). Claystones of possible commercial importance are still undeveloped. Many small sandstone quarries have been opened up and the crushed sandstone used in road construction. None of these quarries are operating now.

Public and industrial water supplies are obtained mainly from streams; most domestic water supplies are obtained from wells. The city of Prestonsburg pumps water from the Levisa Fork, and during 1951 distributed an estimated 74 million gallons to about

3,625 people. The average usage was 56 gpd (gallons per day) per person. In 1951, 59 million gallons was pumped for domestic use, more than 3 million gallons was pumped for industrial and commerical use, and an estimated 12 million gallons was used for public purposes or lost through leakage and waste. Auxier is supplied with untreated water from the Levisa Fork by a privately owned company. During 1951, 5.5 million gallons was pumped to supply an estimated 210 people. Drinking and cooking water is carried from a public-supply well near the Chesapeake & Ohio Railway Co. depot. Families not supplied with river water obtain water from privately owned wells. The Inland Gas Corp. pressure station on the Bob Fitzpatrick Branch of Middle Creek uses an estimated 1.8 million gallons of water per year for cooling. Water piped down from the branch is used about 10½ months of each year. During the rest of the time, when the branch fails to supply enough water, a well is used. The Columbia Fuel Corp. pressure station near Watergap pumps at least 1.7 million gallons of water per year for cooling. Water is pumped from Bull Creek about 10 months each year. When the creek fails to supply enough water, wells are used. Individual domestic supplies are from ground water, augmented in a few places by rainwater stored in cisterns. Stock water is obtained mostly from streams, but in some places it is taken from wells and springs.

GEOLOGY

AREAL GEOLOGY

The Breathitt formation of Carboniferous (Pennsylvanian) age and alluvium of Quaternary age are exposed in the Prestonsburg quadrangle. The Breathitt formation crops out in the uplands and constitutes about 90 percent of the land area. The alluvium fills valleys cut in the Breathitt formation and forms a dendritic pattern in the quadrangle. The largest exposures of alluvium are in the valley of the Levisa Fork in the northeast and north-central parts of the area. Plate 2 shows the areal distribution of these two formations.

GEOLOGIC HISTORY

The following description of the geologic history of the Pennsylvanian Breathitt formation and the Quaternary alluvium is based on the published works of McFarlan (1943) and Wanless (1939, 1946).

During Pennsylvanian time, streams flowing from the north or northeast deposited large quantities of sands, silts, and clays over a large area including what is now the Prestonsburg quadrangle. The area was a delta plain fronting a sea, and had lakes, marshes, lagoons, and shifting channels for the discharge of the streams. Variations in climate, movements of the earth's crust, or changes in the environment of deposition (such as might be caused in the Mississippi River delta of today by the shift of river discharge from one subdelta to another), caused alternate deposition of masses of sands, clays, and silts. Luxuriant growths of trees and climbing lianas in the low swampy areas developed thick accumulations of organic matter. Small changes in sea level caused the invasion of sea water and the formation of limy material and marine muds. The sediments hardened sometime after their deposition. The sands became sandstones, the clays and silts became claystones and siltstones, and the thick accumulations of organic matter became coal beds. The marine limes and muds formed limestones and shales. Possibly rocks younger than Pennsylvanian and older than Quaternary were also deposited; if so, they were removed subsequently.

At the close of the Pennsylvanian period the area was uplifted, and erosion reduced it to a gently rolling plain not far above sea level. Renewed uplift raised the plain to a height well above sea level. Erosion then lowered the plain to the altitude of the present hilltops and cut the present valleys.

Toward the end of the Quaternary period, during the ice age, the Levisa Fork and its tributaries flowed on bedrock, at lower elevations than their present channels. As the glacier covering most of Ohio receded, melt water heavily loaded with sand and gravel built up the alluvium in the Ohio River valley, ponding tributaries entering the river from the south. Thus, the Levisa Fork and its tributaries filled their valleys with the typically fine-grained sediments supplied by their drainage areas. After alluviation of the Ohio River valley ceased, the Ohio River and its tributaries cut down through the alluvium. Thus the present low water level in the Levisa Fork, in most places in the Prestonsburg quadrangle is 40 to 45 feet below the top of the valley fill.

GROUND WATER

SOURCE

Ground water, the water from beneath the surface that supplies wells and springs, is derived almost entirely from local precipitation in the form of rain or snow. Part of the water that falls as rain or snow runs off directly over the land surface to streams; part of it percolates downward into the soil where it is stored and whence it is later transpired by plants or evaporated. The water that escapes runoff, transpiration, and evaporation percolates downward through the soil and underlying strata until it reaches the water table, where it joins the body of ground water in the zone of saturation.

Some idea of the quantities of water discharged by stream runoff, evaporation, and transpiration in the Prestonsburg quadrangle may be gained from streamflow records at Paintsville and from precipitation records in the Levisa Fork drainage basin. Records from 1934 to 1951 show that about 44.6 inches of precipitation fall in an average year; and 15.3 inches of the precipitation is discharged by streams. This includes water that has reached the ground-water reservoirs and has been discharged by seepage into the streams. In the average year the remainder of the precipitation, 29.3 inches, is discharged by evaporation and transpiration. Figure 3 shows the amount of precipitation discharged by runoff and by evapotranspiration during each year from 1934 to 1951. In general, the amount of water discharged by runoff each year varies more than does the amount of water discharged by evapotranspiration. The quantity of water gained or lost through changes in ground-

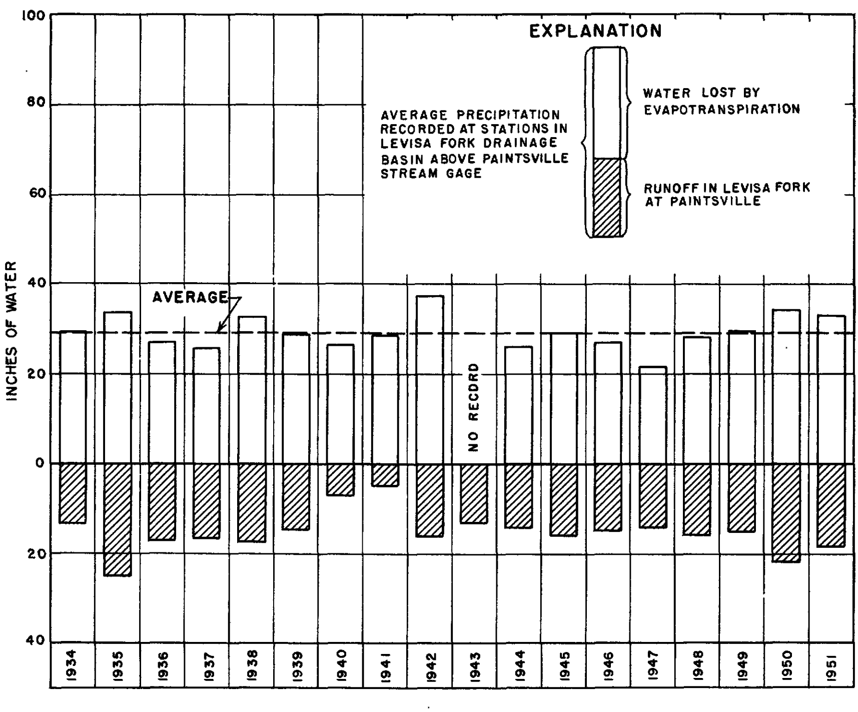

Figure 3. —Graph showing amount of precipitation discharged as runoff and as evapotranspiration.

water storage is divided between evapotranspiration and runoff, but it is small in relation to the total quantities of evapotranspiration and runoff. Probably the variations in evapotranspiration shown in figure 3 would be smaller if more precipitation stations with longer records were present in the Levisa Fork drainage basin.

OCCURRENCE

The rocks that form the outer crust of the earth are generally not solid throughout, but contain numerous open spaces. The properties of the open spaces control the amount of water that can be stored in the spaces, and the rates at which the water can be replenished and yielded to wells and springs. Open spaces between particles of gravel, sand, silt, and clay are called primary openings because they were formed when the sediments were deposited. Fractures, such as joints, in the rocks are called secondary openings because they were formed after the loose materials were wholly or partly consolidated.

The amount of water that can be stored in any rock depends upon the volume of open spaces in the rock—that is, the porosity of the rock. Porosity is expressed as the percentage of the total volume of the rock that is occupied by open spaces. Some factors controlling the porosity of sedimentary rocks are (1) the shape of the grains making up the rock, (2) how thoroughly these grains have been sorted, (3) the cementation and compaction of the rock since its deposition, and (4) the presence of joints and other fractures in the rock.

1. Grains forming sedimentary rocks differ considerably in shape. Microscopic examination of particles from both consolidated and unconsolidated sediments in the Prestonsburg quadrangle shows that most of the grains are angular and subangular in shape. In many cases the porosity of a deposit is increased by the irregular angular shapes of its particles.

2. How well the particles of a rock have been sorted has an important effect on the porosity of the rock. The grains of a well-sorted sediment are all about the same size, whereas the grains of a poorly sorted sediment are of many different sizes. Poorly sorted deposits store less water than well-sorted deposits because in poorly sorted deposits small grains fill the spaces between large grains, thus reducing the amount of open space. Mechanical analyses of samples of alluvium from the Prestonsburg quadrangle and microscopic study of sandstones from the Breathitt formation elsewhere indicate that the sorting of most sediments in the Prestonsburg quadrangle ranges from fair to good.

3. Cementation and compaction reduce the porosity of a rock. The percentage of cementing material in the rocks of the Prestonsburg quadrangle differs greatly from place to place, but they all have been well compacted since deposition. The alluvium, on the other hand, contains little or no cement and is probably not as well compacted.

4. Rocks of the area contain vertical and horizontal joints. Probably the joints store smaller quantities of water than do pore spaces between rock grains.

The capacity of a rock to hold water is determined by its porosity, but its capacity to yield water is determined by its permeability. The permeability of a rock is its capacity for transmitting water, and it is defined as the amount of water, in gallons per day, that will flow through a cross-sectional area of 1 square foot under a hydraulic gradient of 100 percent (loss of 1 foot in head for each foot the water travels) at a temperature of 60° F. The field coefficient of permeability can be defined as the number of gallons of water a day that percolates, at the prevailing temperature of the ground water, through each mile of the water-bearing bed under investigation (measured at right angles to the direction of flow) for each foot of thickness of the bed and for each foot per mile of hydraulic gradient. The field coefficient of permeability multiplied by the thickness of the saturated part of the water-bearing bed in feet gives the coefficient of transmissibility in gallons per day per foot. Rocks that will not transmit water are said to be impermeable. Some deposits in the Prestonsburg quadrangle, such as well-sorted silts or siltstones and clays or claystones, have a high porosity, but because of the minute size of the pores will transmit water only very slowly, if at all. Other deposits in the area, such as well-sorted sands or sandstones containing larger openings that communicate more or less freely with one another, will transmit water more readily.

Part of the water in any deposit is not available to wells because it is held against the force of gravity by the cohesion of the water itself and by its adhesion to the walls of the pores. The ratio of the volume of water that a rock will yield by gravity, after being saturated, to its own volume is known as the specific yield of the rock. The ratio of the volume of water that a rock will retain against gravity, after being saturated, to its own volume is known as the specific retention of the rock. Together these two quantities add up to the porosity. As most of the sediments in the Prestonsburg quadrangle are fine grained, the quantity of water they will yield by gravity from primary pore spaces is only a small fraction of the quantity of water stored in the rocks.

The water table is the upper surface of the zone of saturation in ordinary porous rock. The water table is not a plane surface but slopes from areas of recharge to areas of discharge. The water table does not remain stationary but fluctuates in response to additions to or withdrawals from water in storage. Ground water occurs under water-table conditions rather than artesian conditions in most places in the Prestonsburg quadrangle.

Artesian or confined conditions exist where the upper limit of the zone of saturation is determined by an overlying impermeable bed. Water enters the aquifer at its outcrop and percolates slowly downward to the water table and then laterally in the water-bearing bed beneath the overlying confining bed. Down the dip from the outcrop area the water exerts pressure against the confining bed, so that when a well is drilled through the confining bed the pressure is released, and the water rises above the zone of saturation. In some places in the Prestonsburg quadrangle water is found under local artesian conditions.

MOVEMENT

Practically all ground water suitable for ordinary uses moves through the ground from a place of intake or recharge to a place of outlet or discharge. The rate of movement differs considerably from one area to another, but velocities of a few tens to a few hundreds of feet a year probably are most common under natural conditions.

RECHARGE

Recharge is the addition of water to the underground reservoir. Formations in the Prestonsburg quadrangle are recharged directly by precipitation, by influent seepage from streams, or by percolation of water from adjacent formations.

Recharge by precipitation involves three steps: infiltration of the water into the soil zone, downward movement of the water through an underlying zone of aeration, and addition of the water to the zone of saturation. Because nearly all plants draw their water from the soil zone, and because water must pass through this zone before it recharges the ground-water reservoir, less water reaches the zone of saturation in the Prestonsburg quadrangle during the summer when plants are growing than during the winter when plants are dormant.

A stream, when above water-table level during times of flood, supplies water to the underground reservoir, if the material between the stream channel and the water table is sufficiently permeable to let water percolate from the stream. Much of this water percolates back into the stream rather quickly after its level falls.

If two formations are adjacent, the water from one may percolate into the other. For instance, where joints in the Breathitt formation are in contact with the alluvium, and water enters the joints some place above the alluvium, water may percolate into the alluvium from the joints. Probably most of the discharge of ground water from the Breathitt formation occurs in this way.

DISCHARGE

Ground-water discharge is the release of water directly from the zone of saturation or from the overlying capillary fringe, in which water is held above the water table against the force of gravity by molecular attraction. Discharge takes place through evaporation and transpiration, seepage into streams, percolation of water from one formation into another, and withdrawal of water from wells.

Small quantities of ground water are discharged by transpiration and evaporation in the Prestonsburg quadrangle. Plants transpire ground water where the zone of saturation or the capillary fringe is within the reach of plant roots. Both transpiration and evaporation of ground water takes place where the water table is shallow, such as along the banks of streams or in swampy areas. By far the greatest part of the water in the Prestonsburg quadrangle that is transpired or evaporated is soil moisture rather than ground water.

Most ground water in the area is discharged to streams, partly through springs but mostly as seepage from the alluvium. During times of drought streamflow is maintained almost entirely by natural discharge from the ground-water reservoir.

If two units, such as the Breathitt formation and the alluvium, are connected, then water may be discharged from the one having the greater hydraulic head. Except in time of flood, water is discharged from the Breathitt formation to the alluvium and thence to the streams.

The amount of water drawn from wells is very small compared to that disposed of through natural discharge.

RECOVERY

Ground water is recovered from wells penetrating the zone of saturation, from springs developed at the outcrop of an aquifer, or from coal mines.

Most wells in the Prestonsburg quadrangle are dug or drilled, but one bored well was inventoried. Most dug wells are shallow and obtain their water from silts, sands, and gravel in the valley alluvium; some penetrate weathered bedrock of the Breathitt formation. Most dug wells are constructed with hand tools and walled with rock. If in digging a well little or no water is encountered in the mantle of weathered bedrock or in the alluvium, a hole may be drilled in the rock bottom with a hand drill. One well inventoried was dug through solid rock by using blasting powder.

Drilled wells are gradually replacing dug wells because drilled wells give a more dependable water supply and are less subject to pollution. Drilled wells are constructed with a cable-tool rig mounted on a truck. Usually, the driller, after having penetrated the overburden, drives his casing a foot or two into the rock and then continues to drill until the first adequate supply of water is struck. Sometimes where water of poor quality is struck at a relatively shallow depth, the driller cases off the poor water and then drills deeper to obtain a water supply of better quality. Drilled wells are rarely finished in alluvium. Drillers in the area do not screen wells, and it has been found by experience that open-end drilled wells in alluvium fill up with sand, thus reducing the yield and effective depth of the well. The owners of two wells drilled in alluvium poured gravel into the bottoms of the wells to prevent the sand from heaving up, but their attempts were only partly successful.

Water is drawn from wells by a variety of means. Most dug wells are equipped with a bucket, although pumps are used in some. Of the drilled wells inventoried, 40 percent were equipped with hand bailers, the most common way of drawing water; and 10 percent were equipped with hand-operated lift pumps. Jet pumps, the most popular type of power pump, were used on 29 percent of the drilled wells; and 5 percent of the drilled wells were equipped with power-operated lift pumps. The remainder of the wells had no equipment for drawing water. Many of the wells in this group are filled in or do not have potable water. Thus, 41 percent of the used drilled wells in the area have power pumps. Motors on the lift and jet pumps range from $\frac{1}{4}$ to $1\frac{1}{2}$ horsepower, and $\frac{1}{2}$ horsepower motors are the most common.

Table 1.—*Chemical analyses of water from wells, springs,*

Well no.: c, aluminum (Al), 74.
Depth of well: r, reported.

[Dissolved constituents given in parts per

Well no.	Depth of well (feet)	Geologic unit	Date of collection	Temperature (°F)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)
Wells									
8245-3735-4	49	Breathitt..	Dec. 19, 1950	56		8.0			
5	100	do	July 21, 1952	59		.79			
6	100	do	Dec. 22, 1950	59		.63			
			Dec. 4, 1952						
7	69	do	Dec. 19, 1950	51		28			
8	r100	do	Dec. 4, 1952						
23	60	do	Dec. 8, 1952						
24	126	do	Dec. 4, 1952						
30	58	do	Sept. 27, 1951	60	31	2.4	0.00	42	12
33	62	do	Dec. 8, 1952						
42	91	do	Sept. 27, 1951	59	20	6.5	12	248	119
56	44	do	Aug. 20, 1952	58	11	.65	.00	6.8	2.4
57	51	do	Dec. 5, 1952						
8245-3740-8	68	Breathitt?.	Dec. 14, 1950	56		1.5			
13	43	Breathitt..	do	57		2.2			
14	29	do	Feb. 15, 1951	55		4.9			
15	49	do	do	54		4.0			
16	12	do	Dec. 14, 1950	55		.48			
20	88	do	Dec. 24, 1950	55		1.2			
30	40	do	Dec. 4, 1952						
93	71	do	Dec. 5, 1952						
			do						
94	67	do	Dec. 9, 1952						
96	43	Alluvium	July 2, 1952	60		28			
97	36	Breathitt..	Dec. 5, 1952						
102	r60+	do	do						
103	r71	do	do						
106	r100+	do	do						
107	r108	do	do						
108	59	Alluvium	Oct. 8, 1952	58	14	51	36	26	8.0
109	99	Breathitt..	Dec. 4, 1952						
110	r94	do	Dec. 5, 1952						
111		do	do						
112	93	do	do						
113	100	do	Dec. 4, 1952						
122	r130	do	do						
128	50	do	July 3, 1952	58		4.3			
130	44	do	do	64		.42			
132	42	do	do	54	9.5	.52	.04	13	2.9
135	r60	do	Mar. 12, 1952	63	18	28	.00	16	6.3
142	42	do	Dec. 8, 1952						
146	r71	do	July 24, 1952	60		5.3			
156	127	do	do	57		.56			
157	r63	do	Dec. 8, 1952						
163	98	do	July, 11, 1952	59		1.7			
			Dec. 4, 1952						
171	144	do	Jan. 26, 1951	53		.76			
	785	Lee	Feb. 13, 1951	58		4.5			
8250-3735-16	81	Breathitt..	Aug. 20, 1952	58	13	6.6	.00	144	32
8250-3740-2	r72	do	July 25, 1952	65		.41			
7	9	do	Dec. 19, 1950	47		.29			
8	105	do	July 25, 1952	57	19	.40	.00	5.6	2.2
14	39	do	July 22, 1952	55		6.0			
17	52	do	July 24, 1952	52	27	2.6	.00	30	8.0
18	20	Alluvium	July 22, 1952	58		.25			

and mines in the Prestonsburg quadrangle, Kentucky

Bicarbonate: a, total acidity as H_2SO_4, 560 ppm.
b, total acidity as H_2SO_4, 1,661 ppm.

million. For location of wells, see plate 1]

Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$			Specific conductance at 25°C (micromhos)	pH
								Total	Carbonate	Noncarbonate		
Wells												
...	...	132	1	5	0.5	0.5	...	58	...	...	385	...
...	...	81	2.1	8.0	.0	.1	...	28	...	...	143	...
...	...	409	2	413	.7	.2	...	216	...	...	1,820	...
...	...	...	...	192	...	...	...	...	...	...	...	...
...	...	25	44	3	.0	.5	...	59	...	...	163	...
...	...	...	...	1,680	...	...	...	...	...	...	...	...
...	...	...	...	370	...	...	...	...	...	...	...	...
...	...	...	...	3,420	...	...	...	...	...	...	...	...
18	2.9	228	6.5	7.5	.1	.4	230	154	154	0	376	7.1
...	...	...	...	545	...	...	...	...	...	...	...	...
16	6.1	42	1,100	2.5	.6	.8	1,650	1,110	36	1,074	1,650	6.5
82	2.8	252	.7	4.2	.7	.4	238	27	27	0	399	7.2
...	...	...	...	330	...	...	...	...	...	...	...	...
...	...	82	63	89	.0	45	...	91	...	...	596	...
...	...	98	74	2	.1	.2	...	135	...	...	327	...
...	...	176	38	1.9	.2	.3	...	136	...	...	331	...
...	...	194	7.8	1.2	.3	.1	...	87	...	...	304	...
...	...	190	74	2	.0	.0	...	201	...	...	446	...
...	...	179	47	3	.2	1.5	...	185	...	...	375	...
...	...	...	...	13	...	...	...	...	...	...	...	...
...	...	...	...	860	...	...	...	...	...	...	...	...
...	...	...	...	900	...	...	...	...	...	...	...	...
...	...	...	...	34	...	...	...	...	...	...	...	...
...	...	78	3.3	10	.1	.2	...	60	...	...	156	...
...	...	...	...	46	...	...	...	...	...	...	...	...
...	...	...	...	25	...	...	...	...	...	...	...	...
...	...	...	...	32	...	...	...	...	...	...	...	...
...	...	...	...	600	...	...	...	...	...	...	...	...
...	...	...	...	1,000	...	...	...	...	...	...	...	...
28	2.3	248	7.3	8.0	.4	.2	284	98	...	...	426	6.6
...	...	...	...	3,380	...	...	...	...	...	...	...	...
...	...	...	...	1,550	...	...	...	...	...	...	...	...
...	...	...	...	158	...	...	...	...	...	...	...	...
...	...	...	...	760	...	...	...	...	...	...	...	...
...	...	...	...	3,500	...	...	...	...	...	...	...	...
...	...	...	...	4,100	...	...	...	...	...	...	...	...
...	...	162	16	5.0	.2	.2	...	116	...	...	311	...
...	...	254	.6	23	.6	.2	...	46	...	...	423	...
70	1.3	207	4.4	17	.5	1.4	228	44	44	0	385	7.4
51	.5	152	2.5	39	.2	.1	209	65	65	0	389	6.9
...	...	...	...	152	...	...	...	...	...	...	...	...
...	...	183	24	6.0	.1	1.7	...	134	...	...	336	...
...	...	396	2.1	945	.5	.2	...	112	...	...	3,260	...
...	...	...	...	20	...	...	...	...	...	...	...	...
...	...	286	4.1	3,900	.0	.2	...	900	...	...	10,700	...
...	...	...	...	4,050	...	...	...	...	...	...	...	...
...	...	226	8.6	166	.2	2.7	...	143	...	...	1,030	...
...	...	425	8.1	17,200	.3	...	...	3,780	...	...	42,410	...
558	22	216	1.5	1,080	.1	.5	2,080	490	176	314	3,690	7.0
...	...	260	2.1	265	.3	.3	...	110	...	...	1,220	...
...	...	14	23	2	.0	10	...	41	...	...	114	...
111	3.7	261	3.8	38	.4	.0	315	23	23	0	518	7.3
...	...	94	28	3.5	.1	1.7	...	82	...	...	208	...
22	4.0	186	3.8	3.8	.1	.2	173	109	109	0	296	7.3
...	...	78	17	28	.0	9.9	...	82	...	...	266	...

Table 1.—*Chemical analyses of water from wells, springs, and*

Well no.	Depth of well (feet)	Geologic unit	Date of collection	Temperature (°F)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)
			Springs						
8245-3735-62	....	Breathitt..	July 11, 1952	64	....	113	....	....	....
63	....	......do....	July 14, 1952	74	....	157	....	....	....
8250-3735-19	....	Alluvium..	Feb. 15, 1951	39	....	1.1	....	....	....
20	....	......do....	Feb. 15, 1952	44	....	.65	....	....	....
			Coal mines						
8245-3735-64c	....	Breathitt..	Dec. 14, 1950	40	60	233	8.9	224	177
8245-3740-164	....	......do....	July 2, 1952	62	9.2	.35	.00	19	17

Most springs in the Breathitt formation are utilized by constructing a retaining wall of rock or brick and piping the water to the house by gravity. Many springs in the alluvium are utilized for domestic or stock use by digging a small gathering pit beneath the point of issuance. At one home water issuing from a small coal mine is used. The entrance to the mine is sealed up and water accumulating behind the retaining wall is piped down to the house by gravity.

CHEMICAL CHARACTER

All natural waters contain dissolved mineral matter from the rocks and soils with which they have come in contact. With the exception of connate water (water trapped in the rocks when they were deposited, and not yet flushed out), the quantity of dissolved mineral matter present depends primarily on the type of rock or soils through which the water has passed, the length of time of contact, and the pressure and temperature conditions involved. In addition to these natural factors, there are others connected with human activities, such as drainage from coal mines and leakage from oil and gas wells.

Chemical analyses of water indicate whether water is suitable for specific purposes, and, if it is not suitable, they determine the type of treatment needed to make the water satisfactory. Analyses of water from 31 wells, 4 springs, and 2 coal mines in the Prestonsburg quadrangle are shown in table 1. Included also in the table are the results of a chloride analysis of 24 additional samples. All partial and comprehensive analyses, except those of acid spring and mine waters, are plotted as bar diagrams on *mines in the Prestonsburg quadrangle, Kentucky*—Continued

Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$ Total	Carbonate	Noncarbonate	Specific conductance at 25°C (micromhos)	pH
Springs												
....	....	a0	1,570	7.0	1.0	.2	......	900	......	.....	2,750	2.8
....	....	b0	2,750	5.0	1.1	.2	....	1,090	......	.....	4,060	2.6
....	....	30	14	1.4	.0	1.3	....	26	......	.....	379	....
....	....	21	20	.9	.1	.8	....	25	......	.....	79.4	....
Coal mines												
32	•1.7	0	2,030	85	.6	1.7	2,930	1,290	0	1,290	3,410	2.80
13	2.7	70	88	1.6	.1	.7	194	119	59	60	313	7.3

plate 1. Constituents commonly found in ground water, and their significance in the use of the water, are shown in table 2.

The quantity reported as dissolved solids (the residue on evaporation) consists mainly of dissolved minerals. Some organic matter and water of crystallization may be included. Water containing less than 500 ppm of dissolved solids is satisfactory for most uses. Water containing more than 1,000 ppm of dissolved solids may require costly treatment before it can be made suitable for most domestic and industrial uses. Dissolved solids in 11 water samples from the Prestonsburg quadrangle ranged from 173 to 2,930 ppm. Eight samples contained less than 500 ppm of dissolved solids, and 3 samples contained more than 1,000 ppm. Some of the samples for which chloride only was determined obviously had dissolved-solids contents in excess of 2,930 ppm (table 1).

Hardness is caused predominantly by compounds of calcium and magnesium. Aluminum, iron, manganese, and free acid also cause hardness, but they are present in quantities too small to be important. Hardness is expressed as the quantity of calcium carbonate that is chemically equivalent to all the hardness-causing constituents. The hardness caused by bicarbonate or carbonate of calcium and magnesium is called carbonate hardness; the balance of the hardness of the water is called noncarbonate hardness. Water having a hardness of 60 ppm or less is soft and treatment is seldom needed. Water having a hardness from 61 to 120 ppm is moderately hard, but this much hardness does not interfere seriously with the use of the water for many purposes. Waters having a hardness from 121 to 200 ppm are considered hard, and their hardness will be noticeable in the home. Such waters will be unsatisfactory, without softening, for certain industrial processes. Waters having

Table 2.—*Chemical constituents commonly found in ground water*[1]

Constituent	Source	Significance
Silica (SiO_2)	Siliceous minerals present in essentially all formations.	Forms hard scale in pipes and boilers. Inhibits deterioration of zeolite-type water softeners.
Iron (Fe)	The common iron-bearing minerals present in most formations.	Oxidizes to a reddish-brown sediment. More than about 0.3 ppm stains laundry and utensils reddish brown, is objectionable for food processing, beverages. Larger quantities impart taste, and favor the growth of iron bacteria.
Manganese (Mn)	Manganese-bearing minerals.	Rarer than iron; in general has same objectionable features; brown to black stain.
Calcium (Ca) and magnesium (Mg)	Minerals that form limestone and dolomite and occur in some amount in almost all formations. Gypsum also a common source of calcium.	Cause most of the hardness and scale-forming properties of water, soap consuming.
Sodium (Na) and potassium (K)	Feldspars and other common minerals; ancient brines, sea water; industrial brines and sewage.	In large amounts may give salty taste; objectionable for specialized industrial water uses.
Bicarbonate (HCO_3) and carbonate (CO_3)	Action of carbon dioxide in water on carbonate minerals.	In combination with calcium and magnesium forms carbonate hardness which decomposes in boiling water with attendant formation of scale and release of corrosive carbon dioxide gas.
Sulfate (SO_4)	Gypsum, iron sulfides, and other rarer minerals; common in waters from coal-mining operations and many industrial wastes.	Sulfates of calcium and magnesium form hard scale.
Chloride (Cl)	Found in small to large amounts in all soils and rocks; natural and artificial brines, sea water, sewage.	In large enough amounts may give salty taste; objectionable for various specialized industrial uses of water.
Fluoride (F)	Various minerals of widespread occurrence, in minute amounts.	In water consumed by children, about 1.5 ppm and more may cause mottling of the enamel of teeth, but up to 1.0 ppm seems to reduce decay of teeth.
Nitrate (NO_3)	Decayed organic matter, sewage, nitrate fertilizers, nitrates in soil.	Values higher than the local average may suggest pollution. There is evidence that more than about 45 ppm NO_3 may cause infant cyanosis ("blue baby"), sometimes fatal; waters of high nitrate content should not be used for baby feeding.

[1]California State Water Pollution Control Board, 1952, Water quality criteria: Sacramento, Calif., Pub. 3, 512 p.

a hardness above 200 ppm may be considered very hard. At many places very hard waters are used in the home; but without softening they are not satisfactory for most domestic uses. Softening would be required for many industrial uses of the water.

The specific conductance of water measures its ability to conduct electricity. It varies with the intensity of ionization and the concentration of minerals in solution and with the temperature. Variations in specific conductance show changes in the concentrations of dissolved minerals in waters. Values of specific conductance are expressed as micromhos at 25° C and range from 79.4 to 42,400 micromhos in 37 samples of water collected in the Prestonsburg quadrangle.

The hydrogen-ion concentration, expressed as the logarithm of its reciprocal, or pH, indicates the relative acidity or alkalinity of water. Water having a pH of 7.0 is neutral. Some alkaline waters have a pH higher than 8.0, and some waters containing free mineral acids have values less than 4.5. Waters in the Prestonsburg quadrangle have pH values ranging from 2.6 to 7.4. The pH of a water helps determine the amount and type of treatment, if any, needed to make the water suitable for industrial and domestic use.

TEMPERATURE

Ground-water temperatures were measured biweekly in five observation wells. Water was drawn from the wells in a bailer or bucket, and the temperature of the water measured by a Fahrenheit thermometer.

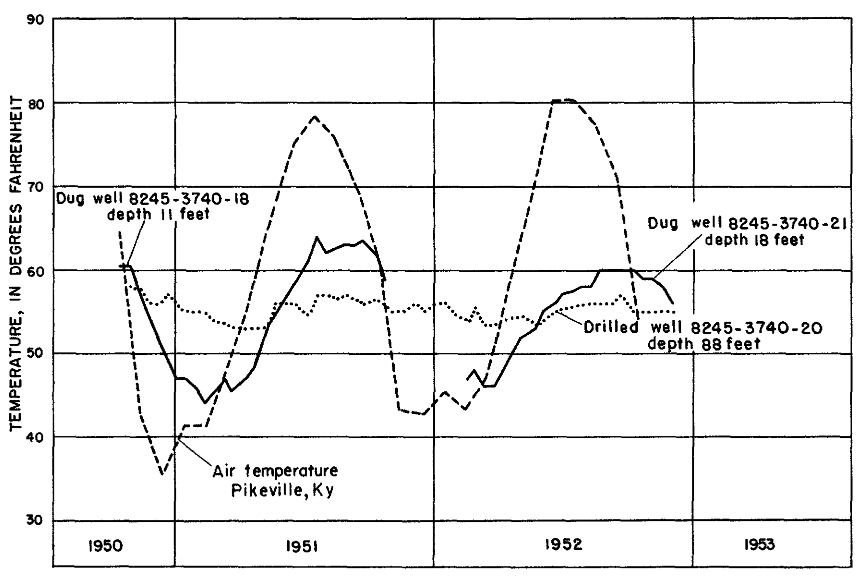

Figure 4.—Comparison of air and ground-water temperatures.

Table 3.—*Geologic formations of the Prestonsburg quadrangle, Kentucky, and their water-bearing properties*

Age	Formation	Thickness (feet)	Lithology	Water-bearing characteristics
Quaternary	Alluvium	0-90	Clay, silt, and fine-grained sand; some gravel.	Yields small supplies of fresh water to wells and springs. Water generally of good quality at shallow depth; deeper wells may encounter water high in iron.
Pennsylvanian	Breathitt	250-1,300	Mainly sandstone, siltstone, claystone, and coal seams in cyclic sequence. Some clay, ironstone and limestone.	Yields small but adequate supplies to domestic wells and springs, mainly from joints and bedding planes. Quality variable; most waters high in iron, and some salty.
	Lee (Salt sands of drillers)	270-500	Sandstone and conglomeratic sandstone with shale lentils and some coal seams.	Contains salt water.
Mississippian	Pennington (includes Maxon sand of drillers)	34-220	Variegated shales and sandstone; some limestone.	Do.
	Little lime (of drillers)	0-38	Dark-colored limestone.	Not known to contain water.
	Pencil Cave shale (of drillers)	0-5	Shale; caves readily in the form of pencils.	Do.
	Big lime (of drillers)	38-186	Light-colored limestone.	Contains water, presumably salty, in the central part of the Prestonsburg quadrangle.
	Keener sand (of drillers)	6-108	Sandstone.	Contains water, presumably salty, in Ohio and West Virginia.
	Big Injun sand (of drillers)	10-240	..................do..............................	Contains brines in Ohio and parts of West Virginia.
	Weir sand (of drillers)	15-300	Sandstone or sandy shale.	Contains brine in Elliott County.
	Sunbury shale, or Coffee shale (of drillers)	7-43	Dark-brown fissile shale.	Not known to contain water.
	Berea sand (of drillers)	10-127	Gritty quartz sandstone.	Contains brines north of Paintsville.

Devonian	Brown shale (of drillers)	430-520+	Interbedded brown and white shales containing a few thin sandy beds.	Not known to contain water.
	Corniferous limestone (of drillers)	545-728	Limestone, dolomitic limestone, and dolomite, containing a few sandstone beds.	Contains salt water at Auxier.
Silurian	Big Six sand (of drillers)	20-118	Calcareous quartz sandstone.	Contains brines in other areas.

The average ground-water temperature is about 57°F, which is approximately the mean annual air temperature. Water temperatures, measured biweekly, in drilled wells vary from about 54°F in winter to about 59°F in summer; water temperatures in shallow dug wells vary from about 45°F in winter to about 62°F in summer. High and low ground-water temperatures lag behind high and low air temperatures during the year (fig. 4).

GEOLOGIC FORMATIONS AND THEIR WATER-BEARING PROPERTIES

A brief summary of the water-bearing properties of formations in the Prestonsburg quadrangle is presented in table 3. Because most rocks older than the Pennington shale have not been satisfactorily correlated, they are described as beds or "sands" recognized by drillers. The Pennsylvanian Breathitt formation and Quaternary alluvium, both of which crop out in the area, contain fresh water. With one exception, wells penetrating the Pennsylvanian Lee formation have encountered salty water. Pre-Pennsylvanian formations contain either no water or salty water and are therefore described only briefly.

SILURIAN AND DEVONIAN SYSTEMS

The Big Six sand (of drillers) in Floyd County and other counties in eastern Kentucky is a gas-producing sandstone of Silurian age. The rock is a calcareous sandstone containing quartz grains, and it yields gas from intergranular pore spaces. This bed yields brines in other areas and should be included in any exploratory drilling for brines (McGrain and Thomas, 1951, p. 21). The Big Six sand ranges from 20 to 118 feet in thickness. It was found at a depth of 2,948 feet in well 8245-3740-196 north of Prestonsburg (surface altitude 750 feet).

The Corniferous limestone (of drillers) is a sequence of limestones, dolomitic limestones, dolomite, and some sandstone. Part of the formation is of Silurian age and part of Devonian age. The Corniferous was found at a depth of 2,115 feet in well 8245-3740-192 near Auxier (surface altitude 645 feet). At a depth of 2,318 feet in this same well the formation yielded about 10 gallons of water per hour. The Corniferous limestone ranges from 545 to 728 feet in thickness in the Prestonsburg quadrangle. According to McGrain and Thomas (1951), the small porosity of this formation south of the Paintsville area lessens the possibility of obtaining industrial brines, although the Corniferous limestone brines were the densest found in their investigation.

The Brown shale (of drillers), believed to be the equivalent of the Ohio shale of Devonian age, consists of brown and white interbedded shales. A few thin sandy beds are present in places. In well 8245-3740-196 this formation was found at a depth of 1,555 feet. The Brown shale ranges from about 430 feet to more than 520 feet in thickness (Thomas, 1951) and is an important gas producer in the area. Gas is present in both horizontal and vertical fractures, but no water has been reported.

MISSISSIPPIAN SYSTEM

The Berea sand (of drillers) is a gritty quartz sandstone ranging from 10 to 127 feet in thickness and is probably equivalent to the Berea sandstone of Mississippian age. This formation was found at a depth of 1,446 feet in well 8245-3740-196. No water was found in the wells studied, but the Berea sand is known to contain water north of Paintsville. There is probably water in intergranular pore spaces (Lafferty, 1949, p. 222).

The Sunbury shale, in many cases logged as the Coffee shale, is a dark-brown fissile shale 7 to 43 feet thick. This formation was found at a depth of 1,418 feet in well 8245-3740-196. The Sunbury shale is not known to contain water.

The formation logged by drillers as the Weir sand is a gas-producing sandstone of early Mississippian age from 15 to 300 feet thick. Principally a sandstone, it grades laterally into sandy shale. The Weir sand was found at a depth of 1,220 feet in well 8245-3740-192. This formation contains salt water in Elliott County (McGrain and Thomas, 1951, p. 11).

The formation logged by drillers as the Big Injun sand, ranging from 10 to 240 feet in thickness, is a gas-producing sandstone. The Big Injun sand was found at a depth of 952 feet in well 8245-3740-189 (surface altitude, 610 feet) west of Prestonsburg. Well records in the Prestonsburg quadrangle do not report water in the Big Injun sand, but the formation contains salt water in Ohio and parts of West Virginia.

The formation logged by drillers as the Keener sand ranges from 6 to 108 feet in thickness. Although not reported as water bearing in this area, the Keener sand does contain water in West Virginia and Ohio (Lafferty, 1949, p. 221). The Keener sand was found at a depth of 930 feet in well 8245-3740-189.

The Big lime (of drillers) consists of undifferentiated Mississippian limestones ranging from Wârsaw or St. Louis through Ste.

Genevieve and Renault-Paint Creek in age (McFarlan, 1943, p. 89). The formation is a light-colored limestone from 38 to 186 feet thick. The Big lime was found at a depth of 1,320 feet in well 8245-3740-191 (surface altitude 1,123 feet), in the central part of the Prestonsburg quadrangle. Water, apparently struck upon entering a thin bed of sandstone within the limestone sequence, is present 20 feet below the top of the formation in this well. The Big lime produces gas and oil in this area, probably from crevices.

The formation logged by drillers in the Prestonsburg quadrangle as the Pencil Cave shale has a maximum thickness of 5 feet and is absent in some places. This formation is probably equivalent to the Golconda formation (McFarlan, 1943, p. 89). The shale caves readily in the form of pencils when drilled. The Pencil Cave shale was found at a depth of 853 feet in well 8245-3740-194 (surface altitude 633 feet), south of Auxier. The formation does not contain water.

The Little lime (of drillers) is equivalent to the Glen Dean limestone (McFarlan, 1943, p. 89) and where present ranges from 2 to 38 feet in thickness. The Little lime was found at a depth of 827 feet in well 8245-3740-194. This formation is not known to contain water.

The Pennington shale consists of variegated shales, sandstone, and some limestone, and the formation ranges from 34 to 220 feet in thickness. This formation includes the Maxon sand (of drillers), an important gas-producing sandstone in the Prestonsburg quadrangle. The shale and limestone members of this formation are not reported to contain water, but the Maxon sand contains salty water. Well records report yields ranging from 1 gallon per hour to a "hole full of water." The yield of a well containing a "hole full of water" is not known, but is presumably greater than several gallons per minute. McGrain and Thomas (1951, p. 12–13) give the results of brine analyses made from wells 8245-3740-170 and 8245-3740-178 penetrating the formation north of Prestonsburg. The Pennington shale was found in well 8245-3740-207 (surface altutude 736 feet) at a depth of 781 feet.

PENNSYLVANIAN SYSTEM

LEE FORMATION

STRATIGRAPHY

The Lee conglomerate was named for exposures in Lee County, Va. (Campbell, 1893). As originally described, the formation consists of three beds of massive sandstone or conglomerate separated by shale and thin sandstones, and it includes from two to six seams of coal. At Big Stone Gap, Va., the formation has a maximum thickness of 1,530 feet. The thickness decreases to the northwest. The Geological Survey recognizes the Lee formation as described by Campbell in 1893. In this report, for convenience, the Lee formation is defined as used by Campbell in 1898. Campbell (1898) uses the term Lee formation to describe successions of rocks 200 to 600 feet thick in the London quadrangle, Kentucky, and 100 to 300 feet thick in the Richmond quadrangle, Kentucky. Campbell recognized two members—the Rockcastle conglomerate lentil, which marks the base of the formation, and the Corbin conglomerate lentil, which marks the top of the formation. The Lee formation in the London and Richmond quadrangles is not exactly equivalent to the Lee formation of Lee County, Va., but it includes the Lee formation of Lee County and the lower part of the Norton formation.

LOCATION AND THICKNESS

The Lee formation is not exposed in the Prestonsburg quadrangle and is known only from records of gas, oil, and test wells. The nearest outcrop of the formation is about 5 miles to the north of the Prestonsburg quadrangle, where it has been brought to the surface by the Paint Creek uplift. East of Myrtle the Lee formation can be found at a minimum depth of about 260 feet; elsewhere the top of the formation lies deeper. Altitudes at the top of the formation range from 172 to 468 feet above mean sea level and are shown on plate 2.

The Lee formation in the Prestonsburg quadrangle ranges from 270 to 520 feet in thickness, and averages 365 feet in thickness. Most thin beds of shale separating the massive sandstones are from 5 to 10 feet thick.

CHARACTER

Exposures of the Lee formation, where it crops out along the Pottsville escarpment and the Pine Mountain fault, represent the character of the formation where it is concealed by younger rocks (Thomas, 1949, p. 168). Where it is exposed the Lee formation consists of massive, cross-laminated sandstones and conglomerates with shale lentils and a few coal seams. The sandstones are fine- to coarse-grained, and the conglomerates consist of white quartz pebbles in a sandstone matrix. Most sand grains are angular and subangular quartz, but a few are mica. The grains are cemented with calcium carbonate, siderite, iron oxide, and silicon dioxide. The sorting, the type of cementing material, and the completeness of cementation, differ considerably, even within a short distance.

Where the Lee formation is typical in the Prestonsburg quadrangle it consists of three massive sandstone members separated by thin beds of shale. Drillers may log the massive sandstones as the First, Second, and Third Salt sands. Well records show as many as five, and as few as one, thick sandstone beds within the Lee formation. The number of sandstone units recorded depends in part on how carefully the original log was kept. In some places, thin beds of shale separating the sandstones contain coal seams. Coal and shale may underlie the massive sandstones of the Lee formation in well 8250-3735-49 east of Dotson. Plate 3 shows the general character of the Lee formation in the Prestonsburg quadrangle.

STRUCTURE

Contours on top of the Lee formation show a general dip to the east at the rate of 20 to 200 feet per mile. (See pl. 2.)

At its outcrop the Lee formation is well jointed. It is not known if the Lee formation contains open joints at depth in the Prestonsburg quadrangle.

SOURCE AND OCCURRENCE OF WATER

The Lee formation is referred to as the Salt sands (of drillers) because the first salt water struck while drilling is usually in these sandstones (Thomas, 1949, p. 168). Most water in the Lee formation of the Prestonsburg quadrangle is probably not derived from local precipitation but may be ancient sea water (connate water) trapped within the sands when the formation was deposited.

Water struck during drilling may be in the First, Second, or Third Salt sand, where the different sands are recognized. Water is present in porous and permeable zones of small geographic extent and irregular distribution. For this reason water may not be struck immediately when the First Salt sand is encountered, and water may be found at several horizons in the sandstone sequence. According to Thomas (1949, p. 171), deposition of cementing material, particularly secondary quartz, and—more important—poor sorting of the sand grains have made most of the Lee formation tight and relatively impermeable. In his study of the London area Otton (1948) found that most of the wells penetrating the exposed Lee formation yielded water that came from joints or crevices in the sandstones. Probably some of the gas or test wells drilled in the Prestonsburg quadrangle struck water in deep joints in the Lee formation.

Water found in the Lee formation in many places rises up in the well, so that drillers report a "hole full of water." In other places the water may spurt up into the air as high as 50 or 60 feet at intervals, like a geyser. In some wells the rising of water in the hole may be due to artesian conditions, but in others it is most certainly the result of gas pressure.

RECHARGE

With the possible exception of waters entering from below, the Lee formation could be recharged only by water from the Breathitt formation above, or by water moving down from the outcrop area of the Lee formation to the north. It is not known whether the Lee formation has been, or could be, recharged by water from the Breathitt formation. The presence of fresh water in the Lee formation, as reported in well 8245-3740-198 in the central part of the area, may indicate recharge of fresh water from the Breathitt formation. Because large quantities of gas and a little water have been withdrawn from the Lee formation in some areas, unfilled voids may exist which possibly have been filled naturally, or could be filled artificially, with fresh water.

DISCHARGE

Water is discharged from the Lee formation by wells penetrating the formation. Where wells allow this water to flow freely into the formations above, contamination of fresh water supplies may result. Because water in the Lee formation in some places in the Prestonsburg quadrangle is under enough gas pressure to force the water to flow at the surface, it is possible that this pressure could force water from the formation into the outcrop area. However, because porous zones in the Lee formation are, in most places, of small areal extent, probably very little water is discharged by this means.

YIELD OF WELLS

Few data are available on the yield of wells penetrating the Lee formation. Well records show yields ranging from half a bailer per hour to a "hole full of water." Inasmuch as 39 out of 67 well records indicate a "hole full of water," wells in the Lee formation probably have fairly large yields.

CHEMICAL CHARACTER OF THE WATER

Wells penetrating the Lee formation in the Prestonsburg quadrangle, except one well, have encountered only salty water. McGrain and Thomas (1951) report the analyses of brines collected from the Salt sands (of drillers) in well 8245-3740-166, well 8245-3740-167, and well 8245-3740-170, all north of Prestonsburg. The present writer collected a water sample from the Salt sand (of drillers) in well 8245-3740-171, north of Prestonsburg. The water from this well contained 17,150 ppm of chloride. A little fresh water in the Salt sand was found at a depth of 420 feet in well 8245-3740-198, in the central part of the quadrangle. More water was struck at 460 and 465 feet in the same well, but the record does not indicate whether that water was fresh or salty. Although the Lee formation is known to contain fresh water under cover in some areas in eastern Kentucky, available evidence indicates that salt water will be encountered in nearly all wells penetrating the Lee formation in the Prestonsburg quadrangle.

BREATHITT FORMATION

STRATIGRAPHY

The Breathitt formation was first described by Campbell (1898) as follows:

> This formation includes all of the Carboniferous rocks lying above the Corbin conglomerate, or the top of the Lee formation. It is composed of shale and sandstone with occasional coal seams, but no individual bed is of sufficient importance to be shown as an independent formation. In the highest hills in the vicinity of London this formation shows about 550 feet in thickness. It is named from Breathitt County, Kentucky, where the formation is present in great force.

As no upper boundary has been defined for the Breathitt formation, it must include rocks of Allegheny age because these rocks are present in Breathitt County. Rocks of Allegheny age cap high hills in the eastern part of the Prestonsburg quadrangle. In this report, all consolidated rocks above the Lee formation are included in the Breathitt formation.

LOCATION AND THICKNESS

The Breathitt formation crops out over the entire area except where it is covered by alluvium in the valleys. (See pl. 2.) The formation has a minimum thickness of about 250 feet east of Myrtle and a maximum thickness of about 1, 300 feet on a hill northeast of Prestonsburg. The difference in thickness is due to the difference in the amount of erosion and not to thinning and thickening of the beds. At one time the Breathitt formation in the Prestonsburg quadrangle was thicker than 1, 300 feet, but the upper beds have been removed by erosion.

CHARACTER

The Breathitt formation consists principally of sandstone and siltstone; but conglomerate, claystone, clay, limestone, ironstone, and coal seams are present in minor amounts (fig. 5). In drillers' logs the siltstones, claystones, and clays are usually reported together as shale or "slate." The rocks lie in an irregular sequence. The lowermost is a massive sandstone which generally grades upward into a thin-bedded or shaly sandstone, or siltstone. An underclay and a coal, a claystone, or a sandstone may be next. So many variations in the sequence are present that usually it is impossible to recognize a typical cycle. Lateral gradations of strata are common. A sandstone may grade laterally into a siltstone, or vice versa. Thus, rocks of the Breathitt formation differ greatly from place to place, both horizontally and vertically.

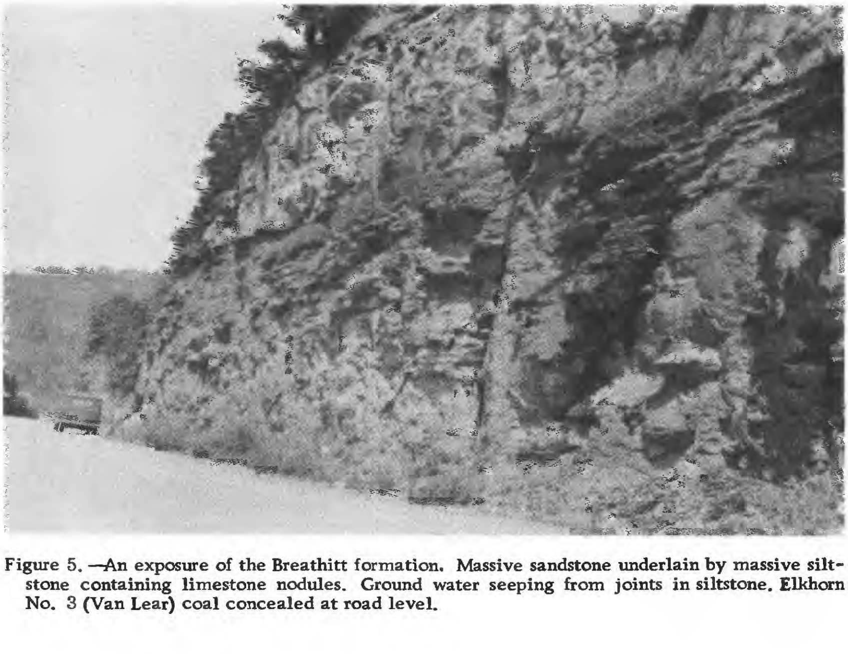

Figure 5. —An exposure of the Breathitt formation. Massive sandstone underlain by massive siltstone containing limestone nodules. Ground water seeping from joints in siltstone. Elkhorn No. 3 (Van Lear) coal concealed at road level.

Information on the characteristics of sandstones in the Breathitt formation was obtained from examination of outcrops in the Prestonsburg quadrangle (see table 9) and from thin-section descriptions, by other authors, of similar sandstones from the Breathitt formation in other areas. Well cuttings and unweathered samples show that most sandstones are gray on fresh surfaces. Outcrops weather at least several inches deep to shades of orange and brown so that truly fresh samples are difficult to collect. The sandstones are predominantly fine grained, but some are very fine or medium grained. The base of massive sandstones generally consists of medium-grained sand, and may include coarse-grained material and ironstone conglomerate. Grain size in thick sandstone beds decreases from bottom to top. According to Robertson[1] and Ringo[2] most grains are angular and subangular quartz, but some are muscovite, biotite, chert, orthoclase, plagioclase, chlorite, and calcite. Cementing materials are primarily secondary quartz and clay paste, but siderite, iron oxide, and calcite are also present. Many sandstones contain impressions, molds, and casts of plant forms, including *Calamites*. Thick sandstone units that are massive and cross laminated at the base are commonly thin bedded or shaly at the top. Joints are common (fig. 6). Massive beds weather to form cliffs and steep slopes on hillsides or cap the tops of hills and ridges.

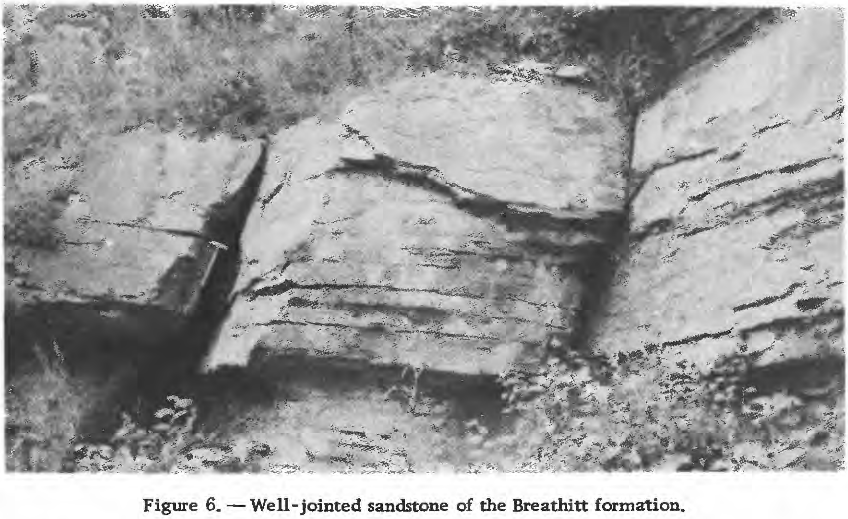

Figure 6. — Well-jointed sandstone of the Breathitt formation.

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[1]Robertson, D. A., 1951, Petrographic analysis of the Pennsylvanian sandstones of Perry County, Ky. [Unpublished master's thesis in files of Univ. Ill.]

[2]Ringo, W. P., Jr., 1951, A study of cementation and inherent crushing strength of sandstone: Highway Materials Research Lab., Lexington, Ky., Univ. of Kentucky. [Manuscript report.]

Siltstones commonly weather to shades of gray and contain conspicuous amounts of mica. Some beds of siltstone contain limestone concretions ranging from an inch to several feet in diameter, and iron nodules are present in some exposures. Many siltstones are not pure but contain thin streaks or beds of fine-grained sandstone. Siltstones may be either massive or shaly. Many joints are of the "pencil fracture" type. Gentle slopes are formed on the siltstone outcrops because the siltstones are not so resistant to weathering as sandstones.

Claystones are shades of gray and brown on fresh surfaces and may be micaceous or silty. Nodules of iron oxide are present in some places, and plant impressions coated with iron oxide or carbon are common. A claystone exposed along U. S. Highway 23 northeast of Prestonsburg is believed to represent the marine Magoffin beds of Morse (1931) and contains abundant pelecypods, brachiopods, and gastropods. Claystones are weak rocks, weather to a gentle slope, and in many places are poorly exposed.

Clays exposed in the Prestonsburg quadrangle are the underclays of coals and therefore may represent ancient soils. The clays are gray in color and are commonly stained orange with iron oxide. Quite impure, they are sandy, silty, or micaceous, and may contain much macerated plant material.

Limestones are present in the area as concretions or thin beds that extend short distances, and are commonly dark gray in color. Concretions occur above coal seams in many places. North of Prestonsburg, on the Prestonsburg-Auxier road, large limestone concretions, ranging from 1 to 3 feet in diameter and from 1 to $1\frac{1}{2}$ feet in thickness, are found from 15 to 27 feet above the Elkhorn No. 3 (Van Lear) coal. Cone-in-cone structure was observed in limestone concretions on the Granny Fitz Branch of Abbott Creek. The Magoffin beds of Morse (1931), exposed along Highway 23, on the north side of a hill north of Prestonsburg, contain a hard fossiliferous limestone. The limestone is a discontinuous bed 65 feet long and 1 foot thick. Limestone concretions encountered in drilling are referred to as "kidney rocks" or "kettle bottoms" because their upper surface is rounded and hard.

Ironstones form a very small fraction of the total thickness of rocks in the Prestonsburg quadrangle. They weather to shades of brown and orange. An ironstone 0.3 foot thick in the Magoffin beds of Morse, exposed along Highway 23 on the south side of a hill north of Prestonsburg, contains Spirifers.

Coals are gray or black in color. Some coals contain partings of clayey material. Where the coal crops out many small fractures break the coal into small blocks.

STRUCTURE

Rocks of the Breathitt formation are gently warped and in the Prestonsburg quadrangle generally dip to the east. A structure map of the Van Lear coal (Hauser and Thomas, 1952) shows dips ranging from about 10 to 100 feet per mile. The western portion of the quadrangle is part of the Paint Creek uplift (Hudnall and Browning, 1949).

No major faults are known to traverse the quadrangle. Minor faults, however, border the back and sides of slump blocks on the valley walls.

Joints are present in consolidated rocks of all types. The strike of joints in the Prestonsburg quadrangle shows some relationship to the strike of valleys, as shown in plate 2. Dips of joints measured ranged from 59° to 90° and averaged 83.5°. Many other joints follow, or are parallel to, bedding planes. Joints measured on outcrops range from less than 0.01 inch to 6 inches in width. The width of joints decreases rapidly as depth increases, and few joints at any appreciable depth, say 100 feet, would be wider than 0.01 inch. Joints exposed on outcrops may be as close together as 2 inches. On the other hand, some outcrops show no conspicuous jointing for a distance of 30 feet. Siltstones, and a few sandstones, contain a type of joint structure known as "pencil fracture." Where pencil fractures are developed, the rock breaks at right angles to the bedding into fragments about the size of short pencils. The surfaces of some joints approximate a plane, but the surfaces of other joints, especially large ones, are curved.

OCCURRENCE OF WATER

Water in the Breathitt formation occurs both in joints and in intergranular pore spaces. Joints supply most of the water immediately used by wells, but intergranular pore spaces store more water than joints do and yield water slowly to intersecting joints and wells. Sandstones, the principal water-bearing beds, contain water both in joints and intergranular pore spaces. Water in shales and coal seams is stored chiefly in joints. Water probably is present under both artesian and water-table conditions. Perched or semiperched water bodies are common.

RELATION TO JOINTS

Evidence that water is present in joint openings in the Breathitt formation is obtained from reports of owners and drillers, observation of spring openings, and from permeability and transmissibility tests.

Reports of "streams of water" entering the well suggest that the water enters the well under pressure from a small opening, such as a joint. The owners of wells 8245-3735-10, 8245-3735-16, and 8245-3740-55 reported that they could "hear a stream of water running in the well." The owners of wells 8245-3740-61, 8245-3740-130, 8245-3740-137, 8250-3740-11, and 8250-3735-11 reported that the water entered, rushed, or gushed into the well "like a stream." The author heard water running into well 8245-3735-5 after the driller struck water; the water sounded as if it were squirting into the well under high pressure. Well owners and drillers report looking down into wells, with the aid of mirrors reflecting sunlight, and seeing streams of water squirt from the side of the hole.

Drillers report that in many wells the water runs from cracks or crevices in the rock. Two drillers believed that most of the cracks penetrated were "flat-lying," and one driller mentioned feeling the drilling bit drop as a crevice was penetrated. The driller of well 8245-3740-14 reported the water came from "a fissure." The owner of well 8245-3740-144 reported the water came from "a crevice" in the rock.

Springs and seeps issue from joints in the Breathitt formation. Along the Prestonsburg-Auxier road north of Prestonsburg, for example, seeps issue from near-vertical joints or pencil fractures in siltstone during wet seasons (fig. 5). Spring 8245-3735-62, southwest of Prestonsburg, issues from a vertical joint in sandstone. Nearby seeps issue from joints following bedding planes.

Permeability and transmissibility tests indicate that joints in the Breathitt formation supply water to wells. Transmissibilities of aquifers tested in the field ranged from about 10 to 9,000 gpd per foot. Horizontal permeabilities of two typical sandstones from the area were determined by laboratory tests to be 0.00071 and 0.0010 gpd per square foot. As the transmissibility of an aquifer is equal to its permeability times the saturated thickness of the aquifer, a well obtaining water from the intergranular pore spaces of these sandstones would have to penetrate at least 10,000 feet of the rock to yield as much water as the weakest well tested. As the permeability of many rocks in the area is probably equal to or less than that of these sandstones, and the wells tested are less than 100 feet deep, it is obvious that larger openings such as joints are supplying water more freely to wells than are intergranular pore spaces.

The quantity of water stored in joints depends upon the length, depth, width, and spacing of the joints. No data are available on the length of joints in the Breathitt formation because exposures are of very small area. For the same reason, there is little evidence as to the depth to which joints extend. However, the percentage of void space created by any system of joints is small. Even if the joints are near the surface and quite wide (Meinzer, 1923, p. 9), they store only small quantities of water.

RELATION TO INTERGRANULAR PORE SPACES

Although small amounts of water are stored in joint openings in the Breathitt formation, most of the water stored is in intergranular openings. Ringo[3] collected eight samples of sandstone from the Breathitt formation at various quarries in eastern Kentucky. He determined the porosity of these rocks by saturating 1-inch cores with water, and then calculating the percentage of saturation by weight. Porosities thus determined ranged from 0.50 percent to 4.41 percent, indicating a small porosity for these rocks. The Geological Survey Hydrologic Laboratory at Lincoln, Neb., determined the porosity of two typical fine-grained sandstones from the Prestonsburg quadrangle to be 10.9 percent and 10.4 percent. These samples were of medium porosity. No data are available on the porosity of claystones in the area. Although large quantities of water are stored in pore spaces in the Breathitt formation, these pore spaces are so small that, except for sandstones, the rocks yield little or no water. Intergranular pore spaces in sandstones yield water slowly to intersecting joints and wells.

RELATION TO THE LITHOLOGIC CHARACTER OF THE ROCKS

Water is found in sandstone, shale, and coal but is most likely to be present in sandstone and coal, in spite of the fact that shale forms most of the geologic section. Records of 49 gas, oil, and test wells in the Prestonsburg quadrangle show that 72 percent of the Breathitt formation is logged as shale or "slate," 27 percent is logged as sandstone, and 1 percent is logged as coal. These well records note 53 finds of water. Thirty finds of water, or 57 percent, were reported from sandstone; 18, or 34 percent, were reported from shale or "slate"; and 5, or 9 percent, were reported from coal seams. Records of 73 water wells and springs in the Prestonsburg quadrangle indicate that in 30 wells or springs, or

[3]Ringo, W. P., Jr., op. cited.

41 percent, water probably comes from sandstone; in 24, or 33 percent, water probably comes from shale; and in 19, or 26 percent, water probably comes from coal. From the lithologic standpoint sandstones are the principal water-bearing beds in the Breathitt formation.

WATER-TABLE AND ARTESIAN CONDITIONS

Water in the Breathitt formation commonly rises above the level at which it is first struck. For example, the owner of well 8245-3735-56, in Watergap, reported that water was found at 41 feet, in sandstone. Depth to water in this well was 8.79 feet, indicating that the water rose about 32 feet in the well. The driller of well 8245-3740-130, in East Point, found water between 40 and 42 feet, in siltstone. Depth to water in the well was 10.71 feet. Thus, the water level rose between 29 and 31 feet in the well after water was struck. In well 8245-3735-5, at the Forks of Middle Creek school, water was found at 91 feet, apparently at the contact between a siltstone and sandstone. The water level in this well rose 54 feet after water was struck. Water in well 8245-3740-16, near Prestonsburg, which was reported to come from a seam of coal at a depth of about 8 feet, was 1.15 feet below the surface. According to the driller, the water in this well flowed over the top of the casing when the coal seam was penetrated. Well 8245-3740-105, in Auxier, was reported to flow at times. When measured by the author, depth to water in this well was 0.6 foot. Water in all these wells probably comes from joints at some depth; when a joint is struck, the water in the well rises to the same level as that in nearby joints or saturated rocks. Where the water level clearly rises above the zone of saturation, as in wells 8245-3740-16 and 8245-3740-105, the water is under pressure, either because it enters the joint system at a higher level than the well, or because the water is in the primary pore spaces of a rock overlain by an impermeable bed. If the latter is true, the well is artesian.

Many different ground-water bodies in the Breathitt formation are separated from one another by impermeable beds. If just one body of water existed in the Breathitt formation, the water levels in wells drilled on hills should be much farther below land surface than the water level in wells drilled in the valleys. This is true in many places, but there are exceptions to the rule. For instance, the water levels in wells 8245-3740-20 and 8245-3740-21 on a hill north of Prestonsburg, at an altitude of over 1,000 feet, sometimes rise to within 11 feet and $1\frac{1}{2}$ feet of the surface, respectively. But the water levels in wells 8245-3740-1 and 8245-3740-7 in the valley below, in Prestonsburg, at an altitude of about 630 feet, rise only to within 26 feet and 31 feet of the surface. Springs issuing from the sides of hills, like 8245-3735-66, indicate the presence of a perched water body. It is thus evident that water bodies on hills may not be connected with the bodies of water in rocks underlying the valleys, and that the water bodies on hills are generally perched or semiperched with respect to those in the valleys.

RECHARGE

Recharge to the Breathitt formation takes place directly from precipitation, from surface water, and from other formations with which it is in contact. Only a very small part of the precipitation that falls in the area of outcrop of the Breathitt formation reaches the zone of saturation. Some of the water is returned to the atmosphere by evaporation and transpiration, some is discharged to streams as surface runoff, and some is retained by the soil. Water from streams may recharge the Breathitt formation where the streams flow over bedrock during a flood stage. The Levisa Fork probably supplies water to the Breathitt formation where this stream flows over bare rock near the highway bridge north of Prestonsburg.

The Breathitt formation also receives water from the Quaternary alluvium which fills valleys cut in the Breathitt formation. Where permeable beds or joints in the Breathitt formation come in contact with water-bearing alluvium, recharge of the Breathitt formation from the alluvium may take place when the water level in the valley alluvium is higher than the water level in the Breathitt formation.

Water from the underlying Lee formation may recharge the Breathitt formation through improperly plugged or unplugged gas wells, or where the casing of these wells has become corroded enough to admit the passage of water. This recharge is undesirable, as the Lee formation contains salt water which contaminates fresh water in the Breathitt formation.

DISCHARGE

Discharge from the Breathitt formation takes place by evaporation and transpiration, seepage into the Quaternary alluvium, and wells, springs, and coal mines. Discharge by evaporation occurs where the water table is at or near the surface, as near seeps and springs. Plants undoubtedly discharge more water by transpiration than is lost through direct evaporation. Probably most of the water discharged from the Breathitt formation passes through the alluvium to streams. Springs discharge water from perched water bodies on hills, or discharge water directly into streams flowing over bedrock during low river stages. Some of this spring water is salvaged for domestic or stock uses. Although the flow of water from most coal mines in the area is small, the mines discharge considerable quantities of water over a long period of time. A small amount of water is also discharged from the Breathitt formation through pumped wells.

WATER-LEVEL FLUCTUATIONS

Recharge to the Breathitt formation causes the water level in wells penetrating the formation to rise. Although precipitation is fairly well distributed throughout the year, recharge from precipitation is greatest during the winter when losses by evaporation and transpiration are small. The accumulative effect of this recharge reaches its peak in late winter or early spring, when water levels in wells reach their highest stage. Because rises in stream level coincide with periods of precipitation, infiltration of river water into the Breathitt formation is difficult to prove. Plate 4 shows water levels in observation wells in the Prestonsburg quadrangle compared with river stage and precipitation.

Discharge from the Breathitt formation causes the water level in wells penetrating the formation to fall. Discharge by evaporation and transpiration is greatest during the growing season, from about April 25 to about October 15. Also, the months of October and November have the least precipitation. The combined effect of the lowering of the water table during the growing season and the lessened precipitation toward the end of this period produces a yearly water-level low during the late summer, fall, or early winter. Discharge by pumping also causes water levels to drop. The water level in both the pumped well and in nearby wells tapping the same body of water will decline. The amount of decline of water levels in nearby wells depends upon the character of the aquifer and distance from the pumped well. Measureable declines in water levels caused by pumping in this area will probably be very local. When pumping ceases, the water levels in both the pumped well and nearby wells will probably return to essentially their original static level.

Fluctuations of water levels in the Prestonsburg quadrangle not caused by changes in ground-water storage are those due to barometric changes, earthquakes, and railway trains. Well gages record barometric fluctuation of water levels in wells tapping confined water in the Breathitt formation. Changes in atmospheric pressure are transmitted less freely to a body of confined water than to the water in the well. Therefore, an increase in atmospheric pressure causes the water level in the well to fall, and a decrease in atmospheric pressure causes the water level to rise. The ratio of water-level change to atmospheric-pressure change is called the barometric efficiency of the well and is usually expressed in percent. The barometric efficiencies of wells 8245-3740-1, 8245-3735-6, and 8245-3735-2 were roughly 10 percent, 20 percent, and 75 percent, respectively. Barometric changes have a daily cycle of two highs and two lows and show effects over longer periods of time as well. A destructive earthquake in southern California caused the water level in well 8245-3735-2 to fluctuate abruptly 0.056 foot on July 21, 1952. The fluctuation above and below the general water level was about equal in magnitude. Passing railway trains compress the aquifer tapped by well 8245-3735-6 in the valley of Middle Creek, causing the water level in the well to fluctuate. When the unloaded freight train goes up the valley, usually in the afternoon, little or no effect is noted. When the train returns in the evening, loaded with coal, the additional weight causes the water level to rise a maximum of 0.005 foot. The water level returns to its former position about an hour after the train has passed.

YIELD OF WELLS

Wells penetrating the Breathitt formation in the Prestonsburg quadrangle differ much in yield, although most wells probably yield less than 10 gpm. Domestic wells, which may supply as many as four or five families, were all reported to yield sufficient quantities of water. However, two wells, each supplying a commercial establishment, failed to give enough water.

Reports of well drillers and well owners and measurements of pumping wells provided information on well yields. Transmissibility and permeability tests indicate the rate at which water moves through the formation to the well. Factors governing well yields in this area are the character of the aquifer, type of well, and location of the well.

MEASUREMENTS OF YIELD

Most drillers estimate that the average well yields from 5 to 10 gpm and believe that a few exceptional wells may give as much as 100 gpm. Drillers' estimates are based largely on bailing tests. The driller rapidly bails the well for a specified period of time, counting the bailers. Knowing the volume of the bailer, he estimates the well yield in gallons per minute. Bailing tests may be repeated several times, and between each test the water level in the well partially recovers. By this means, drillers estimated the yield of wells 8245-3740-132, 8250-3740-12, and 8245-3740-135 to be 1 gpm, 1¼ gpm, and 4 gpm, respectively. The author observed a driller bail well 8245-3740-163 at the rate of about 17 gpm for $11\frac{1}{2}$ minutes. Many gas and test well logs give the yield of water-bearing strata in bailers per hour. Yields range from 1 bailer per hour to a "hole full of water." Rough estimates based on the volume of water contained in each bailer indicate yields of 1 to 4 gpm for beds of different lithology.

Discharge measurements of five pumped wells indicated yields of about 3 to 15 gpm. Well 8245-3735-54 pumps about 3 gpm continuously during times of low creek water to supply makeup water for the Columbia Fuel Corp. pressure station on Bull Creek. The author determined the yield of this well by measuring the time required to fill a container of known volume and estimated the sustained yield of well 8250-3735-8 at the Inland Gas Corp. pressure station to be about 10 gpm. Well 8245-3740-103 in Auxier was reported to yield 6 gpm when tested with a power pump. The owner of well 8245-3740-71, south of Auxier, pumped his well 6 hours with a $\frac{1}{2}$-horsepower pump, using a $\frac{3}{4}$-inch discharge. The well probably yielded about 10 gpm.

Three recovery tests and one "slug" test were made to determine the transmissibility of the Breathitt formation.

Recovery tests were made on well 8245-3740-1 and on well 8245-3735-2, which was tested twice. Each well was bailed for a specified length of time. As soon as the bailing stopped, the rising water level in the well was measured periodically until the water level had returned to its static condition, or nearly so.

The results were plotted on semilog paper. Residual heads were plotted on the arithmetic scale, and the quotients, obtained by dividing the time elapsed since pumping began by the time elapsed since pumping stopped, were plotted on the semilog scale. Some of the test results plotted as curved lines, although theoretically they should have been straight lines passing through the origin of the graph.

Transmissibilities were computed by means of the Theis non-equilibrium equation (Wenzel, 1942).

$$T = \frac{264Q}{s} \log_{10} t/t'$$

in which T is the coefficient of transmissibility, Q is the discharge of the pumped well in gallons a minute, s is the residual drawdown in feet, t is the time since pumping began, in any unit, and t' is the time since pumping stopped, in the same unit. Values of s were corrected for estimated changes in barometric pressure.

Interpretation of the test results was made difficult by the withdrawal and recovery of water stored in the well and by possible changes in storage within the aquifer itself during the test. In addition, the Theis formula used for computing transmissibility assumes that the aquifer is (1) infinite in extent, (2) of uniform thickness, (3) homogeneous, (4) capable of transmitting water with equal facility in all directions, and (5) that the well penetrates the entire thickness of the aquifer. The presence of water in joints and primary porous zones of the Breathitt formation precludes the probability that all these conditions are met.

The test data from well 8245-3740-1 did not plot as a straight line and did not pass through the origin. A tangent to that part of the curve that most nearly approaches a straight line indicates a transmissibility of about 10. Although this value may not be accurate, it does show that the transmissibility of the well is very low.

Two recovery tests were made on well 8245-3735-2. In the first test the well was bailed at the rate of 1.0 gpm for 62.5 minutes. In the second test the well was bailed at the rate of 3.59 gpm for 20.2 minutes. Data from both tests were plotted on a single sheet of semilog paper, using s/Q as the ordinate and $\log_{10} t/t'$ as the abscissa (fig. 7). The points plotted determined a straight line, whose slope indicated that the aquifer has a transmissibility of about 9,000 gpd per foot.

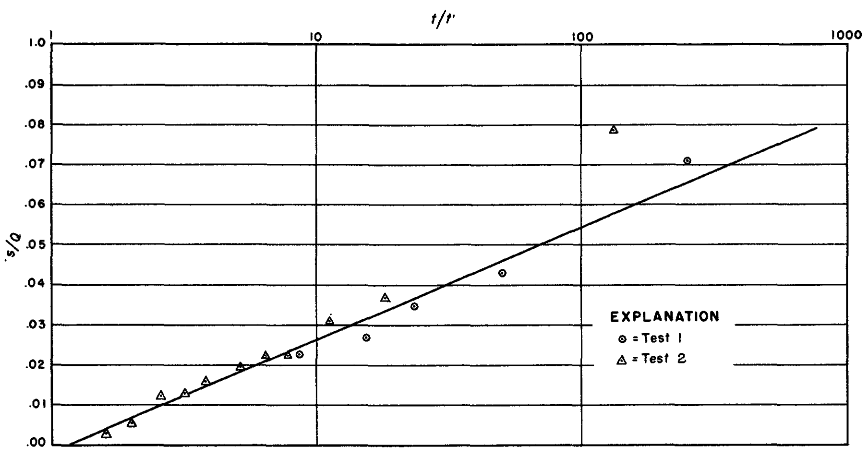

Figure 7.—Semilog time-recovery curve of well 8245-3735-2 in the Breathitt formation.

An attempt was made at well 8245-3735-6 to conduct a "slug" test of the type developed by J. G. Ferris, staff engineer, U. S. Geological Survey, Lansing, Mich. In such a test a known volume of water is dumped into the well, causing a sudden rise in water level. The water level in the well is measured periodically as it declines toward its original position. Because the results of this test plotted as a curved line instead of a straight line, they could not be interpreted quantitatively. However, as the water level in the well was still about 5 feet above static level 17 minutes after the water had been poured, the aquifer is either of low transmissibility or the well is clogged.

The recovery tests and "slug" test indicate that wells penetrating the Breathitt formation probably range widely in their transmissibility values.

The permeability, porosity, specific yield, and specific retention of two samples of typical unweathered sandstones from the Breathitt formation were determined. Sample 1, collected from an abandoned quarry near Auxier, was a light-gray fine-grained micaceous massive sandstone containing thin laminae of carbonaceous material. Sample 2, taken from a road cut northwest of Prestonsburg, was medium light gray, but otherwise similar in appearance to sample 1. Location of the two samples is shown on plate 2. Coefficients of permeability perpendicular to the bedding were 0.00043 for sample 1 and 0.00038 for sample 2. Coefficients of permeability parallel to the bedding were 0.00071 for sample 1 and 0.0010 for sample 2. The porosity of sample 1 was 10.9 percent and the porosity of sample 2 was 10.4 percent. Specific yield and specific retention could not be determined accurately by the centrifuge method used because the sandstones were firmly cemented. The specific yield of 1.1 percent obtained by the centrifuge method for sample 1 is high, and the specific yield of 5.9 percent obtained for sample 2 is unreasonably high. Because specific retention is equal to the porosity minus specific yield, the 9.8 percent value for the specific retention of sample 1 is low, and the 4.5 percent value for sample 2 is much too low. All these tests indicate that if these two samples are typical of most sandstones in the Prestonsburg quadrangle then sandstones in the quadrangle will yield only very small quantities of water very slowly to either intersecting joints or wells.

FACTORS GOVERNING YIELD

Factors governing the yield of wells in the Breathitt formation are the number and size of joints intersected by a well and the number and size of porous zones intersected by a well. These factors in turn are influenced by the extent and type of aquifer and by the depth, diameter, and topographic location of the well.

Joint systems and porous zones supplying water to a well are of finite extent, both horizontally and vertically, and are terminated by impermeable layers or by intersection with the land surface.

The yield of a well will decline when the depressed water level resulting from pumping reaches the limit of a joint system or permeable bed. Therefore, the initial yield of a well may not be the sustained yield of the well.

Sandstones yield more water than other types of rocks in the Breathitt formation because they have better developed joints and primary porous zones.

In general, the deeper the well, the greater the yield will be, because most deep wells encounter more fractures than shallow ones. However, as joints become fewer in number and tighter as the depth increases, each increase of yield will generally diminish with each successive increase of depth.

Wells that have large diameters will yield slightly more water than wells having small diameters. The speed of water moving toward a well increases as the well is approached, because the water is moving through a continuously decreasing cross-sectional area. The water moves fastest at the edge of the well, where friction losses reduce the amount of water entering. Therefore, friction losses are less at the edge of a well of large diameter than at the edge of a well of small diameter. Increasing the diameter of a well also increases the chances that the well will encounter more fractures, although the diameter would have to be enlarged several times before the chance of hitting more joints would increase significantly.

In general, the yield of a well shows some relation to its topographic location. Wells drilled in the valley bottoms are likely to yield more water than wells drilled on the sides or tops of hills. Following are several reasons why this is true.

Where saturated alluvium overlies the Breathitt formation in the valley bottom, the alluvium may at times contribute water to the underlying rock.

Valley bottoms receive water directly from precipitation and from streams. Hills readily shed much water from precipitation as surface runoff.

Ground water moves toward the valleys where part of it discharges into streams by way of the alluvium. Seepage occurs from upland rock slopes beneath the residual mantle. The more impervious the bedrock, the more readily is water deflected down the slope along the contact between the mantle and bedrock.

Wells in valleys generally strike water at a shallower depth than do wells high on hills. For example, well 8245-3740-17, on a hill north of Prestonsburg, is reported to be 192 feet deep, and well 8245-3740-137, on a hill west of Auxier, is reported to be 147 feet deep. Joints encountered at great depths are likely to be fewer in number and tighter than those at shallow depths. Where water is found at a shallow depth on a hill, the water body is perched or semiperched. These water bodies will not supply large quantities of water because the areal extent of the aquifer is limited by the hill itself. As indicated previously, the yield of any well in the Breathitt formation is determined by the number, size, and extent of the openings supplying water. In most of the wells drilled in valleys, these openings are limited by impermeable beds; in wells drilled on hills, these openings may be limited not only by impermeable beds but also by the side of the hill.

Possibly some valleys exist because the rocks have been made weak by close jointing. Joints facilitate the entrance of ground water, which promotes chemical decomposition and permits mechanical erosion. Thus, the rocks underlying valleys may contain more openings through which ground water can move than the rocks underlying hills. It is not known how important this factor is in the Prestonsburg quadrangle. Joints measured at several localities indicate that some relation exists between the strike of joints and the strike of valleys. The dips and the lithologic character of the strata are also important in determining the location and direction of valleys.

CHEMICAL CHARACTER OF THE WATER

Most waters from the Breathitt formation in the Prestonsburg quadrangle are suitable for domestic use, although they differ much in chemical character. Iron and chloride are the most undesirable constituents; waters range from soft to very hard. Most of the waters can be classified as calcium magnesium bicarbonate waters, sodium bicarbonate waters, sulfate waters, and chloride waters. Comprehensive and partial analyses were made of 31 samples; 24 other samples were analyzed for chloride content only. Plate 1 shows bar graphs of all water samples analyzed from the Breathitt formation, excluding samples of acid springs and mine waters.

CHEMICAL CONSTITUENTS OF THE WATER

Ten samples from the Breathitt formation were analyzed for silica content, which ranged from 9.2 ppm in water from mine

8245-3740-164, north of Prestonsburg, to 60 ppm in the acid highly mineralized water from mine 8245-3735-64.

The water from mine 8245-3735-64 was analyzed for aluminum and was found to contain 74 ppm.

All the ground waters analyzed from the Breathitt formation contained, for most purposes, undesirable amounts of iron. Well waters contained 0.29 to 28 ppm of iron. The greatest quantities of iron were found in acid spring waters, most of which came from coal seams, and in mine waters. These waters contained as much as 233 ppm of iron. The high iron content of waters in the Breathitt formation is due to the solution of iron-bearing minerals from the rocks, and (or) the solution of iron from pipes and well casings by corrosive waters. When a water containing more than about 0.3 ppm is exposed to the air, a red precipitate may form, and the water is locally called "red" or "sulfur" water. A sample of this precipitate, collected from a pipe draining well 8245-3740-16, was found to be largely iron and aluminum oxide, but predominantly iron oxide.

Ten samples of water were analyzed for manganese. Seven samples were found to contain no manganese, whereas three samples contained 0.04, 8.9, and 12 ppm.

Waters from 8 wells and 2 coal mines were selectively analyzed for calcium and magnesium. Calcium ranged from 5.6 ppm in the water from well 8250-3740-8 to 248 ppm in the water from well 8245-3735-42. Magnesium ranged from 2.2 ppm in the water from well 8250-3740-8 to 177 ppm in the water from mine 8245-3735-64.

Waters from 8 wells and 2 coal mines were selectively analyzed for sodium and potassium. Sodium ranged from 13 ppm in the water from mine 8245-3740-164 to 558 ppm in the salty water from well 8250-3735-16. Potassium ranged from 0.5 ppm in the water from well 8245-3740-135 to 22 ppm in the water from well 8250-3735-16.

Waters sampled contained as much as 409 ppm bicarbonate. No bicarbonate was found in the highly acid waters from springs 8245-3735-62, 8245-3735-63, and mine 8245-3735-64. Analyses showed that 8 samples had less than 100 ppm, 9 samples had 100 to 200 ppm, 9 samples had 200 to 300 ppm, and 2 samples had more than 300 ppm of bicarbonate.

The sulfate content of waters ranged from 0.6 ppm in well 8245-3740-130 to 2,750 ppm in spring 8245-3735-63. Waters containing undesirable amounts of sulfate—that is, in excess of 250 ppm—were waters from the two springs, from mine 8245-3735-64, and from

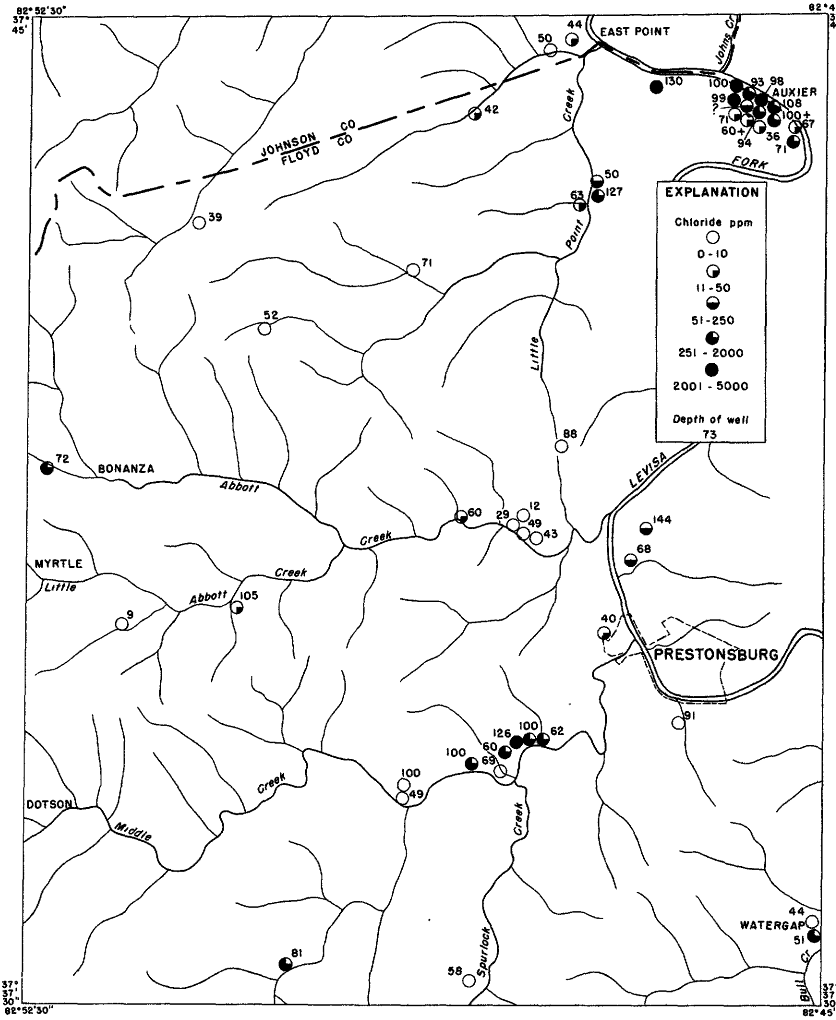

Figure 8. — Map of the Prestonsburg quadrangle, Kentucky, showing chloride in waters from the Breathitt formation.

well 8245-3735-42. Probably most waters in the area that are high in sulfate come from coal seams.

Chloride is an undesirable constituent in some well waters in the Prestonsburg quadrangle. Water from 18 wells contained more than 250 ppm of chloride, and the water from 8 other wells not tested was reported to be salty. The chloride content of samples from the Breathitt formation ranged from 1.2 ppm in well 8245-3740-15 to 4,100 ppm in well 8245-3740-122 west of Auxier. Chloride was present in 31 samples taken for partial and comprehensive analyses. Twenty-four additional samples, which were analyzed for chloride only, were taken mostly from wells suspected to be high in chloride. The chloride content of wells may be related to (1) location of the well, (2) distance from deep gas, oil, and test wells, (3) depth, altitude, and distance below a key bed, and (4) time.

1. The relationship of chloride content to location of a well is difficult to show because neither wells nor samples were scattered evenly throughout the area. Except for the northwest corner, high-chloride waters were found in most parts of the Prestonsburg quadrangle. (See fig. 8.) In two areas, however, the presence of salty water is particularly troublesome. These are (a) the Middle Creek area, southwest of Prestonsburg, and (b) the Auxier area.

a. Water from five wells analyzed in the Middle Creek area contained chloride in amounts ranging from 370 to 3,420 ppm. One of the wells was reported to obtain its water from a sandstone. The water-bearing beds in the other wells are not known. All these wells penetrate strata below the Elkhorn No. 3 (Van Lear) coal. The top of the Lee formation lies 350 to 375 feet below the valley bottom in this area. The depth of the wells ranges from 60 to 126 feet and averages 90 feet. The highest concentration of chloride was found in the deepest well; too little information is available, however, to indicate whether or not chloride increases with depth in the Breathitt formation.

b. Eight of the thirteen wells sampled in the Auxier area have chloride contents in excess of 250 ppm. Formation samples collected by the author, reports of well owners, and logs of nearby gas-test wells indicate that the principal aquifer underlying the town is a bed of sandstone containing salty water. Waters from wells believed to penetrate this bed contained from 600 to 4,050 ppm of chloride. Wells drilled on the Auxier bottom land encountered this sandstone at depths ranging from 85 to 100 feet. Most wells in the hilly part of Auxier, southwest of the Chesapeake & Ohio Railway Co. tracks, obtain fresh water from strata lying at least 30 feet above the sandstone. Wells in the Breathitt formation in the hilly area penetrate a lesser thickness of unconsolidated material than wells drilled through the full thickness of alluvium of the Levisa Fork northeast of the railway tracks, and therefore obtain their water at shallower depths and higher altitudes. Some reports indicate that wells 8245-3740-114 and 8245-3740-115, southwest of the railway tracks, encountered salty water at depths of 114 and 131 feet, respectively. If so, these two wells probably penetrated the same bed of sandstone encountered in wells drilled in the bottom land northeast of the railway tracks.

2. As the presence of salty water in shallow wells may be due to contamination by leaking gas, oil, or test wells, an attemp was made to relate salty water to gas or test wells drilled in the Prestonsburg quadrangle. Several approaches to the problem were considered: (a) the opinions of water-well drillers as to the source of the salty water, (b) the presence of gas in shallow water wells, (c) the location of shallow wells containing salty water in relation to the location of gas or test wells, (d) the direction of increase of the chloride content of shallow wells, and (e) the relation of the presence of salty water in shallow wells to the numerical concentrations of deep gas or test wells.

a. Several well drillers believed that salty water in shallow wells came from gas wells because many water wells drilled near gas wells were salty.

b. The presence of gas in water wells indicates that a connection exists, or did exist, between the shallow aquifer and the deeper gas-bearing strata. Gas was reported to have bubbled up through the water in well 8245-3735-52, south of Prestonsburg, drilled half a foot from gas well 8245-3735-108. The owner of well 8245-3740-25, near East Point, reported that when a test well was drilled in a nearby cornfield, the water level in well 8245-3740-25 dropped, and the water in the well became contaminated with gas. The owner of well 8250-3740-2, near Bonanza, uses both water and gas from his well. A water sample taken from this well contained 265 ppm of chloride. Gas was present in well 8245-3740-93, near Auxier, roughly 100 feet from gas-test well 8245-3740-193, which was reported to have been heavily shot when drilled. The owner of this water well reported that gas was struck before water. When the water level in the well was bailed down, gas bubbled up through the water. When ignited at the casing head, the gas burned with a flame 5 feet high. It is evident that some of the gas in shallow water wells results from the drilling of nearby gas or test wells.

c. Some shallow water wells containing salty water are near gas-test wells; other water wells containing salty water are relatively far from known deep wells. Two samples of water from well 8245-3735-93, which contained gas, had 840 and 900 ppm of chloride. Well 8245-3735-6, southwest of Prestonsburg, about 145 feet from gas well 8245-3735-88, contained 413 ppm of chloride. On the other hand, well 8250-3740-2, whose water contains both gas and 265 ppm of chloride, is 0.8 mile from the nearest known gas or test well. Well 8245-3740-156, whose water contained 945 ppm of chloride, is 0.9 mile distant from the nearest known gas or test well. If wells 8250-3740-2 and 8245-3740-156 are contaminated with salty water leaking from gas or test wells, the water must have traveled a relatively long distance.

d. If a deep gas or test well is a source of salt-water contamination, then the chloride content of contaminated shallow wells should increase as the gas or test well is approached. Analysis of the problem may be complicated by an increase of chloride content with depth in wells or changes in chloride content with differing transmissibilities. In the Auxier area, where many wells are drilled to about the same depth, the trend of chloride increase is to the north or west, but there is no definite indication that the high chloride content of wells in the area is due to contamination from any one gas or test well.

e. If deep gas or test wells are the source of chloride contamination, then in areas where large numbers of gas or test wells are located more shallow water wells should be salty than in areas where few deep wells are present. This possible relationship cannot be shown clearly because the Prestonsburg quadrangle is small, and both gas and test wells and drilled water wells are concentrated in the same localities.

3. The chloride content of waters was plotted against depth of the well, altitude of the bottom of well, and distance below a key bed (Elkhorn No. 3 coal). Depth of wells and distances below the key bed increased roughly as the chloride content of the waters increased, but altitudes of the bottom of wells decreased more regularly with increase of chloride content. Waters at higher altitudes, particularly above the local drainage level, generally circulate more vigorously than waters at lower altitudes, so they are less likely to be either connate waters or heavily contaminated with connate waters.

4. The chloride content of water from wells in the Breathitt formation varies from time to time, but most variations noted were not significant. A sample taken from well 8245-3740-163 on July 11, 1952, contained 3,900 ppm of chloride; a sample taken from this same well on December 4, 1952, contained 4,050 ppm of chloride. Two samples taken from well 8245-3740-93 within an hour of each other contained 840 and 900 ppm of chloride. Samples of water from wells 8245-3735-6 and 8245-3740-111 apparently indicate a decrease in chloride content with time, but salty water from these wells may have been artificially diluted with fresh water.

In summary, the presence of salty waters in the Breathitt formation is spotty in distribution. In some places in the Prestonsburg quadrangle chloride contamination may come from deep gas or test wells or from salty water wells. Wells drilled to depths below the drainage level in areas where shallow waters are known to be salty are most likely to encounter water high in chlorides. Wells drilled to depths above the drainage level are less likely to have salty water. If chloride waters in the Breathitt formation do not come from the Lee formation or older strata, they are, at least in part, connate waters. But it is unlikely that connate waters could remain for long periods of time at depths of 100 feet or less.

The fluoride content of 31 samples analyzed ranged from 0.1 to 1.1 ppm. There were 6 samples that contained no fluoride. The highest fluoride concentrations, 1.0 and 1.1 ppm, were found in the acid waters of springs 8245-3740-62 and 8245-3740-63.

Nitrate was found in nearly all the waters analyzed, and ranged from 0.1 to 45 ppm. There were 2 samples that contained no nitrate.

Dissolved solids ranged from 173 to 2,930 ppm in 10 samples analyzed. The high-sulfate waters from well 8245-3735-42 and mine 8245-3735-64 and the high-chloride water from well 8250-3735-16 contained more than 1,000 ppm of dissolved solids. All other waters analyzed contained less than 500 ppm of dissolved solids.

CHEMICAL PROPERTIES OF THE WATER

Hardness, specific conductance, and hydrogen-ion concentration (pH) were determined in waters analyzed from the Breathitt formation.

Hardness ranged from 23 to 1,290 ppm in 31 samples of water analyzed. Of the samples analyzed, 8 were soft (60 ppm or less). These were either only slightly mineralized or contained a small proportion of calcium and magnesium in relation to sodium and potassium. There were 9 samples that were moderately hard (61-120 ppm), 6 hard (121-200 ppm), and 8 very hard (more than 200 ppm). All but 2 of the very hard waters were acid and high in sulfate or were salty.

Carbonate hardness was differentiated from noncarbonate hardness in 10 of the 31 samples tested. Carbonate hardness is that amount of calcium and magnesium hardness equivalent to bicarbonate; the remaining hardness is called noncarbonate hardness.

There were 6 samples that had only carbonate hardness, 1 sample that had only noncarbonate hardness, and 3 samples that contained both carbonate and noncarbonate hardness. Values of noncarbonate hardness were especially high in the sulfate waters from mine 8245-3735-64 and well 8245-3735-42.

The specific conductance of 31 water samples from the Breathitt formation ranged from 114 micromhos in well 8250-3740-7 southeast of Myrtle to 10,700 micromhos in well 8245-3740-163 in Auxier. Acid waters from springs and mines and salty waters from wells, such as 8245-3740-163, had the greatest values of specific conductance.

The hydrogen-ion concentration (pH) of 12 water samples ranged from 2.6 in spring 8245-3735-63, near Prestonsburg, to 7.4 in well 8245-3740-132, southwest of East Point. Spring 8245-3735-62 and coal mine 8245-3735-64 yielded water having pH values of 2.8. Free mineral acid is considered to be present when the pH is less than about 4.5. The low pH of these 2 samples and the sample from spring 8245-3735-63 indicates that the waters are acid and corrosive. The pH values for water from 1 other coal mine and 8 wells, however, were 6.5 or higher.

CLASSIFICATION OF WATERS ACCORDING TO PRINCIPAL CONSTITUENTS

In order to determine whether or not the water samples could be placed in groups each having a definite chemical characteristic, the water samples were plotted on a chemical diagram. (See fig. 9.) The percentage of reacting value of each of the four groups of ions represented on the sides of the diamond-shaped diagram determines the position of each water sample within the diamond. The diagram shows that most waters in the Breathitt formation can be classified according to their principal constituents as calcium magnesium bicarbonate waters, sodium bicarbonate waters, sulfate waters, and chloride waters.

Water analyses from 49 wells are plotted on the diagram; 27 are from the Prestonsburg quadrangle, and 22 are from the adjoining Paintsville area (Baker, 1955). As the Breathitt formation in both areas is similar, analyses from the Paintsville area can be used to support conclusions drawn from analyses in the Prestonsburg quadrangle.

The following paragraphs discuss the relationship of the water samples in each class to the types of rocks from which they were derived, to the depths from which they came, to their manner of origin, and to their location within the quadrangle.

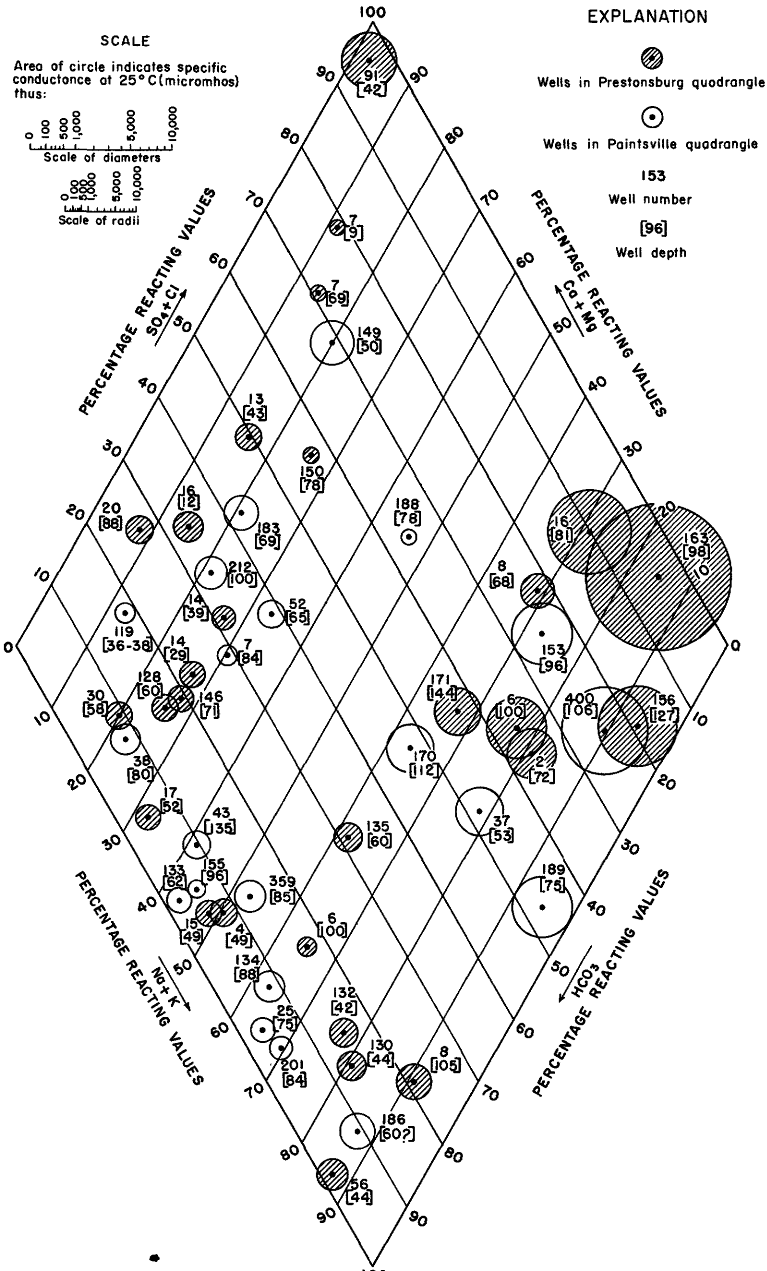

Figure 9. —Diagram showing chemical character of water in the Breathitt formation.

1. Samples of water from 8 wells in the Prestonsburg quadrangle are classed as calcium magnesium bicarbonate waters. Of the samples, 2 were reported to come from sandstone, 3 from "slate" or siltstone, and 1 from coal. The aquifers from which the 2 other samples came are not known. Depth of the wells sampled ranges from 12 to 89 feet and averages 50 feet.

Samples of water from 6 wells in the Paintsville area are classed as calcium magnesium bicarbonate waters. One sample may have come from "slate" and another from coal. The aquifers from which the other samples came are not known. Depth of the wells sampled ranges from 36 to 100 feet and averages 72 feet.

Calcium magnesium bicarbonate waters are the most common type of waters from the Breathitt formation in both areas. Waters in this group show no definite relation to the lithologic character of the aquifer, although most apparently come from shale. The mineral calcite ($CaCO_3$) is a common cementing material in many rocks of the two areas and probably contributes most of the calcium and bicarbonate to the waters. The average depth of the wells was 60 feet. Calcium magnesium bicarbonate waters show no apparent relation to locality in the Prestonsburg quadrangle.

2. Samples of water from 6 wells in the Prestonsburg quadrangle are classed as sodium bicarbonate waters. Formation samples, collected by the author, indicate that the water in well 8245-3740-135 comes from a sandstone, and that the water in well 8245-3735-5 comes from at or near the contact of a sandstone with a siltstone. Formation samples, collected by the driller, from well 8245-3740-130 indicate the water was from a siltstone. One water sample was reported to come from sandstone, and another from "hard rock" and coal. The water-bearing bed of 1 sample is not known. Depth of the wells sampled ranges from 42 to 105 feet and averages 66 feet.

Samples of water from 4 wells in the Paintsville quadrangle are classed as sodium bicarbonate waters. The water from 1 well comes from sandstone or shale, but the lithologic character of the other water-bearing beds is not known. The wells range from about 60 to 88 feet in depth and average 72 feet.

The origin of these sodium bicarbonate waters is difficult to determine. No relation to the lithologic character of the aquifer is apparent. The depth of all 10 wells averaged 70 feet. Sodium bicarbonate waters in some areas are the result of exchange of calcium and magnesium ions in a calcium magnesium bicarbonate water for sodium ions as the waters percolate to greater depths in the formation. Although the sodium bicarbonate waters in the

Prestonsburg and Paintsville areas are found in wells of a slightly greater average depth (10 feet deeper) than the calcium magnesium bicarbonate waters, the difference in depth is too small to be significant. There are not enough facts, including the presence of the minerals needed for base exchange, to prove whether these sodium bicarbonate waters are the result of base exchange. Sodium bicarbonate waters show no relation to locality in the Prestonsburg quadrangle.

3. Three samples of well waters, 2 samples from springs, and 2 samples from coal mines in the Prestonsburg quadrangle were classed as sulfate waters. Water from 2 of the wells came from coal and "slate," but the aquifer of the third well is not known. One of the springs sampled came from a coal seam, the other from sandstone.

One sample of water from a well in the Paintsville area and 3 samples from coal mines were classed as sulfate waters.

Most sulfate waters in the Prestonsburg and Paintsville areas come from coal seams. The relatively high sulfate content of these waters is due principally to the solution of the iron sulfides marcasite and pyrite. Iron sulfides are present in all kinds of rocks, but in these areas they are found principally in coal seams and associated strata. Oxidation of iron sulfides in the presence of water produces an acid iron-bearing water high in sulfate. For instance, the acid waters from springs 8245-3735-62 and 8245-3735-63, and mine 8245-3735-64, in the Prestonsburg quadrangle, had sulfate contents of 1,571, 2,749, and 2,030 ppm, respectively. The water from well 8245-3735-42 had the highest sulfate content (1,099 ppm) and lowest pH (6.5) of any well water analyzed in the Prestonsburg quadrangle. The chemical character of this water, as well as the presence of coal mines in the area, suggests that this water was originally more acid. Passage through lime-bearing rocks probably made the water more alkaline and increased the content of calcium and magnesium. However, water from a coal seam may be neutral or alkaline if the seam does not contain iron sulfides or is not oxidized. For example, the water from mine 8245-3740-164, in the Prestonsburg quadrangle, had a pH of 7.3. Sulfate waters are likely to be present in areas where there has been extensive coal mining.

4. Seven water samples from wells in the Breathitt formation of the Prestonsburg quadrangle are classed as chloride waters. Of the samples, 6 are known or reported to come from sandstones. The water-bearing bed of sample 7 is not known. The average depth of these wells is 99 feet.

Two water samples from wells in the Breathitt formation in the Paintsville area are classed as chloride waters. One sample came from shale, but the aquifer of the other sample is not known. The wells are 96 and 108 feet deep.

The information available suggests that sandstones are more likely to contain waters with a relatively high chloride content than other rocks. If the presence of salty water is due to contamination from a deeper source, then sandstones are more likely to contain salty water because they transmit water more readily than shale. All 9 wells average 99 feet in depth. This suggests that deep wells in the Breathitt formation are more likely to contain chloride waters than shallow wells. Chloride waters may be present in many places in the Prestonsburg quadrangle, but particularly in the Middle Creek area west of Prestonsburg and in Auxier.

Twelve samples of water from both the Prestonsburg and Paintsville areas contained some chemical constituents in nearly equal amounts and therefore could not be classified. Most of these waters are intermediate between chloride and sodium bicarbonate waters, between sodium bicarbonate and calcium magnesium bicarbonate waters, and between calcium magnesium bicarbonate waters and sulfate waters. These intermediate water types may represent mixtures of different types of water, or they may represent the actual proportions in which dissolved minerals were taken into solution. They do not show any apparent relation to the aquifer, depth, or locality. The intermediate water types do not destroy the system of classification used in this discussion, but their presence might be expected from the geologic character of these areas. Probably many of the minerals dissolved by ground water in these areas come from rock-cementing materials. Study has shown that the cementing materials in any one type of rock differ greatly from place to place, both in amount and chemical character. Also, the water in a well may enter at two or more levels, and therefore represent a mixture of two or more depths and rock types.

WATER TEMPERATURE

Biweekly measurements were made of the temperature of water in 4 wells. Table 4 summarizes the temperature data. Wells have different temperature variations because of differences in depth. Well 8245-3740-21, a dug well 18 feet deep, has a much greater temperature variation than the other 3 wells. As the water body tapped by this well lies a very short distance below the surface, the water is easily affected by the temperature of the air and by the water percolating into it. The large diameter of the dug well allows the temperature of the air to affect the water temperature

Table 4.—*Temperature of water in wells penetrating the Breathitt formation in the Prestonsburg quadrangle, Kentucky*

Well	Depth (feet)	Record		Temperature (°F)		
		Begins	Ends	Minimum	Maximum	Average
8245-3740-15	49	Oct. 30, 1950	June 30, 1953	54	60	57
20	88	Oct. 16, 1950	........do........	53	57	55
21	18	Feb. 18, 1952	........do........	46	60	54
8250-3740-3	40	Nov. 29, 1950	........do........	54	59	57

more than the small diameter of a drilled well would allow. Hence, the water in this dug well has a greater variation of temperature than the water in wells 8245-3740-15, 8245-3740-20, and 8250-3740-3, which are 49, 88, and 40 feet deep, respectively.

QUATERNARY SYSTEM

ALLUVIUM

LOCATION AND THICKNESS

Quaternary alluvium overlies the bedrock in all the stream valleys and extends to the heads of even the smallest in streams. (See pl. 2.) The largest areas covered by alluvium are in the valley of the Levisa Fork, where flats as wide as one-third mile are present in and near Prestonsburg and East Point.

The alluvium ranges in thickness from a fraction of an inch, at the valley walls and headwaters of the smallest streams, to a maximum known thickness of 90 feet, in well 8245-3740-194 south of Auxier.

At least two benchlike flats are found above high water stage along the Levisa Fork. The main bench, or terrace, ranges from about 630 feet near East Point to about 640 feet in altitude in Prestonsburg. A lower terrace, about 615 feet in altitude is well developed near East Point, but not elsewhere. Another bench, the present flood plain, is 5 to 10 feet above low water, and from a few feet to 75 feet wide on either side of the river.

CHARACTER

Sample logs collected by the author and data supplied by well owners and drillers provided information about the alluvium. The alluvium consists mostly of clay, silt, and fine sand, although some medium to coarse sand and gravel are present. Generally, the alluvium increases in coarseness from top to bottom. Except in small tributary valleys, the alluvium is much the same in one place as in another. The general fineness of the alluvial fill reflects the fine grain of the sandstones and shales from which it was derived; and the increase in coarseness from top to bottom reflects the decreasing gradient of the streams as the waters at the mouth of the Big Sandy were impounded during glacial time.

Samples collected by the author from well 8245-3740-163 drilled at Auxier provided information about the alluvium of the Levisa Fork. (See fig. 10 and logs of wells, p. 116-118.) From the surface to a depth of 70 feet the particles of alluvium gradually increased in size from silt and clay to sand and gravel. At depths of 70 to 75 feet the alluvium contained a large proportion of fine material and some pieces of coal. Gravel was present in most of the material at depths between 75 feet to 85 feet (bedrock). From the surface to a depth of 43 feet the weathering of iron-bearing minerals above the water table stained the alluvium grayish orange and pale yellowish brown. At depths between 43 and 70 feet the alluvium was yellowish gray. At depths below 70 feet the grains were iron stained and the alluvium dusky yellow. Evidently the alluvium below this depth has been weathered a great deal more than the alluvium above. This fact and the abrupt change in the character of the alluvium at 70 feet suggest that the material lower than 70 feet may represent an older alluvial fill.

The alluvium in tributary valleys was derived from the sandstone and shale outcrops near the tributary streams. Near Abbott Creek and Middle Creek samples of alluvium were collected by the author from wells 8245-3740-135 and 8245-3735-5. Well 8245-3740-135 penetrated 40 feet of clay and silt underlain by 7 feet of sand and gravel. The record of well 8245-3735-5 is not complete, but the alluvium probably consists of silt except for a 2-foot layer of sand and gravel found 6 feet above bedrock. The driller of well 8245-3735-21 along the Katy Friend Branch reported that the alluvium consisted of 42 feet of very fine grained gray sand. Test well 8245-3740-198, drilled in the valley of Abbott Creek, penetrated 5 feet of soil underlain by 15 feet of quicksand and 15 feet of gravel. Evidently, the character of the alluvium in valleys tributary to the Levisa Fork changes from place to place. The large tributary valleys, such as Abbott Creek and Middle Creek, contain mostly fine-grained material underlain by a coarse layer of sand and gravel. The alluvium of the small tributary valleys is less well sorted, and the grain size is controlled largely by the lithologic character of the local rocks.

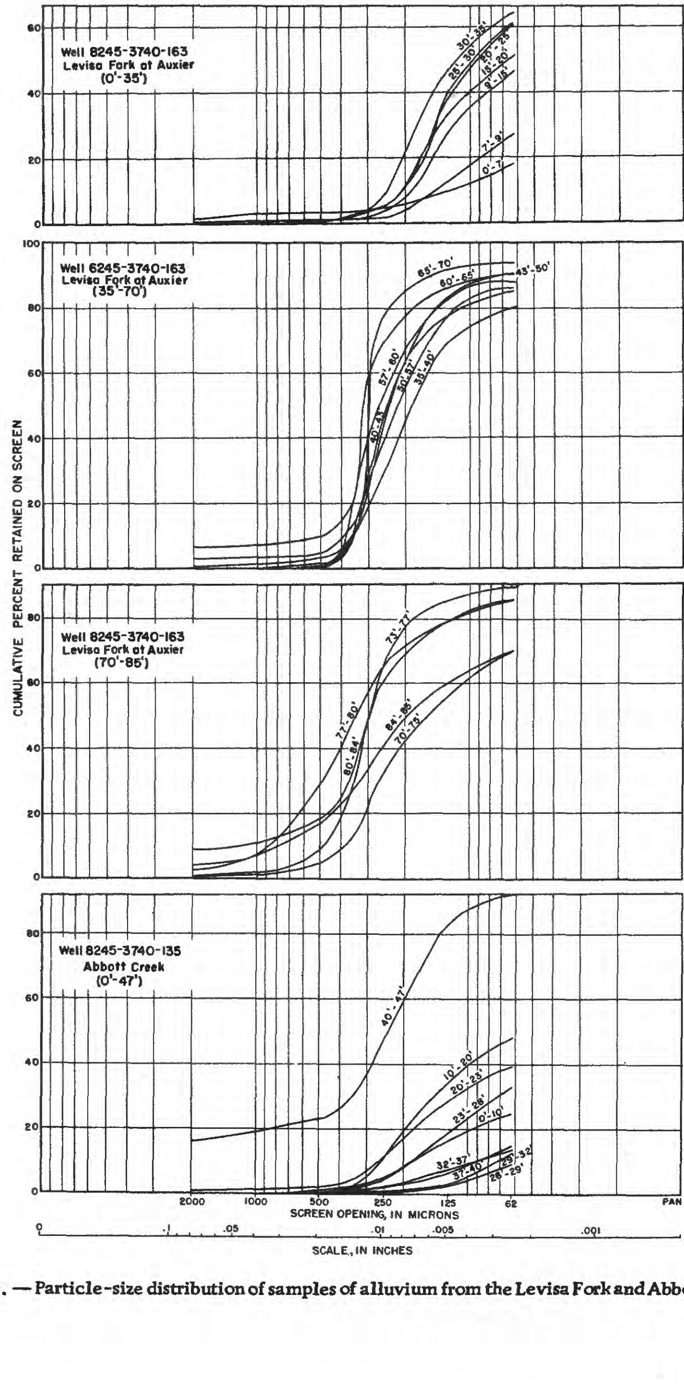

Figure 10. — Particle-size distribution of samples of alluvium from the Levisa Fork and Abbott Creek.

OCCURRENCE OF WATER

Water is stored in and moves through intergranular pore spaces in the unconsolidated alluvium. Gravels, sands, silts, and clays contain water. The gravels and sands yield water readily to wells. The silts yield water slowly, and the clays yield little or no water to wells.

Most ground water in the alluvium is under water-table conditions. Lenses of clay within the formation, however, may produce local artesian conditions.

RECHARGE

The alluvium receives water directly from precipitation, from the infiltration of stream water (fig. 11), and from seepage from the Breathitt formation. Streams recharge the alluvium during times of flood when the water level in the stream is higher than the

Figure 11. —May Branch in flood stage. Shallow dug well in alluvium equipped with recording gage. At flood crest, water level in well was about 0.77 foot below land surface.

water table; the water returns to the streams as the stream level goes down.

DISCHARGE

Water in the alluvium is discharged by evaporation and transpiration, by seepage into streams, and, at times, by seepage into the Breathitt formation. Water is discharged into streams when the surface of the stream is below the water table. During times of drought nearly all the streamflow is water discharged from the alluvium. Wells in the alluvium also discharge water, but this amount is negligible in comparison with the natural discharge.

WATER-LEVEL FLUCTUATIONS

When recharge to the alluvium exceeds discharge, the water table rises; when discharge exceeds recharge, the water table falls. The influence of river stage and precipitation on water levels in wells 8245-3740-23, 8245-3740-11, and 8245-3740-108 that penetrate the alluvium are shown in plate 4. Small water-level fluctuations due to changes in barometric pressure were observed in well 8245-3740-11. The upper silty layer of the alluvium produces barometric effects by forming a partial seal against air pressure, particularly when the silt is saturated with water during wet seasons.

YIELD OF WELLS

The yield of a well in the alluvium depends on the size and shape of the particles, how uniformly the particles have been sorted, how deep the well penetrates into the saturated zone, and the type of well construction. The maximum known saturated thickness of the alluvium is about 45 feet.

Sieve and permeability tests made on 9 samples of alluvium collected from well 8245-3740-163 in Auxier indicate that screened or gravel-packed wells of moderate yield could probably be developed in the alluvium along the Levisa Fork.

Sieve test curves (fig. 10) show that most of the alluvium below the water table could be properly developed by a well with screen slot openings between 0.010 and 0.015 inch wide (10 to 15 slot screen). This screen should pass 60 percent of the material and retain 40 percent.

Laboratory permeabilities were determined for samples of the alluvium taken from depths of 43 to 84 feet. Permeabilities ranged from 3.1 gpd per square foot at depths of 70 to 75 feet to 209 gpd per square foot at depths of 60 to 65 feet. The average permeability was 46 gpd per square foot.

A screened well located about 200 feet from the center line of the Levisa Fork and penetrating 40 feet of saturated alluvium of this type would probably yield as much as 25 gpm.

CHEMICAL CHARACTER OF THE WATER

Chemical analyses were made of water samples from 3 wells and 2 springs in the alluvium. (See table 1.) The waters are less mineralized than those from the Breathitt formation but contain considerable amounts of iron in places. Waters from the alluvium do not show as great a difference from each other in chemical character as those from the Breathitt formation; this may be due, at least in part, to the smaller number of samples taken. The water samples ranged from soft to moderately hard. Plate 1 shows graphic plots of selected analyses. The following paragraphs discuss the chemical properties and constituents and their significance.

The iron content of the samples analyzed ranged from 0.25 ppm in well 8250-3740-18 to 51 ppm in well 8245-3740-108 and included the lowest and highest amounts of iron of any wells in the Prestonsburg quadrangle. The sample from well 8250-3740-18 is the only one in the Prestonsburg quadrangle that did not contain an undesirable amount of iron. The little evidence available suggests that water from deep wells in the alluvium has a higher iron content than water from shallow wells in the alluvium.

The water from well 8245-3740-96, in the valley of the Levisa Fork near Auxier, is calcium magnesium bicarbonate water; other water samples from the alluvium are not readily classified. Bicarbonate ranged from 21 ppm in the slightly mineralized water of spring 8250-3735-20 to 248 ppm in the predominantly bicarbonate water of well 8245-3740-108. Sulfate ranged from 3.3 ppm in well 8245-3740-96 to 20 ppm in spring 8250-3735-20. The amount of sulfate was roughly equal to bicarbonate in springs 8250-3735-19 and 8250-3735-20. These springs are 0.6 mile apart along the Arnett Branch and have waters similar to each other. Chloride ranged from 0.9 ppm in spring 8250-3735-20 to 28 ppm in well 8250-3740-18. Significant quantities of chloride in shallow wells penetrating the alluvium in the Prestonsburg quadrangle are more likely to be due to pollution from surface wastes than to contamination from salty waters in the Breathitt formation.

The fluoride content of the waters is low. The water at well 8250-3740-18 and spring 8250-3735-19 contained no fluoride, that from well 8245-3740-96 and spring 8250-3735-20 contained 0.1 ppm, and that from well 8245-3740-108 contained 0.4 ppm.

Nitrate in the waters ranged from 0.2 ppm in wells 8245-3740-96 and 8245-3740-108 along the Levisa Fork to 9.9 ppm in well 8250-3740-18. As the chloride content of the water in well 8250-3740-18 is also relatively high, the water may be polluted by surface seepage.

The water from well 8245-3740-108 contained 16 ppm of ammonium. Ammonium is not known to be present in any other waters from the Prestonsburg quadrangle. Ammonium in ground waters may be brought in from the air or may result from the decomposition of organic matter or nitrates. The reason for the presence of ammonium in the water from well 8245-3740-108 is not known.

The hardness of the waters ranged from 25 ppm in spring 8250-3735-20 to 98 ppm in well 8245-3740-108. Three of these well and spring waters are soft, and two are moderately hard.

The specific conductance of the waters ranged from 79.4 micromhos in spring 8250-3735-20 to 426 micromhos in well 8245-3740-108. The water from spring 8250-3735-20 was the least mineralized of all samples, from both the consolidated and unconsolidated rocks in the Prestonsburg quadrangle. The average specific conductance of waters from the alluvium was 261 micromhos and is lower than the average for waters from the Breathitt formation. Water from wells and springs in the alluvium is less mineralized than water from the Breathitt formation for two reasons: the alluvium is recharged readily by precipitation, and movement of water in the upper part of the saturated zone is relatively rapid; the alluvium represents material weathered from the consolidated rocks of the Breathitt formation, and by the time the alluvium is deposited much of the soluble material has been removed.

TEMPERATURE OF THE WATER

Ground-water temperatures were measured periodically in 2 wells penetrating the alluvium. The temperature record for well 8245-3740-18, in the valley of Little Paint Creek, extends from October 16, 1950, to October 23, 1951; the temperature record for well 8245-3740-108, in the valley of the Levisa Fork near Auxier, extends from January 14, 1952, to June 30, 1953. Temperatures in well 8245-3740-18 range from 44° to 64° F. Temperatures in well 8245-3740-108 range from 56° to 59° F and average 58° F.

The difference in the temperature range of the two wells is due to differences in the depth to water. The water level in well 8245-3740-18 is 4 to 8 feet below the surface and the water is easily influenced by the temperatures of the air and of the water percolating into it. The large diameter of the well probably allows the air temperature to affect the water in the well. Therefore, the temperature variation in well 8245-3740-18 is comparatively large. The water level in well 8245-3740-108 is 32 to 48 feet below the surface and is not easily affected either by the temperature of the air or by the temperature of the water percolating into it. Because the well is cased to a depth of 63 feet, water entering the well comes from that depth and is less subject to temperature changes than water at the top of the saturated zone. For these reasons, temperature variations of water in well 8245-3740-108 were slight.

RECORDS OF WATER WELLS, SPRINGS, AND COAL MINES YIELDING WATER

Water wells, springs, and coal mines yielding water in the Prestonsburg quadrangle are described in tables 5 and 6 (see Base data). Information classed as "reported" was obtained from the owner, tenant, or driller. Well and water-level depths not classed as "reported" were measured. The material in the principal water-bearing bed is that reported by the owner, tenant, or driller. Quotation marks are used if the term is a local one, or if its use in describing the material is doubtful.

RECORDS OF GAS, OIL, AND TEST WELLS, OF CORE AND AUGER HOLES, AND OF BRIDGE-PIER EXCAVATIONS

One hundred and fifty-seven gas, oil, and test wells in the Prestonsburg quadrangle are described in table 7 (see Base data). Records of these wells were supplied by the Kentucky-West Virginia Gas Co. and the Inland Gas Corp.

Records of core and auger holes and of bridge-pier excavations are given in table 8 (see Base data).

WELL LOGS AND MEASURED SECTIONS

Logs of 55 gas, oil, test, and water wells are listed under the section "Base data." Of the 157 gas, oil, and test-well logs collected during the investigation, 49 containing the most useful water information were selected for listing here. All but one are partial logs. Rock terms are those used by the driller. Where consolidated rocks were penetrated, the material logged as "slate" is shale, and the material logged as "sand" is sandstone. Other water-well log information reported by owners and drillers is given in table 5 under the column headed "Remarks." Samples were collected in the field by the author and a driller and examined in the office by the author.

The two sections (see Base data) were measured with hand level and a steel tape. Color was determined with a standard color chart. Grain sizes are listed according to the Wentworth scale.

WATER LEVELS IN OBSERVATION WELLS

Water levels in observation wells in the Prestonsburg quadrangle are listed in table 9 (see Base data). Biweekly measurements were made with a steel tape. Daily noon readings were taken from a recorder graph. The symbol "a" preceding a daily reading denotes an estimated reading; the symbol "b" denotes a tape measurement.

SELECTED BIBLIOGRAPHY

Baker, J. A., 1955, Geology and ground-water resources of the Paintsville area, Kentucky: U. S. Geol. Survey Water-Supply Paper 1257.

California State Water Pollution Control Board, 1952, Water quality criteria: Sacramento, Calif., Pub. 3, 512 p.

Campbell, M. R., 1893, Geology of the Big Stone Gap coal field of Virginia and Kentucky: U. S. Geol. Survey Bull. 111.

————1898, Description of the London quadrangle, Kentucky: U. S. Geol. Survey Geol. Atlas, folio 47.

Fenneman, N. M., 1938, Physiography of the eastern United States: New York, McGraw-Hill Book Co., Inc.

Hauser, R. E., and Thomas, G. R., 1952, Preliminary structure map on the Van Lear coal: Ky. Geol. Survey, ser. 9.

Hudnall, J. S., and Browning, I. B., 1949, Structural geologic map of the Paint Creek Uplift in Floyd, Johnson, Magoffin, Morgan, and Elliott Counties, Ky.: Ky. Geol. Survey, ser. 9.

Lafferty, R. C., Jr., 1949, Central basin of Appalachian geosyncline: Appalachian Geol. Soc. Bull., v. 1, p. 202–238.

McFarlan, A. C., 1943, Geology of Kentucky: Lexington, Ky., Univ. of Kentucky.

McGrain, Preston, and Thomas, G. R., 1951, Preliminary report on the natural brines of eastern Kentucky: Ky. Geol. Survey, ser. 9, Rept. Inv. 3, 22 p.

Meinzer, O. E., 1923, The occurrence of ground water in the United States with a discussion of principles: U. S. Geol. Survey Water-Supply Paper 489.

Morse, W. C., 1931, Pennsylvanian invertebrate fauna: Ky. Geol. Survey, ser. 6, v. 36, p. 293–348.

Otton, E. G., 1948, Geology and ground-water resources of the London area, Kentucky: Ky. Dept. Mines and Minerals, Geol. Div.

Thomas, R. N., 1949, Salt sand of eastern Kentucky: Appalachian Geol. Soc. Bull., v. 1, p. 166–183.

————1951, Devonian shale gas production in central Appalachian area: Am. Assoc. Petroleum Geologists Bull., v. 35, p. 2249–2256.

U. S. Weather Bureau, 1933–53, Climatological data.

Wanless, H. R., 1939, Pennsylvanian correlations in the Eastern Interior and Appalachian Coal Fields: Geol. Soc. America Special Paper 17.

Wanless, H. R., 1946, Pennsylvanian geology of a part of the southern Appalachian Coal Field: Geol. Soc. America Mem. 13.

Wenzel, L. K., 1942, Methods for determining permeability of water-bearing materials, with special reference to discharging-well methods: U. S. Geol. Survey Water-Supply Paper 887.

BASE DATA

Table 5.—*Records of water wells in*

Location: For location of wells, see plate 1. Type of well: Bo, bored; Dr, drilled; Du, dug. formation. Below land surface: Measured unless noted; r, reported. Lift: B, bucket or bailer; D, domestic; In, industrial; O, observation well; P, public supply; S, stock: Un, unused.

Well no.	Location	Owner or user	Driller	Type of well	Depth of well (feet)	Diameter of well (inches)
8245-3735-1	3.9 miles southwest of West Prestonsburg Post Office.	B. B. Shepard..........	S. Kinser...	Dr	....	6
2	..........do................	Paul Dotson............	....	Dr	52	6
3	4.2 miles southwest of West Prestonsburg Post Office.	..........do..............	....	Du	16	18
4	3.0 miles southwest of West Prestonsburg Post Office.	Henry Fritz.............	....	Dr	49	6
5	..........do................	Forks of Middle Creek school.	James Allen	Dr	100	6
6	2.2 miles southwest of West Prestonsburg Post Office.	Jimmy Green, formerly Tobia Marsillett.	Willard Kinser.	Dr	100	6
7	2.0 miles southwest of West Prestonsburg Post Office.	Clyde Clark............	S. Kinser...	Dr	69	6
8	1.7 miles southwest of West Prestonsburg Post Office.	Amos Dotson...........	Willard Kinser.	Dr	r100	6
9	1.6 miles southwest of West Prestonsburg Post Office.	..........do..............	Willard May.	Dr	r41	6
10	1.2 miles southwest of West Prestonsburg Post Office.	Della Allen............	Hayes Bros..	Dr	r78	6
11	1.0 mile south of junction of Kentucky Highways 404 and 114.	Bill Spriggs.............	....	Dr	39	6
12	..........do................	Irvine Amburgy........	....	Dr	43	6
13	0.9 mile south of junction of Kentucky Highways 404 and 114.	Henry Montgomery...	....	Dr	r80+	....
14	1.4 miles south of junction of Kentucky Highways 404 and 114	Joe Johnson.............	Frank Wells.	Dr	r48	6
15	..........do................	Susie Johnson...........	Isadore Horne.	Dr	r94	6
16	1.5 miles south of junction of Kentucky Highways 404 and 114.	Jerry Hackworth.......	Frank Wells.	Dr	45	6
17	..........do................	Darvin Johnson.........	.....do.......	Dr	44	6
18	1.6 miles south of junction of Kentucky Highways 404 and 114.	Moss Dempsey.........	Kinser(?).....	Dr	r42	6
19	1.9 miles south of junction of Kentucky Highways 404 and 114.	Docka Ousley..........	....	Dr	r68	6

the Prestonsburg quadrangle, Kentucky

Depth of well: measured unless noted; r, reported. Geologic unit: Al, alluvium; Br, Breathitt
E, electric; H, hand operated; J, jet; L, lift pump; Pi, pitcher pump. Use: C, commercial;

Principal water-bearing bed		Water level		Lift	Use	Remarks
Character of material	Geologic unit	Below land surface (feet)	Date of measurement			
....	Br	....	....	L,E	D,S	
Limestone (of drillers).	Br	11.86	Oct. 12, 1950	B,H	Un,O	
....	Al	10.17	Oct. 13, 1950	......	Un	
....	Br	6.45	......do........	B,H	P	Chemical analysis in table 1.
Sandstone and (or) siltstone.	Br	36.97	Aug. 6, 1951	B,H	P	Chemical analysis in table 1 and sample log on p. 113.
Sandstone...	Br	19.35	Dec. 19, 1950	......	Un,O	Chemical analysis in table 1.
....	Br	39.65	......do........	B,H	D	Do.
....	Br	....	....	J,E	P	Chemical analysis of chloride content in table 1.
....	Br	....	....	......	Un	Well partly filled.
Slate (of drillers).	Br	3.48	Mar. 26, 1951	B,H	D	Log, thickness in ft: slate 10: sand 22 to 24; slate (water) with hard kidney rock 44 to 46.
....	Br	15.79	Aug. 7, 1951	B,H	D	
....	Br	17.15	.....do.........	B,H	D	
....	Br	....	....	J,E	D,S	
Red sand-rock (of drillers).	Br	23.89	Aug. 7, 1951	B,H	D	Log, thickness in ft: unconsolidated material 40; red sand-rock 8.
Blue rock (of drillers).	Br	....	....	L,H	D,S	Gas in well.
Sandstone? or coal?.	Br	18.63	Aug. 7, 1951	B,H	D,S	
....	Br	18.80	.....do.........	B,H	D	
....	Br	20±	August 1951	J,E	D	
Limestone? (of drillers).	Br	....	....	J,E	D,S	

Table 5.—*Records of water wells in the*

Well no.	Location	Owner or user	Driller	Type of well	Depth of well (feet)	Diameter of well (inches)
8245-3735-20	0.4 mile south of Junction of Kentucky Highways 404 and 114.	Henry Fitch	Willard Kinser(?)	Dr	38	6
21	1.3 miles south of West Prestonsburg Post Office.	Katy Friend school	James Allen	Dr	74	6
22	1.8 miles southwest of West Prestonsburg Post Office.	Adam Sloan	S. Kinser and W. Kinser.	Dr	110	6
23	1.7 miles southwest of West Prestonsburg Post Office.	Margaret Prater	Kinser	Dr	60	6
24	1.6 miles southwest of West Prestonsburg Post Office.	Della Green	....	Dr	r126	6
25	1.7 miles southwest of West Prestonsburg Post Office.	Charles Warrix	S. Kinser	Dr	76	6
26	1.8 miles southwest of West Prestonsburg Post Office.	John Younce	Willard Kinser.	Dr	67	6
27	2.0 miles southwest of West Prestonsburg Post Office.	Ervin Sloan	....	Dr	42	6
28	2.1 miles southwest of West Prestonsburg Post Office.	Elzie Calhoun	....	Dr	54	6
29	2.4 miles southwest of West Prestonsburg Post Office.	Hobart Young	....	Dr	47	6
30	4.7 miles southwest of West Prestonsburg Post Office.	W. M. Stevens	James Allen	Dr	58	6
31	do	do	W. M. Stevens.	Dr	21	6
32	1.0 mile south of West Prestonsburg Post Office.	Virgie Hughes	....	Dr	76	6
33	1.4 miles southwest of West Prestonsburg Post Office.	W. C. Allen	Hayes Bros	Dr	62	6
34	1.3 miles southwest of West Prestonsburg Post Office.	Junior Burgess	....	Dr	68	6
35	do	J. E. Shepard	S. Kinser and W. Kinser.	Dr	r58	6
36	1.2 miles southwest of West Prestonsburg Post Office.	Bob Fitch	....	Dr	74	6
37	0.6 mile south of Prestonsburg Post Office.	Jane Collins	....	Dr	43	7
38	do	S. T. Bradley	S. T. Bradley	Dr	....	....
39	do	Bill Cooley	....	Dr	....	6
40	0.7 mile south of Prestonsburg Post Office.	Ruth Jesse	S. Kinser	Dr	62	6
41	0.9 mile south of Prestonsburg Post Office.	Marvin Wilson	S. Kinser and W. Kinser.	Dr	r109	6
42	0.6 mile south of Prestonsburg Post Office.	Maude Sloan	do	Dr	91	6
43	do	do	do	Dr	84	6

Prestonsburg quadrangle, Kentucky—Continued

Principal water-bearing bed		Water level				
Character of material	Geologic unit	Below land surface (feet)	Date of measurement	Lift	Use	Remarks
....	Br	14.18	Aug. 3, 1951	B,H	D	
Slate (of drillers) or coal.	Br	14.87	Sept. 5, 1951	B,H	P	Log, thickness in ft: sand, gray, very fine, 42; slate 26; coal seam 2; slate 4.
Rock below coal (of drillers).	Br	34.98	Sept. 4, 1951	B,H	D	
....	Br	24.74	.......do.......	B,H	D	Chemical analysis of chloride content in table 1.
....	Br	56.12	.......do.......	J,E	D	Do.
....	Br	33.31	.......do.......	B,H	D,S	
Slate (of drillers).	Br	31.26	.......do.......	B,H	D,S	Log, thickness in ft: slate 67.
....	Br	17.62	Sept. 5, 1951	B,H	D	
....	Br	30.20	.......do........	B,H	D	
....	Br	27.92	.......do........	B,H	D	
Soft slate (of drillers).	Br	16.20	.......do........	B,H	D	Log, thickness in ft: unconsolidated material 13; sandstone, blue, clayey (water); slate and small coal seam; rock, hard; slate, soft (water). Chemical analysis in table 1.
Blue clay sand (of drillers).	Br	11.98	.......do........	......	Un	Log, thickness in ft: unconsolidated material 13; sandstone, blue, clayey (water).
....	Br	57.70	Sept. 5, 1951	B,H	D	
....	Br	21.89	.......do........	J,E	D,S	Chemical analysis of chloride content in table 1.
....	Br	33.95	.......do........	......	Un	
....	Br	r24.5	March 1950	J,E	D	
....	Br	33.41	Sept. 5, 1951	B,H	D	
....	Br	20.77	Sept. 14, 1951	B,H	D	
....	Br	....	....	J,E	D	
....	Br	....	....	......	Un	Well filled.
....	Br	38.73	Sept. 14, 1951	B,H	D,S	Gas in well.
Slate? (of drillers).	Br	13?	.......do........	.....	Un	Well filled to within 14 ft of surface.
.....do......	Br	7.55	.......do........	B,H	Un	Chemical analysis in table 1.
.....do......	Br	8.09	.......do........	.....	Un	

Table 5.—*Records of water wells in the*

Well no.	Location	Owner or user	Driller	Type of well	Depth of well (feet)	Diameter of well (inches)
8245-3735- 44	0.8 mile south of Prestonsburg Post Office.	Ted Nelson..........	....	Dr	57	6
45	0.9 mile south of Prestonsburg Post Office.	Charles Perry........	Hayes Bros..	Dr	63	6
46	.......do..................	Arthur Hicks..........	.....do.......	Dr	68	6
47	1.1 miles south of Prestonsburg Post Office.	Sam Sizemore........	S. Kinser	Dr	54	6
48	1.2 miles south of Prestonsburg Post Office.	Hettie Sizemore......	.....do.......	Dr	63	6
49	2.9 miles southeast of Prestonsburg Post Office.	Ralph Marshall......	Willard Kinser.	Dr	r100+	6?
50	2.8 miles southeast of Prestonsburg Post Office.	Ed Banks.............	....	Dr	58	6
51	.......do..................	.......do...............	....	Dr	....	6
52	1.4 miles northwest of Watergap Post Office.	Kentucky-West Virginia Gas Co.	Kentucky-West Virginia Gas Co.	Dr	83	11
53	0.1 mile west of Watergap Post Office.	Jack DeRossett......	Willard Kinser.	Dr	r76	6
54	0.8 mile south of Watergap Post Office.	Columbia Fuel Corp.	....	Dr	r85	6
55	.......do..................	.......do...............	....	Dr	r65	6
56	0.1 mile south of Watergap Post Office.	Alex DeRossett.....	Willard Kinser.	Dr	44	6
57	.......do..................	Forks of Bull Creek school.	....	Dr	51	6
58	1.3 miles southwest of Watergap Post Office.	Joe Meadows........	....	Dr	51	7
59	1.6 miles southwest of Watergap Post Office.	Warrix school.......	....	Dr	....	6
8245-3740- 1	North Lake Drive, Prestonsburg.	B. M. Thompson....	....	Dr	80	6
2	.......do..................	W. E. Jackson.......	....	Dr	....	6
3	Near corner of North Lake Drive and unnamed street, Prestonsburg.	Atlas Compton.......	....	Dr	r85	6
4	North Lake Drive, Prestonsburg.	T. E. Neeley........	Martin(?) Lyons.	Dr	r70	6
5	.......do..................	.......do...............	....	Dr	r70	6
6	At end of unnamed street, Prestonsburg.	James Harmon........	S. Kinser(?)	Dr	r90?	6
7	North Lake Drive, Prestonsburg.	Malcolm George.....	....	Dr	65	6
8	Jackson Street, Prestonsburg.	J. W. Burke..........	S. Kinser...	Dr	68	6
9	.......do..................	Ralph Farris..........	S. Kinser(?)	Dr	r60 or 75	6
10	North Lake Drive, Prestonsburg.	Otis Cooley..........	....	Dr	r89	6
11	Main Street, Prestonsburg.	Julia Blackburn......	....	Du	19	18
12	1.8 miles north of Cliff Post Office.	Sol DeRossett........	....	Du	24	18
13	1.5 miles west of Cliff Post Office.	Gervin Waddle......	Gervin Waddle.	Dr	43	6

Prestonsburg quadrangle, Kentucky—Continued

Principal water-bearing bed		Water level		Lift	Use	Remarks
Character of material	Geologic unit	Below land surface (feet)	Date of measurement			
Blue sandstone.	Br	37.79	Sept. 14, 1951	......	D	Gas in well.
Blue slate (of drillers).	Br	26.09	......do.......	B,H	D	
....	Br	14.94	......do.......	B,H	D	
....	Br	9.91	......do.......	B,H	D,S	
....	Br	24.37	......do.......	B,H	D	
....	Br	....	....	J,E	D	
....	Br	24.33	Oct. 23, 1951	J,E	D	
....	....	....	....	......	Un	Well filled.
Sand and slate(of drillers).	Br	33.34	Oct. 25, 1951	......	Un	Log, thickness in ft: soil 30; sand and slate 53.
Coal seam	Br	r25?	1951	J,E	D	
....	Br	....	....	L,E	In	
....	Br	....	....	L,E	In	
Sandstone	Br	8.79	Oct. 25, 1951	B,H	D,P	Log, thickness in ft: surface 13, sandstone 31. Chemical analysis in table 1.
....	Br	16.33	......do.......	B,H	P	Chemical analysis of chloride content in table 1.
....	Br	25.61	......do.......	B,H	D	
....	....	....	....	B,H	P	
....	Br	37.47	Oct. 9, 1950	......	Un,O	
....	Br	....	....	J,E	D	
....	Br	r10	....	J,E	Un	
....	Br	r35	....	J,E	D,P	
....	Br	....	....	L,E	D	
....	Br	....	....	J,E	Un	
....	Br	28.48	Oct. 11, 1950	B,H	Un	
Sand (of drillers).	Br	23.10	Oct. 12, 1950	B,H	D	Chemical analysis in table 1.
....	Br	38.07	......do.......	L,H	Un	
Limestone (of drillers).	Br	r45	....	......	Un	
....	Al	9.13	......do.......	......	Un,O	
....	....	6.21	Oct. 17, 1950	B,H	D,O	
Sandstone	Br	22.09	Oct. 20, 1950	B,H	D	Log, thickness in ft: unconsolidated material 11; coal, streak 1 to 2; slate, rotten 2; sandstone 37. Chemical analysis in table 1.

Table 5.—*Records of water wells in the*

Well no.	Location	Owner or user	Driller	Type of well	Depth of well (feet)	Diameter of well (inches)
8245-3740-14	1.7 miles west of Cliff Post Office.	Raymond Waddle.....	Gervin Waddle.	Dr	29	6
15	1.6 miles west of Cliff Post Office.	Erman Waddle..........	Gervin Waddle and Erman Waddle.	Dr	49	6
16	1.8 miles west of Cliff Post Office.	Sherd Waddle...........	Gervin Waddle.	Dr	12	6
17	1.6 miles north of Cliff Post Office.	J. E. Conley............	....	Dr	r192	6
18	1.9 miles north of Cliff Post Office.	Tom DeRossett.........	....	Du	11	18
19	1.8 miles north of Cliff Post Office.	Rebecca DeRossett....	....	Du	18	18
20	1.6 miles north of Cliff Post Office.	Bee Daniels..............	John May....	Dr	88	6
21	.......do..................	.......do..................	Bee Daniels	Du	18	18
22	.......do..................	Frank Neeley...........	Willard May	Dr	r92	....
23	.......do..................	.......do..................	....	Du	28	18
24	Along unnamed tributary to Greer Branch, 0.8 mile west of U. S. Highway 23.	W. J. Music............	Fyffe..........	Dr	54	6
25	.......do..................	.......do..................	.....do.........	Dr	33	4
26	2.1 miles north of Cliff Post Office.	Kanard Hall (tenant)..	....	Dr	47	6
27	0.3 mile south of West Prestonsburg Post Office.	B. M. Spurlock.........	....	Dr	28	7
28	0.4 mile west of West Prestonsburg Post Office	German Miller..........	John Lyons...	Dr	46	6
29	0.5 mile west of West Prestonsburg Post Office.	Sammy Bays, Jr........	Willard Kinser......	Dr	38	6
30	.......do..................	Delmer Robinson......	.....do.........	Dr	40	6
31	0.2 mile northwest of West Prestonsburg Post Office.	Herbert LeMasters.....	John Lyons...	Dr	r105	6
32	Corner of Harkins Avenue and unnamed street, Prestonsburg.	R. E. Pitts...............	John Lyons(?)	Dr	....	6
33	3.1 miles west of Cliff Post Office.	Bill Morgan..............	Gervin Waddle.	Dr	36	6
34	3.4 miles west of Cliff Post Office.	Buck Hobson............	....	Dr	r70	6
35	3.1 miles west of Cliff Post Office.	E. C. Howell............	Frank May and Son.	Dr	18	5

Prestonsburg quadrangle, Kentucky—Continued

Principal water-bearing bed		Water level		Lift	Use	Remarks
Character of material	Geologic unit	Below land surface (feet)	Date of measurement			
Sandstone	Br	11.33	Oct. 20, 1950	B, H	D	Log, thickness in ft: unconsolidated material 12 to 13; slate 12 to 13; sand, hard (water in fissure) 11. Chemical analysis in table 1.
Sandstone and (or) coal.	Br	12.27	.......do........	B, H	D, O	Log, thickness in ft: clay, yellow 8; clay, blue 40; sandstone, broken up, soft, 2 to 2½; coal (water) 2; sandstone, blue, hard 12±. Chemical analysis in table 1.
Coal.......	Br	1.15	.......do........	B, H, Gr	D	Log, thickness in ft: dirt 6; slate 3 to 4; coal (water) 2 to 3; sandstone 8±. Chemical analysis in table 1.
....	Br	....	....	L?, E	D, P	
....	Al	5.83	Oct. 16, 1950	B, H	D	
....	Al	7.05	.......do........	B, H	D	
Slate (of drillers).	Br	16.68	.......do........	B, H	D, O	Log, thickness in ft: dirt 10; slate (water) 84. Chemical analysis in table 1.
Slate (of drillers), soil and clay.	Br	6.97	.......do........	......	Un, O	Log, thickness in ft: dirt and clay (water) 6 to 7; slate (water) 11 to 12.
Sandstone?	Br	r40	....	J?, E	D	
....	....	12.76	Oct. 30, 1950	......	Un, O	
....	Br	32.77	Mar. 26, 1951	B, H	D	Gas in well.
....	Br	25.80	.......do........	......	Un	Do.
....	Br	26.08	Mar. 25, 1951	B, H	D	
....	Al?	19.76	Sept. 5, 1951	......	Un	
Black slate (of drillers).	Br	20.84	Sept. 6, 1951	B, H	D	Log, thickness in ft: sandstone 5 to 6; slate, black (water) 40 to 41.
Yellow sandstone.	Br	3.26	.......do........	B, H	Un	
Blue rock (of drillers).	Br	15.02	.......do........	B, H	Un	Chemical analysis of chloride content in table 1.
....	Br	r75	1934	J, E	D	
....	....	....	Sept. 6, 1951	......	Un	Well filled.
....	Br	20.45	.......do........	B, H	D	
....	Br	....	....	L, H	D	
Soft slate (of drillers).	Br	12.12	Sept. 6, 1951	B, H	D	Log, thickness in ft: dirt 9; slate, soft (water) 9.

Table 5.—*Records of water wells in the*

Well no.	Location	Owner or user	Driller	Type of well	Depth of well (feet)	Diameter of well (inches)
8245-3740- 36	3.0 miles west of Cliff Post Office.	Altha Hackworth.....	....	Dr	....	7
37	3.5 miles west of Cliff Post Office.	Homer Neeley........	....	Dr	....	....
38	2.3 miles west of Cliff Post Office.	Norman Prater........	....	Dr	....	....
39	2.2 miles west of Cliff Post Office.	Jim Miller.............	S. Kinser....	Dr	r63	6?
40	1.3 miles west of Cliff Post Office.	Charlie Arnett........	.....do.......	Dr	61	6
41	2.0 miles west of Cliff Post Office.	Paris Conley..........	....	Dr	r81	6?
42	1.7 miles west of Cliff Post Office.	Delmis Saunders......	....	Dr	....	6
43	1.1 miles west of Cliff Post Office.	Ollie Hill..............	John May....	Dr	....	....
44	1.8 miles southwest of Cliff Post Office.	Big Branch school....	....	Dr	49	6
45	0.9 mile northwest of Cliff Post Office.	Orville Dotson........	Link Fyffe...	Dr	50	6
46	0.6 mile northwest of Cliff Post Office.	Earl Moore............	John May....	Dr	r60±	6
47	0.7 mile northwest of Cliff Post Office.	..........do...........	......do......	Dr	r60	6
48	.......do..................	E. P. Hill.............	.....do.......	Dr	....	....
49	0.8 mile northwest of Cliff Post Office.	Mrs. Tom Hereford	....	Dr	r45	....
50	1.2 miles east of Prestonsburg Post Office.	E. H. Smith..........	Hayes.........	Dr	40	6
51	1.4 miles east of Prestonsburg Post Office.	Grant Walders........	Willard Kinser..	Dr	....	....
52	1.5 miles east of Prestonsburg Post Office.	Mrs. Porter Mayo....	.....do........	Dr	....	6
53	1.4 miles west of Cliff Post Office.	G. L. Goodman......	John May.....	Dr	87	6
54	0.7 mile northwest of of Cliff Post Office.	William Greenwade	....	Dr	31	8
55	1.4 miles west of Cliff Post Office.	G. L. Goodman......	John May....	Dr	r45	6
56	At junction of U. S. Highway 23 and Kentucky Highway 114, Prestonsburg.	William Greenwade	....	Dr	r92	6
57	0.5 mile northeast of Cliff Post Office.	Bascom May..........	Lyons.........	Dr	r57	6
58	0.9 mile northeast of Cliff Post Office.	Oscar Miller..........	....	Dr	r80	6
59	1.3 miles northeast of Cliff Post Office.	Maude Clark..........	Link Fyffe...	Dr	r110	6
60	1.4 miles northeast of Cliff Post Office.	Spradlin Branch school.	....	Dr	....	6
61	.......do..................	Thurmon and Arnold Clark.	Link Fyffe...	Dr	r63	6
62	.......do..................	Dow Webb.............	.....do.......	Dr	r62	6
63	.......do..................	Kermit Morgan.......	Gervin Waddle and Link Fyffe.	Dr	r100±	6
64	1.5 miles northeast of Cliff Post Office.	Arthur Goebel.........	Link Fyffe	Dr	r79	6
65	1.6 miles northeast of Cliff Post Office.	M. V. Clark...........	Isadore Horne	Dr	r94	6
66	1.7 miles northeast of Cliff Post Office.	Bert Calhoun..........	....	Dr	....	....

Prestonsburg quadrangle, Kentucky —Continued

Principal water-bearing bed		Water level		Lift	Use	Remarks
Character of material	Geologic unit	Below land surface (feet)	Date of measurement			
...	Br	...	Sept. 6, 1951	...	Un	Well filled to above surface.
...	Br	...	...	J, E	D	
...	Br	...	...	J?, E	D, S	
...	Br	25	1939±	J, E	D	
...	Br	15.92	Sept. 13, 1951	B, H	D	
...	Br	...	...	Pi, H	D	
...	Br	...	...	...	D?	
...	Br	...	...	L, H	S	
...	Br	17.70	Sept. 12, 1951	B, H	P	
...	Br	16.26	...do...	J, E	D	
...	Br	...	...	L, E	D, S	
...	...	...	...	L, H	S	
...	Br	...	...	L, E	D, S	
Sand...	Al	...	...	L, H	D	
...	Br	10.64	Sept. 13, 1951	...	Un	
...	Br	...	...	E	Un	
...	Br	...	...	...	Un	Well filled.
White sandstone.	Br	46.30	Sept. 13, 1951	B, H	D	Log: slate; sandstone, white (water).
...	...	23.75	...do...	B, H	D	
...	Br	...	...	...	Un	Well filled to within 4 ft of surface.
...	Br	r62	1936±	L, E	Un	
Hard rock	Br	...	...	L, H	D	
...	Br	...	...	J, E	D, S	
Sandstone	Br	r80±	1948±	L, E	D	
...	Br	...	...	L, H	P	
...	Br	r13	April 1951	J, E	D	
...	Br	...	...	J, E	D	
Sandstone	Br	...	...	...	Un	
...	Br	...	...	J, E	D	
Sandstone?	Br	r40	1941	J, E,	D	Log, thickness in ft: alluvium 84; slate; sandstone? (water).
...	Br	...	...	J, E	D, S	

Table 5.—*Records of water wells in the*

Well no.	Location	Owner or user	Driller	Type of well	Depth of well (feet)	Diameter of well (inches)
8245-3740- 67	1.8 miles northeast of Cliff Post Office.	W. R. Wells..........	Hobart Hayes.	Dr	r85	6
68	.......do.................	Bud Calhoun..........	....	Dr	53	6
69	2.3 miles northeast of Cliff Post Office.	Polk Saunders.........	....	Dr	56	6
70	2.6 miles northeast of Cliff Post Office.	Carl Bingham..........	Link Fyffe...	Dr	r70	6
71	3.6 miles south of Auxier Post Office.	Hansford Honeycutt...	James Allen	Dr	r49	6
72	3.5 miles south of Auxier Post Office.	George Hyden........	....	Dr	79	6
73	.......do.................	George school.........	....	Dr	59	6
74	3.4 miles south of Auxier Post Office.	John Branham.........	....	Dr	61	6
75	3.2 miles south of Auxier Post Office.	.......do...............	....	Dr	r74	....
76	3.1 miles south of Auxier Post Office.	Dennis Warrix.........	....	Dr	48	6
77	3.2 miles south of Auxier Post Office.	Alex Bingham.........	Willard Kinser.	Dr	41	6
78	1.3 miles northeast of Cliff Post Office.	Harry Simons..........	....	Du	50	22
79	1.4 miles northeast of Cliff Post Office.	T. J. Bingham.........	Link Fyffe...	Dr	r90+	6
80	.......do.................	Edgar Bingham.........	Isadore Horne.	Dr	r90	6
81	1.5 miles northeast of Cliff Post Office.	Woodrow Stevens......	Link Fyffe...	Dr	r90+	6
82	1.6 miles northeast of Cliff Post Office.	Roe Layne..............	....	Dr	....	6
83	.......do.................	Jim Stevens............	John Lyons...	Dr	r96	5
84	1.7 miles northeast of Cliff Post Office.	Cliff school............	S. Kinser and W. Kinser	Dr	....	6
85	.......do.................	John Lafferty, Jr.......	James Allen	Dr	r101	6
86	2.5 miles north of Cliff Post Office.	Tom Moore............	....	Dr	165	3
87	3.2 miles north of Cliff Post Office.	R. L. May.............	James Allen	Dr	48	6
88	2.3 miles northeast of Cliff Post Office.	Tom Moore............	....	Dr	....	4?
89	0.8 mile southeast of Auxier Post Office.	L. G. Mayo............	....	Dr	....	6
90	0.7 mile southeast of Auxier Post Office.	Carri Wells............	Willard Kinser.	Dr	75	6
91	0.6 mile southeast of Auxier Post Office.	David Bickford.........	Link Fyffe....	Dr	r49	6
92	.......do.................	Willard Collins........	.....do........	Dr	41	6
93	0.5 mile southeast of Auxier Post Office.	William Wells.........	J. H. Fyffe..	Dr	71	6
94	0.6 mile southeast of Auxier Post Office.	G. W. Wells...........	Link Fyffe....	Dr	67	6
95	0.5 mile southeast of Auxier Post Office.	W. G. Webb...........	....	Dr	15	7
96	0.6 mile southeast of Auxier Post Office.	W. H. Horne..........	W. H. Horne	Bo	43	8
97	0.2 mile southeast of Auxier Post Office.	Logan Fraley..........	....	Dr	36	6

Prestonsburg quadrangle, Kentucky— Continued

Principal water-bearing bed		Water level		Lift	Use	Remarks
Character of material	Geologic unit	Below land surface (feet)	Date of measurement			
....	Br	r11 to 13	June 1951	J,E	D	
....	Br	15.04	Nov. 20, 1951	B,H	D	
....	Br	36.22	Oct. 30, 1951	B,H	D	
....	Br	....	....	J,E	D,S	
....	Br	r15	1950	J,E	D	
....	Br	34.29	Nov. 6, 1951	J,E	D	
....	Br	42.60	.....do..........	B,H	Un	
....	Br	28.63	.....do..........	B,H	D	
....	Br	....	....	J,E	D	
Sandstone	Br	....	....	J,E	D,S	
Coal seam?	Br	8.32	Nov. 6, 1951	J,E	D	
Sand........	Al	43.70	Dec. 6, 1951	B,H	D	Log: clay; sand (water).
....	Br	r40	October 1948	J,E	D	
Sandstone..	Br	30 to 40	December 1951.	J,E	D	
....	Br	....	....	L,H	D	
....	Br	....	....	B,H	D	
Coal seam	Br	r50 to 60	1951	L,H	S	
....	Br	....	....	L,H	D,S,F	
....	Br	....	....	J,E	D,S	
Coal seam.	Br	50.78	Dec. 7, 1951	......	Un	Core hole. Log on p. 114.
White rock (of drillers).	Br	4.39	.......do.........	B,H	D	
....	Al	....	....	......	Un	Well filled to within 3± ft of top.
....	Br	....	....	J?, E	D	
....	Br	47.26	Dec. 13, 1951	B,H	D	
....	Br	....	....	J?, E	D	
....	Br	12.23	Dec. 13, 1951	J,E	D,S	
....	Br	38.18	Jan. 9, 1952	B,H	D	Chemical analysis of chloride content in table 1.
Hard rock (of drillers).	Br	37.41	Dec. 13, 1951	J,E	D	Do.
Quicksand (of drillers).	Al	2.25	Jan. 9, 1952	B,H	D	Log, thickness in ft: clay, yellow 22½; clay, blue 1½; quicksand (water) 4.
.....do......	Al	35.12	Jan. 14, 1952	B,H	S	Log, thickness in ft: soil, sandy 20; muck, blue 3 to 4; quicksand, medium-grained (water) 22 to 23. Chemical analysis in table 1.
....	Br	11.61	.......do.........	B,H	D	Chemical analysis of chloride content in table 1.

Table 5.—*Records of water wells in the*

Well no.	Location	Owner or user	Driller	Type of well	Depth of well (feet)	Diameter of well (inches)
8245-3740- 98	0.3 mile south of Auxier Post Office.	W. J. Music...........	Link Fyfee(?)	Dr	59	6
99	0.4 mile south of Auxier Post Office.	Richard Wells.........	....	Dr	43	6
100	0.3 mile south of Auxier Post Office.	Warin Caudill.........	....	Dr	....	6
101	0.2 mile south of Auxier Post Office.	T. J. Davis............	Link Fyffe...	Dr	....	6
102	0.1 mile southwest of Auxier Post Office.	.......do.................	.......do......	Dr	r60+	6
103	.......do..................	E. B. Daniels..........	....	Dr	r71	....
104	0.2 mile southwest of Auxier Post Office.	Emory Gilbert..........	....	Dr	r78	....
105	.......do..................	W. H. Mills............	....	Dr	64	6
106	House number 54, Auxier.	Lincoln Daniels........	Raymond Melvin.	Dr	r100+	....
107	House number 39, Auxier.	E. E. Wells.............	.......do.......	Dr	r108	6
108	House number 48, Auxier.	Jake Hollifield.........	Link Fyffe...	Dr	59	6
109	House number 6, Auxier.	George Reynolds......	....	Dr	99	6
110	House number 26, Auxier.	G. W. Music..........	Raymond Melvin.	Dr	r94	......
111	At Auxier Post Office..	Mallory Stores, Inc...	....	Dr	....	5
112	House number 11, Auxier.	Ora Curnuette...........	Link Fyffe...	Dr	93	6
113	House number 1, Auxier.	Claude Music..........	Raymond Melvin.	Dr	100	6
114	0.1 mile south of Auxier Post Office.	T. J. Davis..............	John Lyons..	Dr	r114	6
115	.......do..................	.......do.................	.......do......	Dr	r131	6
116	House number 105, Auxier.	Phillip Childers........	Raymond Melvin.	Dr	r89	6
117	3.1 miles southeast of East Point Post Office.	Otto Hyden.............	Hayes(?).....	Dr	89	6
118	0.6 mile west of Auxier Post Office.	Palmer Wells...........	Link Fyffe...	Dr	80	6
119	0.7 mile southwest of Auxier Post Office.	Samuel T. Hobson....	Hayes........	Dr	54	6
120	1.0 mile southwest of Auxier Post Office.	Marvin Crider..........	Link Fyffe...	Dr	50	6
121	0.6 mile southwest of Auxier Post Office.	Floyd Moles............	....	Dr	32	6
122	1.5 miles west of Auxier Post Office.	Bill Foley................	....	Dr	r130	r4?
123	.......do..................	.......do.................	Link Fyffe...	Dr	r69	r8
124	0.5 mile southeast of East Point Post Office.	Tony Reneer...........	S. Kinser and James Allen.	Dr	r296	r6

Prestonsburg quadrangle, Kentucky— Continued

Principal water-bearing bed		Water level		Lift	Use	Remarks
Character of material	Geologic unit	Below land surface (feet)	Date of measurement			
....	Br	12.91	Jan. 14, 1952	B,H	D	
....	Br	19.09	.......do.......	B,H	D,S	
....	Br	....	....	....	Un	
Hard shale	Br	....	....	....	Un	
....do......	Br	r10±	1950	J,E	D,S	Chemical analysis of chloride content in table 1.
....	Br	....	....	L,H	P	Do.
....	Br	r20	July 1950	J,E	D	
....	Br	.60	Jan. 14, 1952	B,H	D	
....	Br	....	....	J,E	D	Chemical analysis of chloride content in table 1.
....	Br	....	....	J,E	D	Do.
....	Al	38.53	Jan. 14, 1952	B,H	D,O	Log, thickness in ft: clay and fine sand 79; slate, soft, and hard rock (water) 26; coal. Chemical analysis in table 1.
....	Br	46.71	Dec. 4,1952	....	Un	Chemical analysis of chloride content in table 1.
Black slate (of drillers).	Br	....	....	....	D	Log, thickness in ft: alluvium 90; slate, black (water) 4. Chemical analysis of chloride content in table 1.
....	Br	....	....	J,E	C	Chemical analysis of chloride content in table 1.
Blue rock (of drillers).	Br	39.96	Jan. 15, 1952	J,E	D	Log, thickness in ft: alluvium 85; rock, blue (water) 9. Chemical analysis of chloride content in table 1.
Sandstone..	Br	37.55	.......do.......	B,H	D,S	Log, thickness in ft: alluvium 89; sandstone (water) 17. Chemical analysis of chloride content in table 1.
....	Br	....	....	......	Un	Well filled.
....	Br	....	....	....	Un	
....	Br	....	....	....	Un	
....	Br	38.39	Jan. 15, 1952	B,H	D,S	
Hard limestone (of drillers).	Br	21.06	Jan. 16, 1952	J,E	D	
Slate?......	Br	12.37	Jan. 15, 1952	B,H	D	
....	Br	12.55	.......do.......	B,H	D	
....	Br	17.05	Jan. 16, 1952	B,H	Un	
....	Br	....	....	....	D	Chemical analysis of chloride content in table 1.
....	Br	....	....	....	Un	
....	Br	r60	....	L,E	Un	

Table 5.—*Records of water wells in the*

Well no.	Location	Owner or user	Driller	Type of well	Depth of well (feet)	Diameter of well (inches)
8245-3740-125	0.5 mile southeast of East Point Post Office	Tony Reneer	Pat Ramsey	Dr	r109	r6
126	0.3 mile east of East Point Post Office.	E. M. Conley	Charles McKenzie.	Dr	36	6
127	do	Myrtle Boyd	do	Dr	45	6
128	100 ft southwest of East Point Post Office.	East Point school	do	Dr	50	6
129	0.2 mile east of East Point Post Office.	Naomi Greer		Dr		
130	0.3 mile east of East Point Post Office.	G. L. Ramey	McKenzie and Conley.	Dr	44	6
131	25 ft northeast of East Point Post Office.	S. M. Music	Link Fyffe	Dr	r56	6
132	1.1 miles southwest of East Point Post Office.	Tobe Auxier	do	Dr	42	6
133	0.3 mile northwest of East Point Post Office.	John Price	do	Dr	r95	4
134	0.5 mile northwest of East Point Post Office.	Ernest Hunt	do	Dr	r130	6
135	2.1 miles west of Cliff Post Office.	Bill Conley	Hayes Bros	Dr	r60	6
136	250 feet south of East Point Post Office.	J. K. DeLong	Link Fyffe	Dr		6
137	1.9 miles southeast of East Point Post Office.	W. F. Morell	Willard Kinser.	Dr	r147	6
138	0.4 mile northwest of East Point Post Office.	Martin Crider	Link Fyffe	Dr	r54	6
139	0.6 mile southeast of East Point Post Office.	Charles McKenzie		Dr	r58	6
140	0.9 mile southeast of East Point Post Office.	J. L. Music	Link Fyffe and Son.	Dr	r60	6
141	1.3 miles southeast of East Point Post Office.	Hershel Crider		Dr	31	6
142	1.6 miles south of East Point Post Office.	Joe Blackburn	Willard Kinser.	Dr	r50	6
143	2.0 miles south of East Point Post Office.	Bill Blackburn		Dr	r60	6
144	2.5 miles south of East Point Post Office.	W. L. Baldridge	S. Kinser	Dr	r51	6
145	2.7 miles south of East Point Post Office.	John Music	McKenzie and Conley.	Dr	54	6
146	3.9 miles southwest of East Point Post Office.	Sam Music	S. Kinser	Dr	r71	6
147	4.0 miles southwest of East Point Post Office.	Ed Music	John May	Dr	r45	
148	2.8 miles south of East Point Post Office.	W. A. Baldridge	Link Fyffe	Dr	r60	6
149	2.9 miles south of East Point Post Office.	Nelson Baldridge	do	Dr	r60	6
150	3.1 miles south of East Point Post Office.	Fred Baldridge	do	Dr	32	6
151	2.8 miles south of East Point Post Office.	Harry Baldridge	S. Kinser	Dr		6
152	2.9 miles south of East Point Post Office.	Clifford Baldridge	Link Fyffe	Dr	r75	6

Prestonsburg quadrangle, Kentucky— Continued

Principal water-bearing bed		Water level		Lift	Use	Remarks
Character of material	Geologic unit	Below land surface (feet)	Date of measurement			
....	Br	r69	....	J,E	Un	
....	Br	r69	....	L,E	Un	
....	Br	15.82	Jan. 18, 1952	B,H	D	
Sandy-like rock (of drillers).	Br	25.63	.......do........	B,H	D	
Siltstone....	Br	10.06	.......do.......	....	Un	Chemical analysis in table 1 and sample log 9 on p. 115.
....	....	....	....	E	Un	
Siltstone...	Br	10.71	Jan. 18, 1952	L?,E	D	Chemical analysis in table 1 and sample log on p. 115.
Hard rock (of drillers).	Br	r12	....	L,H	D,S	
.....do......	Br	14.07	Mar. 4, 1952	B,H	D	
....	Br	r50	....	J,E	D	
Blue rock slate (of drillers).	Br	33.41	Mar. 4, 1952	B,H	D	
Sandstone..	Br	r13	Mar. 13, 1952	J,E	D	Chemical analysis in table 1 and sample log on p. 115.
....	Br	....	....	J,E	D	
....	Br	r100	March 1952	B,H	D	Log thickness, in ft: soil 2 to 3; sandstone with a little slate 144 to 145.
Slate (of drillers) or sandstone.	Br	r10 to 12	....	J,E	D,S	
....	Br	r20	....	L,H	D	
....	Br	....	....	L,H	D,S	
Coal.........	Br	6.08	May 12, 1952	Pi,H	Un	
....	....	r20	....	J,E	D,C	Chemical analysis of chloride content in table 1.
....	Br	....	....	......	D	
....	Br	r11	....	L,H	D,S,C	
....	Br	13.40	May 14, 1952	B,H	D	
....	Br	r21	....	J,E	D	Chemical analysis in table 1.
Sand........	Al	....	....	J,E	D	
Sandstone..	Br	r5	Fall 1949	J,E	D	
....	Br	....	....	J,E	D,S	
Black slate (of drillers).	Br	r5.71	May 14, 1952	B,H	D	
....	....	....	....	J,E	D	
....	....	....	....	J,E	D	

Table 5.—*Records of water wells in the*

Well no.	Location	Owner or user	Driller	Type of well	Depth of well (feet)	Diameter of well (inches)
8245-3740-153	2.9 miles south of East Point Post Office.	Herbert Spradlin......	Link Fyffe...	Dr	60	6
154	3.1 miles south of East Point Post Office.	W. L. Baldridge, Jr.	McKenzie and Conley.	Dr	r61	6
155	3.2 miles south of East Point Post Office.	J. M. Hall............	....	Dr	r61	r5
156	1.7 miles south of East Point Post Office.	Claude Robinson.....	J. H. Fyffe..	Dr	127	6
157	1.9 miles south of East Point Post Office.	J. H. Nunnery........	Willard May	Dr	r63	6
158	.......do..................	.......do...............	Claude May	Dr	r62	6
159	2.0 miles south of East Point Post Office.	J. B. Music...........	McKenzie and Conley.	Dr	r61	6
161	3.8 miles northwest of Cliff Post Office.	Upper Little Paint school.	....	Dr	......	6
163	House number 27, Auxier.	William Wells........	J. H. Fyffe and Son.	Dr	98	6
208	1.6 miles southwest of East Point Post Office.	Marion Lilly, Jr.....	....	Du	14	30±
209	2.5 miles southwest of East Point Post Office.	Mrs. Belle Moles.....	....	Du	13	36±
210	2.0 miles southwest of East Point Post Office.	Jeff Moles.............	....	Du	17	24+
211	4.5 miles southwest of East Point Post Office.	C. B. Combs..........	Ruben Howard.	Du	19	36±
212	4.4 miles southwest of East Point Post Office.	Curtis Richardson....	Curtis Richardson and Sons.	Du	23	24
213	5.4 miles southwest of East Point Post Office.	Clarence Tackett....	James Allen and Woodrow Allen.	Dr	77	6
214	0.9 mile northwest of Cliff Post Office.	O. E. Holmes........	Polk Saunders	Dr	54	5
8250-3735-1	7.1 mile southwest of West Prestonsburg Post Office.	Willard Stevens......	....	Dr	......	......
2	6.8 miles southwest of West Prestonsburg Post Office.	M. T. Dotson........	Willard Kinser	Dr	r58	......
3	.......do..................	Arnett school.........	S. Kinser(?).	Dr	24+	6
4	6.5 miles southwest of West Prestonsburg Post Office.	M. T. Dotson........	S. Kinser.....	Dr	r60	6
5	6.0 miles southwest of West Prestonsburg Post Office.	Walter Holbrook....	May...........	Dr	37	6
6	5.9 miles southwest of West Prestonsburg Post Office.	Boyd Holbrook........	....	Dr	......	......
7	5.2 miles southwest of West Prestonsburg Post Office.	Fitzpatrick school....	....	Dr	......	6
8	4.0 miles southwest of West Prestonsburg Post Office.	Inland Gas Corp.	....	Dr	r54	4
9	7.0 miles southwest of West Prestonsburg Post Office.	Ellis Manes...........	....	Dr	46	6
10	6.5 miles southwest of West Prestonsburg Post Office.	G. R. Spradlin.......	....	Dr	50	5

Prestonsburg quadrangle, Kentucky— Continued

Principal water-bearing bed		Water level		Lift	Use	Remarks
Character of material	Geologic unit	Below land surface (feet)	Date of measurement			
....	....	r24.75	May 14, 1952	B,H	D	
Blue sand-rock (of drillers).	Br	r30±	....	J,E	D	
Sandstone..	Br	r1	....	J,E	D	
....	Br	27.68	May 14, 1952	......	Un	Chemical analysis in table 1.
....	Br	....	....	J,E	D	Chemical analysis of chloride content in table 1.
....	Br	....	....	L,E	S	
....	Br	r25	....	J,E	D	
....	....	....	....	L,H	P	
Sandstone..	Br	42.82	July 9, 1952	J,E	D	Chemical analysis in table 1 and sample log on p. 116.
....	Al?	13.98	Nov. 14, 1952	B,H	D	
....	Al?	12.99	.......do........	B,H	D,S	
Coal bloom (of drillers).	Br	13.19	.......do........	B,H	D	
....	Al	r8 to 10	....	Pi,B,H	D	
Slate (of drillers).	Al, Br	6.69	Nov. 14, 1952	B,H	D,S	Log, thickness in ft: dirt and clay 15; slate (water) 9.
Coal seam.	Br	26.90	.......do........	B,H	D,S	
Sandstone..	Br	20	Nov. 24, 1952	B,H	D	Log, thickness in ft: dirt 6; clay, blue 31; sandstone (water) 17.
....	Br	....	....	J?,E	D	
....	Br	....	....	J,E	D	
....	Br	....	....	B,H	Un	
....	Br	....	....	L	D,P	
....	Br	19.87	Jan. 9, 1951	B,H	D	
....	Br	....	....	J?,E	D	
....	Br	....	....	B,H	P	
....	Br	r18 to 20	....	L,E	In	
....	Br	7.20	July 5, 1951	B,H	D,S	
....	Br	12.64	.......do........	......	Un	

Table 5.—*Records of water wells in the*

Well no.	Location	Owner or user	Driller	Type of well	Depth of well (feet)	Diameter of well (inches)
8250-3735-11	6.5 miles southwest of West Prestonsburg Post Office.	G. R. Spradlin.........	W. Kinser and S. Kinser.	Dr	r41	....
12	5.1 miles southwest of West Prestonsburg Post Office.	Penn Fitzpatrick........	John May...	Dr	r49	5
13	5.2 miles southwest of West Prestonsburg Post Office.	.......do.................	.....do.......	Dr	r49	6
14	2.5 miles southwest of junction of Kentucky Highways 404 and 114.	Edgar Hale.............	Willard May	Dr	46	6
15	......do..................	.......do.................	....	Dr	r50	5?
16	2.4 miles southwest of junction of Kentucky Highways 404 and 114.	.......do.................	James Allen.	Dr	81	6
17	......do..................	Joe Hicks...............	S. Kinser...	Dr	r60	6
8250-3740-1	Bonanza....................	Bonanza school........	....	Dr	....	....
2	0.5 mile west of Bonanza Post Office.	Albert Spradlin........	John May..	Dr	r72	....
3	0.9 mile east of Bonanza Post Office.	L. H. Dotson..........	....	Dr	40	6
4	Myrtle......................	Myrtle school..........	....	Dr	....	....
5	.......do....................	E. P. Prater............	....	Dr	51	6
6	William Branch, 1.3 miles southwest of the Little Abbott Creek road.	A. B. Spears...........	J. E. Williams.	Du	13	18
7	2.0 miles south of Bonanza Post Office.	N. P. Holbrook........	N. P. Holbrook.	Du	9	18
8	4.8 miles west of Cliff Post Office.	Bruce Hackworth.......	Willard Kinser.	Dr	105	6
9	4.7 miles west of Cliff Post Office.	G. W. Adams..........	Isadore Horne.	Dr	64	6
10	0.5 mile northeast of the head of Middle Fork.	Farrell Hannah.........	Frank Wells	Dr	45	6
11	0.9 mile northeast of the head of Middle Fork.	Marvin Hannah........	.....do.......	Dr	28	6
12	Along unnamed branch, 0.9 mile north of the head of Middle Fork.	Mason Fitzpatrick....	Link Fyffe, Jr.	Dr	67	6
13	0.6 mile north of Whitaker Post Office.	Marvin Robinson......	J. H. Fyffe	Dr	r55	6
14	200 ft southwest of Whitaker Post Office.	J. L. Whitaker........	Link Fyffe..	Dr	39	6
15	50 ft southeast of Whitaker Post Office.	G. C. Whitaker.......	.....do........	Dr	64	6
16	0.1 mile northwest of Whitaker Post Office.	Big Lick Fork school..	....	Dr	......	6
17	5.3 miles southwest of East Point Post Office.	Joe DeRossett..........	Link Fyffe..	Dr	52	6
18	Along unnamed branch, 0.9 mile north of the head of Middle Fork.	Mason Fitzpatrick.....	....	Du	20	....
38	1.2 miles northeast of the head of Middle Fork.	Virgil Taylor..........	....	Du	13	24±

Prestonsburg quadrangle, Kentucky— Continued

Principal water-bearing bed		Water level		Lift	Use	Remarks
Character of material	Geologic unit	Below land surface (feet)	Date of measurement			
....	Br	r4 to 5	1949	......	D	
Sandstone..	Br	....	....	J,E	D,S	
Sandstone?	Br	....	....	......	Un	Well partly filled.
....	Br	13.54	Aug. 7, 1951	Pi,H	D,S	
....	Br	r22	....	B,H	S	
Sandstone..	Br	17.98	Aug. 7, 1951	B,H	D	Chemical analysis in table 1.
....	Br	....	....	J,E	D	
....	Br	....	....	L,H	P	
Sandstone..	Br	....	....	J,E	D	Log, thickness in ft: alluvium 30; slate?; sandstone (water). Gas in well. Chemical analysis in table 1.
....	Br	15.26	Nov. 14, 1950	B,H	Un, O	
....	Br	....	....	L,H	P	
Slate (of drillers).	Br	25.41	Nov. 21, 1950	......	Un	
Coal.........	Br	7.49	.......do.......	B,H	D	Log, thickness in ft: dirt 20; slate, black 4; coal.
.....do.......	Br	4.09	.......do.......	B,H	D	Log, thickness in ft: dirt 5; rock, gray, hard 6; coal. Chemical analysis in table 1.
....	Br	40.26	Sept. 11, 1951	B,H	D	Gas in well. Chemical analysis in table 1.
Sandstone..	Br	34.77	.......do.......	B,H	D	
Slate (of drillers).	Br	8.83	May 7, 1952	......	Un	Log, thickness in ft: alluvium 45; slate (water) 1; coal.
Coal.........	Br	8 to 9	.......do......	B,H	D	Log, thickness in ft: dirt and soil; rock; coal; rock 5.
....	Br	12.35	.......do......	......	Un	Log, thickness in ft: surface 18; rock, white 42; rock, black 10.
....	Br	21.86	.......do......	J,E	D	
....	Br	24.13	.......do......	B,H	D	Chemical analysis in table 1.
....	....	47.59	.......do......	......	Un	
....	Br	8.60	.......do......	L,H	P	
Sandstone..	Br	11.73	May 14, 1952	B,H	D	Chemical analysis in table 1.
....	Al	12.29	July 22, 1952	B,H	D	Do.
....	Al?	12.69	Nov. 13, 1952	B,H	D	

Table 5.—*Records of water wells in the*

Well no.	Location	Owner or user	Driller	Type of well	Depth of well (feet)	Diameter of well (inches)
8250-3740-39	1.6 miles northeast of the head of Middle Fork.	Middle Fork school...	....	Du	22	30±
40	0.9 mile north of Whitaker Post Office.	Ray Blair...............	Ray Blair..	Du	17	24±
41	0.1 mile northwest of Whitaker Post Office.	Big Lick Fork school..	James Allen.	Dr	r50	5
42	1.4 miles southwest of Whitaker Post Office.	Sherman Tackett.....	.....do......	Dr	60	6

Prestonsburg quadrangle, Kentucky— Continued

Principal water-bearing bed		Water level		Lift	Use	Remarks
Character of material	Geologic unit	Below land surface (feet)	Date of measurement			
....	Al?	11.89	Nov. 13, 1952	B, H	D, P	
Hard bluish rock (of drillers).	Br	14	Dec. 8, 1952	....	Un	Log, thickness in ft: talus 8½; siltstone, blade 1½; coal 2; claystone, silty 4; rock bluish, hard (water) 1.
....	Br	9.19	Nov. 13, 1952	L, H	P	
Limestone (of drillers).	Br	30.56	.......do.......	B, H	D, S	

Table 6.—*Records of springs and water-yielding coal*

Location: For location of springs and mines see plate 1.

Spring or mine no.	Location	Owner or name	Topographic situation	Principal water-bearing bed	
				Character of material	Geologic unit
					Records of
8245-3735-60	1.4 miles northwest of Watergap Post Office.	Wes Campbell...	Base of road cut	....	Al
61	1.3 miles northwest of Watergap Post Office.	Taulbee Branham.	....do.....	....	Al
62	1.2 miles southwest of West Prestonsburg Post Office.	State of Kentucky.	Hillside (road cut).	Sandstone......	Br
63	Town Branch bridge, Prestonsburg.	Chesapeake & Ohio Railway Co.	Side of cliff.	Coal seam.....	Br
65	3.9 miles southwest of West Prestonsburg Post Office.	Paul Dotson......	Nose of hill.	Coal seam?...	Br
66	.......do...............	.......do...........	Hillside...	Coal seam....	Br
8245-3740-160	1.6 miles west of Cliff Post Office.	Frank Arnett.....	.....do.....	Coal seam?...	Br
8250-3735-18	7.7 miles west of West Prestonsburg Post Office.	Bill Adams.......	Base of terrace.	....	Al
19	8.0 miles west of West Prestonsburg Post Office.	.......do...........	.....do.....	Sand..........	Al
20	7.4 miles west of West Prestonsburg Post Office.	.......do...........	Side of terrace.	....	Al
8250-3740-43	5.5 miles southwest of East Point Post Office.	Will Collins.....	Road cut in hillside.	Siltstone.......	Br
44	5.2 miles southwest of East Point Post Office.	Eva Collins......	.....do....	Coal seam....	Br
					Records of water-
8245-3735-64	4.3 miles west of West Prestonsburg Post Office.	Paul Dotson......	Hillside...	Sandstone and coal seam.	Br
8245-3740-164	5.3 miles northeast of Cliff Post Office.	Wiley Warrix...	.....do.....	Coal seam....	Br

mines in the Prestonsburg quadrangle, Kentucky

Geologic unit: Al, alluvium; Br, Breathitt formation.
Use: D, domestic; S, stock; Un, unused.

Improvements	Yield		Use	Temperature (°F)	Remarks
	Rate of flow (gpm)	Date of measurement			
springs					
Two dug pits...........	Not flowing..	Oct. 25, 1951	Un	54	Contact spring.
Dug pit covered by corrugated iron.	½ to 1	.......do............	S	....	
None.....................	1 -	July 11, 1952	Un	64	Joint spring.
.........do...............	5	July 14, 1952	Un	....	Contract spring.
Rock retaining wall. ..	1 -	Oct. 13, 1950	Un	....	Do.
Brick retaining wall. Piped to house.	1 -	.......do............	D	....	Do.
Stone and board retaining well.	....	....	D	....	
Pit and tunnel lined with rocks.	1	Jan. 16, 1951	D	49	
Pit covered with boards.	1	.......do............	D	47	Contact spring. Chemical analysis in table 1.
Pit lined with rock and covered with galvanized iron sheet.	5	.......do............	D	46	Chemical analysis in table 1.
Basin dug out at base of seep.	1 -	Nov. 14, 1952	....	....	Joint spring.
Pit dug out in front of coal seam.	1 -	.......do............	S	....	Contact spring (?).
yielding coal mines					
None.....................	5	Dec. 14, 1950	Un	40	Chemical analysis in table 1.
Mine entrance sealed. Piped to house.	....	....	D	62	Do.

Table 7.—*Records of gas, oil, and test wells drilled in the Prestonsburg quadrangle, Kentucky*

Location: For location of wells, see plate 2. Use: G, gas well; T, test well; O, oil well.

Well no.	Location	Farm or lessor, and no.	Driller or company	Reported altitude above sea level (feet)	Depth of well (feet)	Diameter of well (inches)	Use	Remarks
8245-3735-67	0.2 mile northeast of the mouth of Shop Branch.	John Stevens 2	...	727	1,035	...	G	
68	Along Katie FriendBranch, 0.3 mile southeast of Middle Creek.	Katy Friend	...	640	1,454	...	...	
69	Along Middle Creek, 0.3 mile south of the mouth of Bob Fitzpatrick Branch.	Colcord 1	...	631	774	...	...	
70	0.2 mile north of the mouth of Whitaker Branch.	John Huff 1	...	700	2,747	...	G	
71	Along Right Fork of Bull Creek 0.1 mile east of Shop Branch.	Big Sandy Coal and Coke Co. 1.	...	657	945	...	G	
72	0.6 mile east of the mouth of Bob Fitzpatrick Branch.	Jonathan Fitzpatrick 2	...	713	892	...	T	
73	Along Middle Creek, 0.3 mile northwest of the mouth of Left Fork.	Jonathan Fitzpatrick 3	...	627	775	...	G	
74	Along Middle Creek, 0.4 mile northwest of the mouth of Left Fork.	Jonathan Fitzpatrick 4	...	638	554	...	G	
75	0.3 mile northeast of the mouth of Bob Fitzpatrick Branch.	B. P. Friend 2	...	682	815	...	G	
76	0.2 mile east of the mouth of Bob Fitzpatrick Branch.	B. P. Friend 3	...	638	788	...	T	
77	0.6 mile east of the mouth of Bob Fitzpatrick Branch.	Jonathan Fitzpatrick 5	...	644	609	...	G	
78	Along Middle Creek, 0.1 mile northeast of Left Fork.	Bill Fitzpatrick 1	...	625	1,917	...	G	
79	Along Left Fork, 0.2 mile south of Middle Creek.	H. H. Fitzpatrick and H. D. Fitzpatrick 2.	...	621	566	...	...	
80	Along Left Fork, 0.3 mile northeast of Whitaker Branch.	H. H. Fitzpatrick and H. D. Fitzpatrick 4.	...	627	1,892	...	...	
81	0.6 mile north of the mouth of Whitaker Branch.	H. H. Fitzpatrick	...	737	2,900	...	G	

82	0.4 mile southeast of junction of Left Fork and Middle Creek.	H. H. Fitzpatrick and H. D. Fitzpatrick.	...	721	651	...	G	Partial log on p. 113.
83	0.3 mile southeast of junction of Katie Friend Branch and Middle Creek.	Henry Stanley 1...	...	677	2,227	...	G	
84	0.3 mile southeast of junction of Left Fork and Middle Creek.	Ike Fitzpatrick...	...	...	909	...	G	
85	Along Katy Friend Branch, 0.4 mile south of Middle Creek.	Harris Stanley...	...	653	2,084	...	G	
86	0.4 mile northeast of the mouth of Bill Fitzpatrick Branch.	H. H. Fitzpatrick 6...	...	875	810	...	...	
87	0.4 mile northeast of the mouth of Left Fork.	J. C. Hopkins 1...	...	722	868	...	...	
88	Along Middle Creek, 0.6 mile northeast of Left Fork.	J. C. Hopkins and Valentine Hopkins 2.	...	642	2,041	...	...	
89	Along Bill Fitzpatrick Branch, 0.5 mile northwest of Middle Creek.	W. H. Fitzpatrick 1...	...	724	907	...	G	
90	Along Ike Fitzpatrick Branch, 0.7 mile northwest of Middle Creek.	Ike Fitzpatrick 2...	...	688	847	...	G	
91	Near Left Fork, 0.4 mile southwest of junction with Middle Creek.	H. H. Fitzpatrick 7...	...	773	925	...	...	
92	0.5 mile north of the mouth of Left Fork.	H. H. Fitzpatrick 8...	...	...	881	...	G	
93	Along Ike Fitzpatrick Branch, 1.0 mile northwest of Middle Creek	Ike Fitzpatrick 2...	...	738	2,025	...	G	
94	Along Middle Creek, 0.1 mile northwest of Katie Friend Branch.	Ellen Fitzpatrick 1...	...	611	2,062	...	G	
95	0.3 mile northwest of the mouth of Spurlock Creek.	Ike Fitzpatrick...	...	803	957	...	G	
96	0.8 mile northwest of the mouth of Spurlock Creek.	Ike Fitzpatrick 5...	...	951	1,130	...	...	
97	Along Middle Creek, 0.5 mile northwest of Left Fork.	Hiram Harris...	...	614	2,125	...	G	
98	Along Mutton Fork of Bull Creek at junction with unnamed branch.	John Scutchfield...	...	712	2,197	...	G	
99	Along Blue River Branch, 0.3 mile northwest of Left Fork.	Jim Hale 1...	...	645	2,029	...	G	

Table 7.—*Records of gas, oil, and test wells drilled in the Prestonsburg quadrangle, Kentucky*—Continued

Well no.	Location	Farm or lessor, and no.	Driller or company	Reported altitude above sea level (feet)	Depth of well (feet)	Diameter of well (inches)	Use	Remarks
8245-3735-100	Along Left Fork, 0.3 mile northeast of Whitaker Branch.	Lee Whittaker 1	....	645	1,940	....	G	
101	0.3 mile northwest of Watergap Post Office.	Jess Hatfield 1	....	763	2,183	....	G	
102	Along Town Branch, 0.1 mile south of the Levisa Fork.	Ballard James and Fred Williams 2.	....	626	1,999	....	G	
103	Along Town Branch, 0.3 mile south of the Levisa Fork.	Clark and Ferguson 2	....	763	2,094	....	......	
104	Along Middle Creek, 0.3 mile northeast of junction with Katie Friend Branch.	Harris and Stanley 3	....	732	2,068	....	G	
105	Along the Levisa Fork 0.4 mile east of Town Branch.	W. W. Richmond	....	632	2,036	....	G	Partial log on p. 113.
106	Near the Levisa Fork, 0.2 mile west of Town Branch.	Harris Stanley 4	....	720	2,071	....	G	
107	0.1 mile north of the head of Katie Friend Branch.	Big Sandy Co. 13	....	775	937	....	G	
108	At the head of the Mutton Fork of Bull Creek.	Big Sandy Co. 14	....	869	2,288	....	G	
109	Along Middle Creek, 0.3 mile north of Katie Friend Branch.	H. H. Fitzpatrick 3	....	627	2,130	....	G	
110	0.2 mile west of the mouth of Jim Potter Branch.	J. R. Langley 1	Kentucky-West Virginia Gas Co.	804	746	....	G	
111	Along Spurlock Creek, 0.2 mile southeast of Middle Creek.	J. R. Langley 2	......do	630	1,959	....	G	
112	0.6 mile southwest of the mouth of Jim Potter Branch	J. R. Langley 3	......do	948	1,056	....	G	
113	Along Right Fork, 0.2 mile west of Wallen Fork.	George McGuire 1	....	795	2,185	....	G	
114	Along Wallen Fork, 0.5 mile northwest of Right Fork.	Obediah McGuire	Kentucky-West Virginia Gas Co.	899	2,268	....	G	
115	Along Middle Creek, at junction with Bill Fitzpatrick Branch.	W. H. Fitzpatrick 1	....	625	1,917	....	......	
116	Along Right Fork, 0.2 mile west of Bull Creek.	C. C. Stephens	Kentucky-West Virginia Gas Co.	653.53	1,182	10 to 5 3/16	T	

117	Along Middle Creek, 0.2 mile east of Bob Fitzpatrick Branch.	Judith Friend 1	....	638	763	....	G	
118	Near Middle Creek, 0.5 mile southeast of junction with Bob Fitzpatrick Branch.	J. H. Fitzpatrick 1	....	731	880	....	G	Partial log on p. 114.
119	0.1 mile southwest of the mouth of Bob Fitzpatrick Branch.	Jonathan Hicks 1	....	631	2,166	....	T	
8245-3740-162	Near Little Abbott Creek, 0.6 mile south of junction with Abbott Creek.	Kycoga Land Co.	Inland Gas Corp.	723	861	10 to 6 5/8	G	Partial log on p. 116.
165	Along unnamed branch, 0.2 mile northwest of Greer Branch.	Melissa Greers Heirs	....	627	1,030	....	T	
166	0.2 mile east of junction of May Branch and the Levisa Fork.	B. C. May and T. R. May.	Kentucky-West Virginia Gas Co.	687.0	885	14 to 8 1/4	G	Brine analysis is made by Kentucky Geological Survey. Partial log on p. 118.
167	0.1 mile west of the head of May Branch of the Levisa Fork.	do	do	762.0	2,231	14 to 6 5/8	G	Do.
168	Along the Levisa Fork, 0.2 mile north of May Branch.	Cynthia Porter 1	....	632	1,968	10 to 8 1/4	G	Partial log on p. 118.
169	Along the Levisa Fork, 0.1 mile southeast of junction with May Branch.	Webb and Hereford 1	....	635	1,981	13 to 7	G	
170	Near May Branch, 0.5 mile northeast of junction with the Levisa Fork.	Bascom May	Inland Gas Corp.	662	1,067	13 3/8 to 7	G	Brine analysis made by Kentucky Geological Survey. Partial log on p. 119.
171	Along the Levisa Fork, 0.4 mile northeast of junction with May Branch.	Cynthia Porter 2	....	632	1,035	13 3/8 to 6 5/8	G	See table 1 for chemical analysis of water. Partial log on p. 120.
172	Along the Levisa Fork, 1.0 mile northeast of junction with Town Branch.	Miranda Marrs	....	645	880	....	T	
173	Along Middle Creek, 0.1 mile south of junction with the Levisa Fork.	Hiram Harris 1	....	658	2,015	....	G	
174	Along the Levisa Fork, at junction with Stephens Branch.	Big Sandy Coal and Coke Co. 1.	Herman Moore Oil and Gas Co.	609	1,783	....	T	Partial log on p. 120.
175	0.5 mile northwest of the head of May Branch of the Levisa Fork.	Florence Hereford	Kentucky-West Virginia Gas Co.	796.0	1,315	14 to 8 1/4	G	Do.

Table 7.—*Records of gas, oil, and test wells drilled in the Prestonsburg quadrangle, Kentucky*—Continued

Well no.	Location	Farm or lessor, and no.	Driller or company	Reported altitude above sea level (feet)	Depth of well (feet)	Diameter of well (inches)	Use	Remarks
8245-3740-176	0.1 mile below the head of unnamed branch of the Levisa Fork.	Jonathan Spradlin	do	749.0	1,219	14 to 8 1/4	O	Partial log on p. 121.
177	0.6 mile below the head of unnamed branch of the Levisa Fork.	A. J. Music	do	655.0	2,058	14 to 6 5/8	G	Do.
178	0.2 mile east of the mouth of unnamed branch of the Levisa Fork.	do		687	2,097		G	Do.
179	0.4 mile southwest of the mouth of Middle Creek.	Hiram Harris		661	2,033		G	
180	Near Middle Creek, 0.4 mile west of junction with the Levisa Fork.	H. H. Fitzpatrick 2		671	2,015		G	
181	0.8 mile south of junction of May Branch and Abbott Creek.	M. S. Fitzpatrick		890	2,272			
182	0.5 mile south of Auxier Post Office.	Auxier Coal Co.		630	2,761		G	
183	0.3 mile west of Auxier Post Office.	J. C. B. Auxier		657	2,761		G	
184	0.3 mile southwest of the mouth of Johns Creek.	J. C. B. Auxier 1		651	2,723		G	
185	0.5 mile southwest of junction of Johns Creek and the Levisa Fork.	J. C. B. Auxier		630	2,755		G	
186	Along Abbott Creek, 0.1 mile west of Elliott Branch.	Walter Hatcher 1		634	733		G	
187	Along unnamed branch, 0.3 mile north of Abbott Creek.	Highland Coal Co.	Piney Oil and Gas Co.	665	1,974		G	
188	0.9 mile south of junction of Johns Creek and the Levisa Fork.	Lee Hall		625	2,780		G	Partial log on p. 122.
189	Along Abbott Creek, 0.1 mile east of Short Branch.	S. H. Fitzpatrick	Inland Gas Corp.	610	1,876		G	Do.
190	0.3 mile north of the mouth of Elliott Branch.	do		913	3,053		G	

191	0.5 mile northwest of the mouth of Elliott Branch.	......do......................	Inland Gas Corp......	1,123	2,293	10 to 6 5/8	G	
192	0.2 mile northwest of Auxier Post Office.	Samuel Kelly 1..............	Piney Oil and Gas Co.	645	2,754	10 to 6 5/8	G	Partial log on p. 123.
193	0.4 mile southeast of Auxier Post Office.	S. T. Johnson...............	....	626	2,871	....	T	Do.
194	0.9 mile south of junction of Johns Creek and the Levisa Fork.	Bell Wells 1...................	....	633	2,763	....	.....	
195	0.6 mile north of the mouth of Jane Brown Branch.	Bell Wells 2..................	....	625	2,803	8 to 6 5/8	G	
196	0.5 mile east of the mouth of Alley Fork.	Big Sandy Coal and Coke Co.	Columbian Fuel Corp.	750.0	3,005	10 to 6 5/8	G	
197	Along unnamed branch, 0.2 mile northwest of Right Fork of Little Paint Creek.	Mahala Snarely..............	Inland Gas Corp......	745	2,834	13 to 8 1/4	T	Partial log on p. 124.
198	Along Little Abbott Creek, 0.2 mile above the mouth.	Emanuel Meade.............	......do................	642	812	13 to 6 5/8	T	Do.
199	Along Meade Branch, 0.3 mile above junction with Abbott Creek.	......do......................	......do................	657	774	10 to 5 3/16	G	Do.
200	0.2 mile north of the mouth of Meade Branch.	Dora Hackworth.............	......do................	729	893	10 to 6 5/8	T	Do.
201	0.2 mile below the head of Meade Branch.	Kentucky-West Virginia Gas Co.	......do................	677	819	10 to 6 5/8	G	Do.
202	At head of Mead Branch..........	......do......................	......do................	791	958	10 to 6 5/8	G	Do.
203	Near May Branch, 1.5 miles southwest of junction with Abbott Creek.	W. M. Dingus...............	......do................	848	990	10 to 6 5/8	G	
204	Near May Branch, 1.2 miles southwest of junction with Abbott Creek.	Big Sandy Coal and Coke Co.	......do................	748	864	10 to 6 5/8	G	
205	Near May Branch, 1.5 miles southwest of junction with Abbott Creek.	......do......................	......do................	780	976	10 to 6 5/8	T	
206	Along Abbott Creek, 0.4 miles southeast of Deep Hole Branch.	P. B. Arnett 1................	....	615	1,901	10 to 6 5/8	G	Partial log on p. 126.
207	0.3 mile southeast of the mouth of Elliott Branch.	H. B. Patrick..................	Inland Gas Corp.....	736	837	10 to 6 5/8	G	Do.
8250-3735-21	Along Steve Fitzpatrick Branch, 0.3 mile above the mouth.	S. H. Fitzpatrick 1..........	....	674.5	824	....	.....	
22	Along Middle Creek, 0.1 mile north of Holbrook Branch.	L. B. Holbrook 1............	....	642.53	794*	....	.....	

Table 7.—*Records of gas, oil, and test wells drilled in the Prestonsburg quadrangle, Kentucky*—Continued

Well no.	Location	Farm or lessor, and no.	Driller or company	Reported altitude above sea level (feet)	Depth of well (feet)	Diameter of well (inches)	Use	Remarks
8250-3735-23	0.1 mile northeast of junction of Steve Fitzpatrick Branch and Middle Creek.	Steve Fitzpatrick 2	....	634	796	....	.....	
24	Along Middle Creek, 0.2 mile east of Granny Fitz Branch.	L. B. Holbrook 4	....	642	829	....	G	Partial log on p. 127.
25	0.4 mile southeast of the mouth of Steve Fitzpatrick Branch.	Cynthia Holbrook 1	....	833	982	....	.....	
26	Along Steve Fitzpatrick Branch, 0.5 mile below the head.	Steve Fitzpatrick 3	....	747	1,007	....	.....	
27	Along Middle Creek, 0.2 mile southwest of Holbrook Branch.	Kelsie Holbrook 1	....	644	789	....	.....	
28	Along Granny Fitz Branch, 0.1 mile above the mouth.	Kelsie Holbrook 2	....	658	804	....	G	
29	At junction of Jack Arnett Branch and Middle Creek.	Mitchel Dotson 1	....	654	720	....	G	
30	Along Granny Fitz Branch, 0.5 mile below the head.	Kelsie Holbrook 3	....	723.6	812	....	G	
31	At head of Granny Fitz Branch	Kelsie Holbrook 4	....	793	991	....	G	
32	Near Granny Fitz Branch, 0.6 mile above the mouth.	Kelsie Holbrook 5	....	755.5	922	....	G	
33	At head of Sam Hale Branch	L. B. Shepherd	Kentucky-West Virginia Gas Co.	811.3	2,846	10 to 6 5/8	T	
34	Along Middle Creek, 0.1 mile southwest of Holbrook Branch.	L. B. Holbrook 3	....	642	801	....	.....	
35	At junction of Arnett Branch and Middle Creek.	Mitchel Dotson 2	....	657	755	10 to 6 5/8	G	
36	0.2 mile northeast of junction of Arnett Branch and Middle Creek.	Mitchel Dotson 4	....	678.7	780	....	G	
37	Along Arnett Branch, 0.6 mile above the mouth.	Mitchel Dotson 5	....	715	853	....	T	Partial log on p. 127.
38	0.3 mile northeast of junction of Steve Fitzpatrick Branch and Middle Creek.	Steve Fitzpatrick 4	....	702	835	....	.....	

39	Along Steve Fitzpatrick Branch, 0.2 mile above the mouth.	Steve Fitzpatrick 5	....	651	570	....	T	
40	0.4 mile east of junction of Steve Fitzpatrick Branch and Middle Creek.	G. M. Stepp	....	657	1,780	....	.....	
41	Along Bob Fitzpatrick Branch, 0.3 mile above the mouth.	F. C. Colcord 3	....	655	785	....	G	
42	0.2 mile northwest of junction of Holbrook Branch and Middle Creek.	L. B. Holbrook 4	....	684	796	....	G	
43	Along Middle Creek, 0.1 mile west of junction with Steve Fitzpatrick Branch.	Cynthia Holbrook 3	....	680	825	....	G	
44	0.7 mile northwest of junction of Blue River Branch and Left Fork.	George Hale	....	675	2,422	....	G	
45	0.7 mile northwest of junction of Bob Fitzpatrick Branch and Middle Creek.	F. C. Colcord Creek 4	....	753	2,085	....	G	Partial log on p.127.
46	0.3 mile east of junction of Steve Fitzpatrick Branch and Middle Creek.	Stephen Fitzpatrick	Penn Fitzpatrick and others.	650	1,889	....	.....	
47	At junction of Steve Fitzpatrick Branch and Middle Creek.	Penn Fitzpatrick	....do....	650	1,892	....	G	
48	0.1 mile northwest of junction of Granny Fitz Branch and Middle Creek.	J. M. Richardson 1	Kentucky-West Virginia Gas Co.	653	1,658	10 to 6 5/8	G	
49	0.3 mile northwest of junction of Granny Fitz Branch and Middle Creek.	J. M. Richardson 2	W. D. Reed	690	927	10 to 6 5/8	T	Partial log on p.128.
50	0.4 mile east of the mouth of Jack Arnett Branch.	Nancy Dotson 1	....	762	941	10 to 6 5/8	T	Do.
51	0.3 mile southeast of the mouth of Granny Fitz Branch.	John Richardson 1	....	840	1,260	13 to 8 1/4	T	Do.
52	0.5 mile east of the mouth of Granny Fitz Branch.	John Richardson 2	....	812	2,076	....	G	
53	0.2 mile west of the mouth of Arnett Branch.	Spradlin and Hall 1	Elkhorn Coal Corp.	683	2,656	13 to 6 5/8	G	Partial log on p.129.
54	Along Arnett Branch 0.6 mile northwest of the mouth.	Spradlin and Hall 2	....	705	2,722	13 to 6	T	
55	Along Middle Creek 0.1 mile east of Arnett Branch.	Spradlin and Hall 3	....	658	2,648	10 to 6 5/8	G	Partial log on p.129.
56	0.2 mile east of the mouth of Jack Arnett Branch.	Eva Dotson	Kentucky and Ohio Gas Co.	677	3,041	....	T	Do.

Table 7.—*Records of gas, oil, and test wells drilled in the Prestonsburg quadrangle, Kentucky*—Continued

Well no.	Location	Farm or lessor, and no.	Driller or company	Reported altitude above sea level (feet)	Depth of well (feet)	Diameter of well (inches)	Use	Remarks
8250-3735-57	0.1 mile southeast of the head of Neeley Branch.	Thomas Puckett	Kentucky-West Virginia Gas Co.	861	2,757	14 to 6 5/8	T	Partial log on p.130.
58	0.2 mile southeast of junction of Steve Fitzpatrick Branch and Middle Creek.	Holbrook Heirs	Kentucky and Ohio Gas Co.	750	2,783	10 to 6 5/8	T	Do.
59	0.2 mile above the mouth of Mill Branch.	Spradlin and Hall 4	....	650	2,690	10 to 6 5/8	T	
60	0.7 mile south of junction of Neeley Branch and Little Abbott Creek.	Kycoga Land Co	Inland Gas Corp	883	940	10 3/4 to 7	G	Partial log on p.131.
61	1.0 mile northwest of junction of Bob Fitzpatrick Branch and Middle Creek.	The Fitz Coal Co	do	830	968	10 3/4 to 7	G	Do.
8250-3740-19	0.8 mile north of the head of Middle Fork.	M. B. Fitzpatrick	....	744	1,700	....	G	
20	1.1 miles north of the head of Middle Fork.	Jesse Caudhill 1	....	800.6	1,771	....	G	
21	0.3 mile south of the mouth of Mart Meade Branch.	Martin Meade 1	....	719.5	840	....	G	
22	0.4 mile below the head of Middle Fork.	Jim Farris 1	....	860	1,816	....	G	
23	0.4 mile east of the Bonanza Post Office.	Frank Spradlin 1	....	678	1,909	....	......	
24	0.3 mile above the mouth of Meadow Branch.	Kycoga Land Co	Inland Gas Corp	798	875	....	T	Partial log on p.132.
25	0.1 mile below the head of Meadow Branch.	do	do	778	951	10 to 6 5/8	T	Do.
26	0.4 mile southeast of the mouth of Hackworth Branch.	Jim Hill 1	....	675	2,700	10 to 8 1/4	T	
27	0.4 mile northeast of the mouth of Mart Meade Branch.	Kycoga Land Co	Inland Gas Corp	654	774	10 to 6 5/8	G	Partial log on p.132.
28	0.5 mile west of junction of Meadow Branch and Little Abbott Creek.	do	do	674	854	10 to 8 5/8	T	Do.

29	0.6 mile north of Junction of Neeley Branch and Little Abbott Creek.	......do......	......do......	717	571	10 3/4 to 8 1/4	G	Do.
30	......do......	......do......	......do......	795	929	10 to 6 5/8	T	
31	0.2 mile west of the mouth of Meadow Branch.	......do......	......do......	664	776	10 3/4 to 7	G	Partial log on p. 133.
32	0.3 mile below the head of Mart Meade Branch.	Bruce Hackworth 2......	......do......	783	819	10 3/4 to 7	G	Do.
33	0.5 mile southeast of junction of Mart Meade Branch and Little Abbott Creek.	Bruce Hackworth 3......	......do......	800	937	10 3/4 to 7	T	Do.
34	0.2 mile northwest of the mouth of Meadow Branch.	Jim Webb, Jr. 1......	......	......	786	......	G	
35	0.2 mile above the mouth of Neeley Branch.	Tom Stanley......	Kentucky-West Virginia Gas Co.	728	714	14 to 8 1/4	G	Partial log on p. 134.
36	0.4 mile above the mouth of Neeley Branch.	Kycoga Land Co......	Inland Gas Corp......	780	770	10 3/4 to 7	G	Do.
37	0.1 mile northwest of the mouth of William Branch.	Marion Neeley 1......	......	693	1,751	......	G	

Table 8.—*Records of core and auger holes and of bridge-pier excavations in the Prestonsburg quadrangle, Kentucky*

Location: For location of core and auger holes, and of bridge-pier excavations, see plate 2, Type of hole: Au, auger hole; Co, core hole.

Well no.	Location	Owner or name	Company	Altitude above sea level (feet)	Type of hole	Depth		Remarks
						Feet	Inches	
			Core and auger holes					
8245-3740-215	At the head of Little Paint Creek.	....	Big Sandy Coal and Coke Co.	999.95	Co	373	4	
216	0.3 mile above the mouth of Alley Fork.	....	........do.............	712	Co	85	0	
217	1.0 mile north of the head of Little Paint Creek.	....	........do.............	707.22	Co	131	0	
218	0.5 mile northwest of the mouth of Jane Brown Branch.	....	........do.............	709.10	Co	116	4	
219	0.4 mile south of Auxier Post Office.	Thims Mayo..	....	720.1	Co	114	0	
220	0.3 mile southwest of Auxier Post Office.	....	....	733.5	Co	107	0	
221	0.6 mile northeast of Auxier Post Office.	John Stratton..	....	781	Co	100	0	
222	0.7 mile northeast of the mouth of Johns Creek.	J. C. Kelly...	....	776.3	Co	157	0	
223	0.3 mile northeast of the mouth of Johns Creek.	.......do.......	....	673.9	Co	43	6	
224	0.2 mile northeast of the mouth of Johns Creek.	....	....	689.3	Co	61	0	
225	0.6 mile northeast of the mouth of Johns Creek.	J. C. Kelly...	....	727.3	Co	108	0	
226	0.3 mile south of Auxier Post Office.	....	....	730	Co	105	0	
227	0.4 mile southeast of Auxier Post Office.	J. C. C. Mayo	....	700.8	Co	67	0	
228	0.3 mile southeast of Auxier Post Office.	B. C. May....	....	673.9	Co	73	0	
229	0.2 mile south of Auxier Post Office.	....	....	....	Co	74	6	
233	0.1 mile south of junction of Stevens Branch and the Levisa Fork.	....	U. S. Army Engineers.	616.3	Au	13.3	....	

Bridge-pier excavations

230	Highway bridge across the Levisa Fork north of Prestonsburg.	State of Kentucky.	....	617	....	43	....	Pier No. 1 (west).
231	..............do........................	.......do.........	....	598	....	13	....	Pier No. 2.
232	..............do........................	.......do.........	....	588	....	29	....	Pier No. 3 (east).

Table 9.—*Water levels in observation wells in the Prestonsburg quadrangle, Kentucky*

[All water levels given in feet below land-surface datum. For description of wells, see table 5]

Well 8245-3735-2. Owner: Paul Dotson

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Oct. 12, 1950	11.86	Feb. 12, 1951	11.11	June 19, 1951	12.13	Nov. 6, 1951	13.70
16	12.18	26	10.85	July 3	12.55	20	13.33
30	11.92	12	10.86	17	12.84	Dec. 4	12.17
Nov. 13	11.84	26	11.10	31	13.23	18	11.47
29	11.46	Apr. 9	10.68	Aug. 14	13.77	Jan. 2, 1952	11.64
Dec. 11	10.88	12	10.71	28	14.11	16	11.28
22	11.45	23	11.52	Sept. 11	14.09	30	11.11
Jan. 2, 1951	11.89	May 7	11.36	25	13.87	Feb. 18	11.01
15	11.44	22	11.46	Oct. 9	13.80	27	10.98
29	11.76	June 4	12.04	23	13.84		

Well 8245-3735-2—Continued

[Noon daily water level from recorder graph, 1952]

Day	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	...	...	10.79	11.13	...	12.02	12.99	13.35	13.77	14.33	14.44
2	...	11.38	10.93	11.05	11.44	12.12	...	13.24	13.83	14.36	14.13
3	...	11.21	11.10	11.22	11.38	12.10	...	13.53	14.10	14.40	14.31
4	...	11.01	10.94	11.23	11.35	12.12	...	13.67	14.00	[b]14.28	14.19
5	...	11.57	10.97	11.14	11.43	12.17	13.04	13.68	13.97	...	13.96
6	...	11.62	11.21	11.15	11.49	12.22	13.05	13.62	14.05	...	14.00
7	...	11.66	11.32	11.32	11.50	12.21	...	13.58	14.16	...	14.03
8	...	11.57	11.40	11.15	11.50	12.07	[b]13.01	13.71	14.04	...	[a]13.91
9	...	11.31	11.46	11.15	11.54	12.11	13.00	13.76	13.94	...	13.84
10	...	11.15	11.36	11.08	11.57	12.19	13.00	13.71	14.03	...	13.53
11	...	10.92	11.55	11.15	11.66	12.31	13.09	13.70	14.18	...	13.77
12	...	11.29	11.32	11.30	11.64	12.46	13.12	13.68	14.11	...	13.61
13	...	10.78	11.04	11.39	11.74	12.45	13.26	13.71	14.13	...	13.59
14	...	11.16	11.18	11.49	11.80	12.41	13.26	13.70	14.14	...	13.63
15	...	11.17	11.33	11.25	11.81	12.39	13.19	13.60	14.04	...	13.63
16	...	11.18	11.58	11.34	11.79	12.50	[a]13.06	13.62	14.23	...	13.68
17	...	11.26	11.65	11.42	11.80	12.57	...	13.53	14.23	...	13.58
18	...	11.15	11.59	11.47	11.98	12.57	13.29	13.55	14.28	[b]14.48	13.59
19	...	11.04	11.54	11.40	11.96	12.49	13.30	13.53	14.10	...	13.64
20	...	11.09	11.54	11.22	12.04	12.43	13.29	13.81	14.42	...	13.35
21	...	11.12	11.58	11.40	12.12	12.46	13.26	13.85	14.61	...	13.39
22	...	...	11.55	11.39	12.15	12.51	13.33	13.82	14.44	...	13.35
23	...	...	11.48	11.35	12.13	12.56	13.42	13.89	14.33	...	13.28
24	...	...	11.45	11.27	12.01	12.66	13.43	14.00	14.27	...	13.45
25	...	10.91	11.37	11.12	11.91	12.70	13.50	13.92	14.29	...	13.44
26	...	10.94	11.29	11.28	11.91	12.76	13.55	13.80	14.34	...	13.47
27	...	10.93	11.16	11.40	11.93	12.76	13.50	13.86	14.19	...	13.39
28	...	11.04	11.11	11.37	11.98	12.70	13.34	13.91	14.10	[b]14.51	13.48
29	10.96	11.03	11.09	11.38	11.95	12.71	13.42	13.96	14.45	14.40	13.39
30		11.14	11.18	11.35	11.88	12.82	13.38	13.87	14.50	14.53	13.26
31		11.02				12.94	13.32		14.36		12.88

[a]Estimated. [b]Tape measurement.

Well 8245-3735-2—Continued

[Noon daily water level from recorder graph, 1953]

Day	Jan.	Feb.	Mar.	Apr.	May	June
1	13.44	...	11.97	...	11.87	11.66
2	13.06	...	11.71	...	11.94	11.90
3	12.86	[a]11.80	11.67	...	12.22	11.94

[a]Estimated.

Table 9.—*Water levels in observation wells in the Prestonsburg quadrangle, Kentucky*—Con.

Well 8245-3735-2—Continued

Day	Jan.	Feb.	Mar.	Apr.	May	June
4	13.13	12.04	11.47	....	12.31	11.92
5	13.06	12.04	11.75	....	12.20	11.96
6	13.30	11.84	11.81	....	12.18	12.01
7	....	11.97	11.86	11.60	12.07	12.05
8	12.78	12.03	11.79	11.82	12.07	12.06
9	12.59	12.40	11.94	11.70	12.11	12.14
10	12.42	12.43	11.85	11.64	12.09	12.18
11	12.49	11.97	11.81	11.86	11.98	12.25
12	12.89	11.86	11.76	11.57	11.94	12.19
13	12.72	12.08	[a]11.70	11.80	11.97	12.04
14	12.75	12.05	11.69	12.07	11.94	12.05
15	12.75	11.77	11.53	11.82	11.93	12.13
16	12.72	11.92	11.84	....	11.88	12.15
17	12.47	12.29	11.77	....	11.73	[a]12.07
18	12.40	12.41	11.38	....	11.74	....
19	12.25	12.37	11.60	....	11.64	12.29
20	12.15	12.08	11.75	....	11.72	12.30
21	12.17	....	11.70	12.01	11.66	12.34
22	12.32	....	11.67	11.89	11.57	12.48
23	12.00	12.34	11.58	11.88	11.63	12.56
24	....	12.05	11.57	11.92	11.67	12.58
25	....	11.81	11.61	11.81	11.60	12.64
26	....	11.65	11.68	11.76	11.51	12.72
27	[b]11.90	11.58	11.57	[a]11.99	11.75	12.78
28	....	11.91	11.43	12.03	11.93	12.83
29	....		11.60	11.97	11.83	12.88
30	....		11.69	11.81	11.61	[c]12.87
31	....		11.55		11.55	

[a]Estimated.
[b]Tape measurement.
[c]Measurement discontinued.

Well 8245-3735-6. Owner: Jimmy Green. Water level, 1950: Dec. 19, 19.35

[Noon daily water level from recorder graph, 1951]

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	......	......	......	......	19.99	20.41	20.76	21.48	21.59	21.52	21.21	20.07
2	[b]20.13	......	......	18.80	19.95	20.43	20.84	21.49	21.53	21.52	21.10	20.14
3	......	......	......	18.58	19.30	20.49	20.89	21.48	21.50	21.53	21.07	20.21
4	......	......	......	[a]18.52	......	20.54	20.89	21.54	21.55	21.56	21.06	20.16
5	......	......	......	18.64	......	20.39	20.98	21.56	21.56	21.62	21.14	20.04
6	......	......	......	18.74	......	20.30	21.03	21.53	21.45	21.64	21.11	19.99
7	......	......	......	18.78	17.86	20.29	21.04	21.48	21.44	21.61	20.76	20.02
8	......	......	......	18.86	17.93	20.22	21.05	21.49	21.51	21.64	20.76	18.18
9	......	......	......	19.00	18.17	20.20	21.07	21.52	21.52	21.64	20.82	17.01
10	......	......	......	[a]19.09	18.42	20.22	21.10	21.51	21.54	21.65	20.85	17.55
11	......	......	......	[a]19.26	18.56	20.31	21.09	21.51	21.55	21.66	20.89	17.84
12	......	[b]18.12	[b]18.85	19.11	18.86	20.39	21.10	21.53	21.52	21.73	20.90	18.21
13	......	......	......	18.79	19.11	20.40	21.09	21.54	21.50	21.76	20.90	18.64
14	......	......	......	18.87	19.32	20.40	21.08	21.56	21.40	21.77	20.82	18.79
15	[b]18.39	......	......	18.83	[a]19.42	20.43	21.09	21.58	21.34	21.74	20.68	[a]16.35
16	......	......	......	18.89	......	20.48	21.12	21.58	21.34	21.73	20.40	......
17	......	......	......	19.04	......	20.54	21.23	21.63	21.36	21.73	20.35	......
18	......	......	......	19.13	......	20.63	21.25	21.64	21.40	21.73	20.39	[a]17.85
19	......	......	......	19.18	......	20.67	21.24	21.68	21.47	21.73	20.46	18.09
20	......	......	......	19.37	......	20.68	21.29	21.68	21.53	21.72	20.55	18.17
21	......	......	......	19.43	20.00	20.70	21.30	21.68	21.56	21.73	20.59	16.51
22	......	......	......	19.46	20.04	20.73	21.32	21.71	21.55	21.74	20.61	16.97
23	......	......	......	19.60	20.00	20.79	21.33	21.76	21.59	21.72	20.63	......
24	......	......	......	19.61	20.09	20.86	21.35	21.77	21.57	21.70	20.59	......
25	......	......	......	19.66	20.17	20.89	21.35	21.77	21.44	21.80	20.25	......
26	......	[b]18.70	[b]18.68	19.71	20.19	20.89	21.37	21.76	21.40	21.77	19.75	18.42

[a]Estimated.
[b]Tape measurement.

Table 9.—*Water levels in observation wells in the Prestonsburg quadrangle, Kentucky*—Con.

Well 8245-3735-6—Continued

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
27	......	......	....	19.81	20.17	20.89	21.38	21.75	21.40	21.71	19.76	18.63
28	....	......	....	19.82	20.20	20.89	21.38	21.69	21.49	21.64	19.79	18.69
29	[b]19.38	......	[b]18.78	19.84	20.24	20.89	21.42	21.69	21.54	21.73	19.92	18.72
30	......		[b]21.71	19.90	20.30	20.81	21.45	21.68	21.53	21.71	20.01	18.81
31	......		[a]18.79		20.38		21.47	21.67		21.73		18.96

[a]Estimated. [b]Tape measurement.

Well 8245-3735-6—Continued

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 1, 1952	[d]19.14	Jan. 26, 1952	[d]17.70	Feb. 16, 1952	[d]17.51	Oct. 7, 1952	22.09
2	[d]18.89	27	[d]17.23	17	[d]17.22	20	22.15
3	[d]17.38	28	[d]15.42	20	[a]17.93	Nov. 4	22.06
4	[d]17.47	29	[d]15.96	21	[d]18.24	18	22.24
9	[d]18.30	30	[d]16.82	27	19.20	Dec. 3	21.89
10	[d]18.13	31	[d]17.41	Mar. 13	18.04	15	21.10
11	[d]18.07	Feb. 1	[d]17.77	25	14.76	30	21.41
12	[d]18.11	2	[d]18.03	Apr. 8	19.43	Jan. 13, 1953	19.03
13	[d]18.26	3	[d]18.15	21	19.87	27	19.03
14	[d]18.44	4	[d]17.95	May 5	19.27	Feb. 10	20.25
15	[d]18.63	5	[d]17.90	19	19.75	23	18.87
16	[d]18.85	6	[d]18.02	June 2	19.49	Mar. 9	18.81
17	[d]18.91	7	[d]18.25	18	20.74	23	20.13
18	[d]18.23	8	[d]18.39	30	20.36	Apr. 6	20.28
19	[d]18.00	9	[d]18.61	July 14	21.08	20	20.24
20	[d]17.97	10	[d]18.75	28	21.27	May 4	20.91
21	[d]18.12	11	[d]18.77	Aug. 8	21.38	20	15.83
22	[d]17.83	12	[d]18.90	25	21.60	June 8	20.75
23	[d]16.91	13	[d]18.95	Sept. 9	21.84	19	21.20
24	[d]16.68	14	[d]17.50	22	21.92	30	[c]21.71
25	[d]17.34	15	[d]17.37				

[a]Estimated. [d]Daily noon water level from recorder graph.
[c]Measurement discontinued.

Well 8245-3740-1. Owner: B. M. Thompson

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Oct. 10, 1950	37.47	Oct. 30, 1950	37.70	Nov. 29, 1950	37.45	Dec. 22, 1950	36.05
16	37.54	Nov. 13	37.63	Dec. 11	35.34		

Well 8245-3740-1—Continued

Noon daily water level from recorder graph, 1951

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	....	34.08	33.57	34.78	35.44	36.26	37.17	38.04	38.32	38.72	37.92
2	[b]36.50	......	34.11	33.63	34.80	35.48	36.27	37.21	38.06	38.33	38.36	37.95
3	....	......	34.13	33.52	34.50	35.53	36.31	37.26	38.05	38.36	38.42	37.97
4	....	......	34.20	33.17	34.10	35.59	36.31	37.29	38.03	38.38	38.46	37.97
5	....	......	34.14	33.27	34.04	35.37	36.40	37.32	38.06	38.40	38.49	37.99
6	....	......	33.71	33.38	34.12	35.11	36.40	[a]37.36	38.07	38.42	38.46	37.98
7	....	......	33.60	33.48	34.03	35.13	36.42	37.36	38.12	38.45	38.45	37.98
8	....	......	33.68	33.67	33.85	35.24	36.46	37.39	38.12	38.45	38.43	37.72
9	....	....	33.80	33.73	33.86	35.27	36.51	37.44	38.08	38.46	38.41	37.30
10	....	......	33.89	33.88	33.96	35.32	36.55	37.46	38.09	38.49	38.41	37.18
11	....	......	33.94	34.04	34.00	35.21	36.59	37.47	38.14	38.50	38.43	37.25
12	....	[b]34.10	33.95	34.01	34.26	35.28	36.62	37.51	38.16	38.53	38.43	37.31
13	....	34.21	34.00	33.72	34.41	35.38	36.67	37.53	38.17	38.54	38.44	37.40
14	....	34.38	34.09	33.51	34.56	35.46	36.69	37.56	38.19	38.55	38.48	37.36

[a]Estimated. [b]Tape measurement.

Table 9.—*Water levels in observation wells in the Prestonsburg quadrangle, Kentucky*—Con.

Well 8245-3740-1—Continued

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
15	[b]36.35	34.45	34.13	33.57	34.64	35.45	36.73	37.57	38.07	38.56	38.51	36.97
16	....	34.27	34.22	33.70	34.72	35.51	36.72	37.61	38.09	38.59	38.44	36.22
17	....	34.25	34.26	33.78	34.83	35.58	36.75	37.63	38.10	38.61	38.33	36.45
18	....	34.30	34.10	33.83	34.92	35.64	36.78	37.68	38.15	38.63	38.30	36.63
19	....	34.36	33.79	33.89	34.94	35.72	36.81	37.69	38.18	38.65	38.33	36.63
20	....	34.35	33.53	34.09	34.98	35.75	36.87	37.72	38.21	38.66	38.37	36.52
21	....	34.39	33.30	34.12	35.07	35.82	36.90	37.74	38.22	38.68	38.36	36.16
22	....	33.65	33.44	34.25	35.12	35.85	36.94	37.78	38.23	38.70	38.37	[a]35.40
23	....	33.41	33.51	34.46	35.17	35.92	36.97	37.81	38.28	38.70	38.39	35.63
24	....	33.59	33.78	34.43	35.22	35.97	37.01	37.84	38.28	38.73	38.41	35.92
25	....	33.69	33.83	34.51	35.23	36.03	37.02	37.88	38.25	38.75	38.14	36.00
26	....	33.79	33.99	34.58	35.23	36.08	36.96	37.89	38.25	38.75	37.84	36.12
27	....	33.97	33.95	34.64	35.29	36.13	36.98	37.91	38.26	38.75	37.72	36.17
28	....	34.03	33.97	34.70	35.33	36.17	37.02	37.94	38.28	38.76	37.78	36.13
29	[b]36.30	....	34.00	34.71	35.37	36.23	37.05	37.97	38.30	38.79	37.86	36.15
30	....		34.14	34.73	35.39	36.26	37.09	37.99	38.30	38.79	37.89	36.17
31	....		33.83		35.39		37.13	38.01		38.80		36.22

[a]Estimated. [b]Tape measurement.

Well 8245-3740-1—Continued

[Noon daily water level from recorder graph, 1952]

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	36.30	33.63	35.16	33.22	....	34.48	36.04	37.20	37.75	38.41	38.99	39.00
2	36.37	33.79	35.15	33.40	....	34.59	36.10	37.22	37.77	38.45	39.01	38.98
3	36.39	33.85	35.04	33.54	....	34.66	36.14	37.25	37.82	38.50	39.03	39.03
4	36.28	33.90	34.50	33.54	....	34.74	36.19	37.25	37.85	38.49	39.04	39.04
5	36.21	34.05	33.79	33.70	....	34.84	36.26	37.28	37.87	38.52	39.05	39.02
6	36.17	33.98	33.94	33.79	33.65	34.93	36.31	37.29	37.89	38.54	39.07	39.03
7	36.19	34.13	34.13	33.86	33.81	35.00	36.32	37.27	37.92	38.57	39.10	39.00
8	36.15	34.14	....	33.93	33.87	35.08	36.34	37.30	37.95	38.57	39.11	38.95
9	36.23	34.29	34.26	34.01	34.00	35.16	36.41	37.31	37.98	38.58	39.12	38.95
10	36.24	34.37	34.32	34.06	34.01	35.19	36.45	37.35	38.00	38.65	39.13	38.90
11	35.46	34.40	34.46	34.17	33.93	35.27	36.51	37.40	38.04	38.64	39.14	38.55
12	35.38	....	33.96	34.19	33.79	35.30	36.53	37.40	38.06	38.64	39.16	38.06
13	35.50	34.65	33.78	34.24	33.36	35.36	36.56	37.40	38.16	38.66	39.19	38.31
14	35.56	34.37	34.00	34.28	33.43	35.43	36.60	37.26	38.13	38.66	39.18	38.39
15	35.63	34.07	34.11	34.33	33.56	35.48	36.65	37.33	38.13	38.67	39.18	38.43
16	35.70	34.00	34.23	34.38	33.73	35.53	36.71	37.36	38.15	38.69	39.19	38.44
17	35.72	33.97	34.41	34.41	33.87	35.60	36.72	....	38.17	38.71	39.19	38.46
18	35.71	34.03	34.49	34.44	34.04	35.67	36.74	37.45	38.19	38.74	39.19	38.49
19	35.50	34.05	34.59	34.49	34.09	35.72	36.69	37.48	38.20	38.74	39.21	38.52
20	35.46	34.12	34.59	34.54	33.97	35.79	36.72	37.50	38.22	38.78	39.23	38.51
21	35.47	34.30	34.56	34.58	33.93	35.85	36.77	37.54	38.24	38.81	39.21	38.54
22	35.32	34.47	34.21	34.64	33.97	35.86	36.81	37.54	38.22	38.82	39.17	38.56
23	34.23	34.55	32.27	34.69	34.06	35.65	36.86	37.51	38.24	38.83	38.98	38.57
24	33.68	[a]34.61	....	34.74	34.16	35.52	36.91	37.51	38.27	38.85	38.99	38.61
25	34.21	34.79	31.18	34.54	34.19	35.53	36.94	37.53	38.29	38.87	38.94	38.61
26	34.40	34.83	....	34.38	34.30	35.67	36.99	37.62	38.30	38.89	38.92	38.63
27	34.39	34.90	....	33.69	34.34	35.77	37.02	37.61	38.33	38.89	38.96	38.64
28	33.53	34.91	....	32.84	34.41	35.86	37.06	37.63	38.36	38.92	38.96	38.67
29	32.89	35.04	....	31.90	34.48	35.92	37.10	37.67	38.37	38.95	38.96	38.68
30	33.02		....	32.11	34.41	35.96	37.15	37.74	38.39	38.97	38.99	38.68
31	33.44		....		34.39		37.17	37.72		38.98		38.66

[a] Estimated.

Well 8245-3740-1—Continued

[Noon daily water level from recorder graph, 1953]

Day	Jan.	Feb.	Mar.	Apr.	May	June
1	38.73	37.64	36.98	36.42	36.97	35.68
2	38.68	37.66	36.89	36.54	36.98	35.81

Table 9.—*Water levels in observation wells in the Prestonsburg quadrangle, Kentucky*— Con.

Well 8245-3740-1—Continued

Day	Jan.	Feb.	Mar.	Apr.	May	June
3	38.64	37.69	....	36.55	37.01	35.88
4	38.66	37.77	....	36.68	37.03	35.96
5	38.63	37.79	....	36.68	37.04	36.04
6	38.63	37.81	....	36.66	37.02	36.13
7	38.49	37.85	....	36.75	36.60	36.13
8	38.21	37.88	....	36.76	35.95	36.09
9	38.04	37.91	....	36.66	35.92	36.17
10	38.07	37.91	36.34	36.65	36.07	36.24
11	38.07	37.88	36.41	36.72	36.15	36.33
12	38.09	37.86	36.45	36.60	36.25	36.09
13	38.11	37.86	36.52	36.66	36.35	36.21
14	38.13	37.69	36.52	36.66	36.39	36.27
15	38.14	37.65	36.53	36.44	36.46	36.24
16	38.17	37.59	36.60	36.45	36.52	36.30
17	38.14	37.54	36.55	36.48	36.55	36.35
18	38.10	37.42	36.47	36.47	36.61	36.42
19	38.04	37.43	36.45	36.55	36.27	36.47
20	38.03	37.44	36.35	36.53	34.14	36.51
21	38.03	37.37	36.35	36.57	33.31	36.57
22	37.92	36.42	36.40	36.62	33.92	36.63
23	37.80	36.23	36.45	36.65	34.54	36.65
24	37.77	36.56	36.45	36.76	34.76	36.69
25	37.79	36.65	36.19	36.75	34.89	36.72
26	37.79	36.73	36.10	36.77	35.01	36.77
27	37.78	36.82	36.13	36.86	35.23	36.81
28	37.78	36.93	36.18	36.88	35.32	36.84
29	37.68		36.30	36.90	35.39	36.88
30	37.56		36.36	36.91	35.46	[c]36.86
31	37.59		36.40		35.56	

[c] Measurement discontinued.

Well 8245-3740-11. Owner: Julia Blackburn

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Oct. 12, 1950	9.13	Oct. 30, 1950	9.35	Nov. 29, 1950	8.70	Dec. 22, 1950	9.21
16	9.68	Nov. 13	8.94	Dec. 11	7.99		

Well 8245-3740-11—Continued

[Noon daily water level from recorder graph, 1951]

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	....	....	8.62	8.39	9.04	9.05	9.55	10.98	12.13	10.71	8.78	9.13
2	[b]9.41	....	8.72	7.98	8.49	9.17	9.62	11.03	12.23	10.78	9.01	9.28
3	....	....	8.70	7.65	6.76	9.29	9.70	11.08	11.93	10.85	8.93	9.38
4	....	....	7.18	7.90	7.23	9.32	9.74	11.19	11.85	10.97	9.13	8.96
5	....	....	7.03	8.17	6.79	7.87	9.88	11.28	....	11.08	9.32	8.38
6	....	....	7.41	8.33	7.38	8.18	9.99	11.36	....	11.15	9.36	8.61
7	....	....	7.11	8.44	6.49	8.49	10.06	11.34	....	11.16	7.87	8.87
8	....	....	7.49	8.47	7.17	7.74	10.15	11.42	....	11.11	8.33	5.76
9	....	....	7.99	8.63	6.71	8.10	10.23	11.49	....	11.14	8.79	....
10	....	....	8.25	8.67	8.11	8.31	10.34	11.11	....	11.18	9.02	....
11	....	....	8.39	8.72	8.29	8.51	10.40	11.21	11.35	11.22	9.19	[a]7.94
12	....	[b]7.77	8.47	7.80	8.48	8.66	10.48	11.30	11.38	11.31	9.30	8.32
13	....	....	8.21	7.89	8.71	8.42	10.49	11.39	11.43	11.39	9.39	8.73
14	....	....	7.45	7.72	8.81	8.54	9.18	11.47	10.35	11.45	8.38	8.65
15	[b]6.66	....	7.90	8.00	8.92	8.63	9.42	11.53	10.44	11.47	8.29	6.57
16	....	....	8.16	8.21	9.02	8.75	9.55	11.58	10.55	11.52	7.46	[a]7.52
17	....	....	8.38	8.36	9.10	8.91	9.69	11.66	10.65	11.59	7.97	....
18	....	....	....	8.48	9.24	9.18	9.80	11.73	10.77	11.64	8.50	[a]7.72

[a] Estimated.

[b] Tape measurement.

Table 9.—*Water levels in observation wells in the Prestonsburg quadrangle, Kentucky*—Con.

Well 8245-3740-11—Continued

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
19	....	....	a6.88	8.49	9.36	9.18	9.90	11.80	10.85	11.68	8.85	7.85
20	....	....	6.65	8.66	9.44	9.29	9.96	11.88	10.99	11.67	9.10	7.87
21	....	....	7.15	8.72	9.54	9.26	10.07	11.94	11.10	11.65	9.24	6.64
22	....	....	7.73	8.78	9.60	9.30	10.18	12.03	11.16	11.56	9.35	7.42
23	....	....	7.97	8.78	9.44	9.43	10.28	12.11	11.22	11.50	9.41	8.02
24	....	....	8.27	8.76	9.43	9.58	10.40	12.18	11.20	11.48	8.09	8.52
25	....	....	....	8.83	9.48	9.69	10.42	12.24	10.76	11.47	7.90	8.75
26	....	b8.54	8.34	8.94	9.53	9.78	10.51	12.30	10.78	11.38	7.26	8.12
27	....	....	8.43	9.05	9.28	9.82	10.58	12.36	10.63	11.25	7.89	8.49
28	....	....	8.46	9.03	9.16	9.90	10.66	11.97	10.46	11.17	8.36	8.65
29	b7.91	....	8.39	9.06	8.60	9.90	10.74	12.00	10.55	11.25	8.72	8.74
30	....		8.21	9.09	8.82	9.63	....	12.05	10.63	11.25	8.95	8.68
31	....		8.31		8.94		10.90	12.09		11.28		8.81

[a] Estimated. [b] Tape measurement.

Well 8245-3740-11—Continued

[Noon daily water level from recorder graph, 1952]

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	9.04	8.57	8.83	9.20	8.76	9.07	9.72	11.79	13.16	15.11	15.84	14.69
2	9.09	8.70	9.06	9.30	8.95	9.27	9.87	11.80	13.21	15.13	15.87	14.61
3	7.20	8.56	7.75	9.44	9.18	9.39	9.95	11.86	13.32	15.18	15.90	14.59
4	7.47	7.34	7.31	9.45	9.34	9.51	10.05	11.91	13.41	15.22	15.92	14.57
5	6.81	7.62	8.15	8.70	9.43	9.66	10.09	11.88	13.48	15.26	15.94	13.58
6	7.50	8.09	8.62	8.86	9.53	9.78	10.22	11.74	13.55	15.29	15.95	13.43
7	8.05	....	8.91	9.09	9.68	9.87	10.31	11.69	a13.63	15.31	15.97	13.25
8	8.30	....	9.07	9.28	9.68	9.96	10.37	11.76	a13.71	15.35	16.00	13.13
9	8.56	....	9.13	9.41	9.72	10.05	10.45	11.83	13.81	15.35	16.02	13.00
10	7.14	....	9.19	9.48	9.13	9.88	10.54	11.82	13.88	15.35	16.01	11.71
11	7.62	....	7.18	9.61	8.29	9.60	10.65	11.89	13.95	15.38	15.99	9.80
12	8.06	....	7.42	9.60	8.31	9.65	10.76	11.96	14.02	15.40	15.99	9.71
13	8.37	9.20	7.90	9.57	8.50	9.46	10.83	12.04	14.10	15.41	16.00	9.91
14	8.62	7.38	8.49	8.92	8.79	9.58	10.89	12.12	14.12	15.42	16.02	10.14
15	8.80	7.69	8.82	9.12	8.92	9.69	10.95	12.17	14.22	15.43	16.03	10.37
16	9.00	7.98	9.02	9.34	9.08	9.80	11.03	12.23	14.29	15.45	16.06	10.58
17	8.71	7.26	9.20	9.46	9.25	9.90	10.94	....	14.34	15.47	16.09	10.72
18	7.35	7.93	9.29	9.53	9.40	10.00	11.02	12.36	14.40	15.50	16.12	10.88
19	7.73	8.32	8.37	9.60	9.41	10.06	11.06	12.41	14.46	15.54	16.14	11.06
20	7.58	8.55	8.60	9.68	7.28	10.15	11.12	12.45	14.54	15.58	16.14	11.06
21	8.02	8.86	8.88	9.74	7.29	10.16	11.19	12.49	14.62	15.62	16.12	10.98
22	6.56	9.06	4.63	9.78	8.09	9.94	11.26	12.55	14.68	15.66	15.71	10.93
23	7.17	9.13	....	9.81	8.49	8.00	11.33	12.63	14.75	15.68	15.59	10.96
24	7.50	9.19	2.85	9.75	8.72	7.85	11.42	12.70	14.82	15.69	15.49	11.15
25	8.15	9.34	6.45	6.75	8.74	8.47	11.50	12.75	14.86	15.70	15.29	11.29
26	8.43	9.37	7.69	7.49	8.86	8.84	11.57	12.80	14.90	15.73	15.08	11.39
27	6.87	9.33	8.35	7.50	9.00	9.12	11.64	12.86	14.94	15.74	14.94	11.48
28	6.24	9.34	8.69	7.31	9.11	9.35	11.70	12.92	15.00	15.75	14.83	11.61
29	7.16	9.47	8.92	7.80	9.09	9.51	11.77	12.97	15.04	15.77	14.75	11.64
30	7.89		9.13	8.36	8.76	9.62	11.84	13.03	15.07	15.81	14.69	11.60
31	8.34		9.19		8.89		11.72	13.08		15.81		11.45

[a] Estimated.

Well 8245-3740-11—Continued

[Noon daily water level from recorder graph, 1953]

Day	Jan.	Feb.	Mar.	Apr.	May	June
1	10.97	8.43	9.35	9.21	9.64	10.01
2	10.40	8.79	7.06	9.28	9.75	10.17
3	9.25	8.94	6.36	9.39	9.98	10.26
4	8.71	9.18	6.32	9.54	10.08	10.33
5	8.70	9.28	7.16	9.64	10.09	10.42
6	8.95	9.27	7.87	9.62	9.54	10.51

Table 9.—*Water levels in observation wells in the Prestonsburg quadrangle, Kentucky*—Con.

Well 8245-3740-11—Continued

Day	Jan.	Feb.	Mar.	Apr.	May	June
7	[a]5.76	8.97	8.42	9.14	8.55	10.18
8	5.55	9.10	8.69	9.10	8.28	10.12
9	6.54	9.39	8.98	9.15	8.28	10.24
10	6.92	9.51	9.13	9.14	8.59	10.36
11	7.32	9.34	9.26	9.22	8.82	10.10
12	7.71	8.23	9.35	9.00	9.06	10.14
13	7.87	8.04	9.26	9.00	9.27	10.05
14	8.16	8.30	9.24	9.17	9.42	9.56
15	8.44	7.62	7.87	9.16	9.27	9.60
16	8.69	7.44	7.99	9.07	9.24	9.71
17	8.42	7.88	8.48	9.14	9.22	9.79
18	7.23	8.35	7.58	9.12	9.15	9.92
19	7.38	8.60	7.89	9.10	7.34	10.06
20	7.65	8.64	8.51	9.19	4.33	10.21
21	6.93	6.77	8.84	9.30	3.72	10.35
22	7.24	7.26	9.07	9.38	7.32	10.51
23	7.47	7.63	9.21	9.49	8.43	10.60
24	7.32	8.08	....	9.62	8.84	10.66
25	7.53	8.45	....	9.67	9.02	10.74
26	7.77	8.63	....	9.73	9.18	10.83
27	7.89	8.87	....	9.86	9.47	10.91
28	7.71	9.17	....	9.87	9.67	10.36
29	7.74		....	9.83	9.74	10.14
30	7.98		....	9.79	9.78	[c]8.40
31	8.15		9.43		9.90	

[a] Estimated. [c] Measurement discontinued.

Well 8245-3740-12. Owner: Sol DeRossett

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Oct. 17, 1950	6.21	June 19, 1951	6.46	Feb. 27, 1952	5.35	Nov. 4, 1952	12.65
30	5.86	July 3	7.01	Mar. 12	4.91	17	14.18
Nov. 13	5.39	17	6.17	25	4.94	Dec. 3	12.98
29	5.25	31	7.32	Apr. 8	5.17	15	6.08
Dec. 11	5.00	Aug. 14	7.93	21	5.28	30	7.22
22	5.31	28	9.37	May 5	5.54	Jan. 13, 1953	5.42
Jan. 2, 1951	5.53	Sept. 11	10.03	19	5.55	27	5.18
15	4.92	25	6.48	June 2	5.65	Feb. 10	5.62
29	4.90	Oct. 9	7.77	18	6.62	23	5.07
Feb. 12	5.00	23	9.39	30	6.30	Mar. 9	5.17
26	4.98	Nov. 9	5.77	July 14	7.25	23	5.08
Mar. 12	4.98	20	5.82	28	7.46	Apr. 6	5.30
26	4.93	Dec. 4	5.19	Aug. 8	7.14	20	5.13
Apr. 9	4.96	18	5.01	25	7.61	May 4	5.67
23	5.15	Jan. 2, 1952	5.31	Sept. 9	8.26	20	4.90
May 7	4.95	16	5.20	22	8.64	June 8	5.77
22	6.40	30	4.94	Oct. 7	10.14	19	6.35
June 4	6.74	Feb. 18	4.93	20	11.42	[c]30	5.65

[c] Measurement discontinued.

Well 8245-3740-15. Owner: Erman Waddle

Oct. 18, 1950	12.27	Jan. 29, 1951	11.55	May 22, 1951	11.93	Sept. 11, 1951	13.17
30	12.05	Feb. 12	10.49	June 4	12.27	25	13.14
Nov. 13	11.75	26	11.00	19	12.30	Oct. 9	13.17
29	11.50	Mar. 12	11.13	July 3	12.50	23	13.65
Dec. 11	10.48	26	11.16	17	12.56	Nov. 6	12.98
22	11.54	Apr. 9	11.25	31	12.72	20	12.33
Jan. 2, 1951	11.88	23	11.66	Aug. 14	13.15	Dec. 4	11.91
15	11.36	May 7	11.19	28	13.22	18	11.01

Table 9.—*Water levels in observation wells in the Prestonsburg quadrangle, Kentucky*—Con.

Well 8245-3740-15. Owner: Erman Waddle—Continued

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 2, 1952	11.49	May 19, 1952	11.68	Oct. 7, 1952	14.01	Feb. 23, 1953	11.44
16	11.28	June 2	11.57	20	14.49	Mar. 9	11.32
30	10.53	18	12.31	Nov. 4	14.28	23	11.68
Feb. 18	10.97	30	12.24	18	14.33	Apr. 6	11.84
27	11.50	July 14	12.69	Dec. 3	15.06	20	11.80
Mar. 12	11.47	28	12.97	15	13.87	May 4	12.30
25	8.29	Aug. 8	13.12	30	13.50	22	9.75
Apr. 8	11.42	25	13.43	Jan. 13, 1953	12.33	June 8	12.22
21	11.73	Sept. 9	13.70	27	11.67	19	12.51
May 5	11.19	22	13.75	Feb. 10	12.14	[c]30	12.58

[c] Measurement discontinued.

Well 8245-3740-20. Owner: Bee Daniels

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Oct. 16, 1950	16.68	July 3, 1951	20.79	Feb. 27, 1952	23.63	Nov. 4, 1952	39.42
30	16.72	17	38.83	Mar. 12	13.27	17	36.69
Nov. 13	14.41	30	42.78	25	12.87	Dec. 3	44.48
29	24.75	Aug. 14	54.48	Apr. 8	12.68	15	40.74
Dec. 11	14.25	28	82	21	14.64	30	38.36
22	17.95	Sept. 4	47.67	May 5	13.52	Jan. 13, 1953	28.75
Jan. 2, 1951	18.15	11	42.46	19	12.78	27	19.05
15	13.24	25	36.56	June 2	12.94	Feb. 10	16.38
29	14.73	Oct. 9	39.30	18	32.88	23	14.59
Feb. 12	13.63	23	78.32	30	19.41	Mar. 9	13.25
26	14.11	Nov. 6	66.09	July 14	42.30	23	14.09
Mar. 12	12.55	20	51.73	28	55.95	Apr. 6	12.11
26	11.82	Dec. 4	29.87	Aug. 8	40.82	20	13.04
Apr. 9	12.02	18	21.77	25	53.49	May 4	12.78
23	13.26	Jan. 2, 1952	17.42	Sept. 9	38.65	20	12.15
May 7	12.34	16	13.44	22	47.53	June 8	15.16
22	41.04	30	13.14	Oct. 7	42.84	19	17.15
June 4	34.64	Feb. 18	13.53	20	38.40	[c]30	19.88
19	36.00						

[c] Measurement discontinued.

Well 8245-3740-21. Owner: Bee Daniels

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Oct. 16, 1950	6.97	June 19, 1951	5.14	Feb. 27, 1952	5.60	Nov. 4, 1952	15.83
30	4.53	July 3	6.83	Mar. 12	2.50	17	16.05
Nov. 13	3.26	17	8.39	25	2.52	Dec. 3	16.24
29	2.50	31	9.30	Apr. 8	4.58	15	16.43
Dec. 11	2.86	Aug. 14	10.43	21	5.14	30	16.59
22	4.11	28	12.44	May 5	4.24	Jan. 13, 1953	11.59
Jan. 2, 1951	5.41	Sept. 11	12.79	19	4.37	27	8.35
15	1.61	25	13.19	June 2	4.61	Feb. 10	9.30
29	2.99	Oct. 9	13.32	18	7.23	23	5.83
Feb. 12	2.56	23	14.93	30	8.48	Mar. 9	3.61
26	3.09	Nov. 6	17.23	July 14	9.50	23	3.17
Mar. 12	3.10	21	16.79	28	11.10	Apr. 6	3.87
26	3.03	Dec. 4	14.99	Aug. 8	12.50	20	3.70
Apr. 9	3.42	18	4.78	25	13.00	May 4	4.98
23	3.72	Jan. 2, 1952	3.50	Sept. 9	14.23	20	2.18
May 7	1.89	16	3.16	22	14.51	June 8	5.91
22	4.26	30	2.53	Oct. 7	15.15	19	7.11
June 4	5.13	Feb. 18	2.53	20	15.50	[c]30	8.36

[c] Measurement discontinued.

Table 9.—*Water levels in observation wells in the Prestonsburg quadrangle, Kentucky*—Con.

Well 8245-3740-23. Owner: Frank Neeley

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Oct. 30, 1950	12.76	July 3, 1951	13.23	Mar. 12, 1952	9.97	Nov. 17, 1952	16.55
Nov. 13	12.40	17	13.06	25	10.25	Dec. 3	17.08
29	11.66	31	13.50	Apr. 8	12.10	15	16.52
Dec. 11	12.00	Aug. 14	13.62	21	12.70	30	17.04
22	13.06	28	13.75	May 5	12.59	Jan. 13, 1953	11.49
Jan. 2, 1951	13.48	Sept. 11	13.86	19	12.46	27	11.31
15	10.75	25	13.90	June 2	12.55	Feb. 10	12.47
29	12.33	Oct. 9	13.87	18	13.02	23	11.22
Feb. 12	12.22	23	14.09	30	13.04	Mar. 9	12.18
26	12.00	Nov. 9	14.02	July 14	13.20	23	12.03
Mar. 12	11.96	20	11.97	28	13.16	Apr. 6	12.57
26	12.07	Dec. 4	12.63	Aug. 8	13.20	20	12.10
Apr. 9	12.06	18	11.42	25	13.55	May 4	13.32
23	12.58	Jan. 2, 1952	12.20	Sept. 9	14.01	22	11.34
May 7	10.08	16	11.90	22	14.41	June 8	13.80
22	13.16	30	10.64	Oct. 7	14.93	19	13.98
June 4	13.14	Feb. 18	10.52	20	15.43	[c]30	14.01
19	13.12	27	12.44	Nov. 4	16.06		

[c] Measurement discontinued.

Well 8245-3740-108. Owner: Jake Hollifield

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Jan. 14, 1952	38.53	June 2, 1952	40.61	Oct. 20, 1952	46.62	Mar. 9, 1953	38.61
30	35.25	18	42.96	Nov. 4	46.80	23	40.47
Feb. 18	37.53	30	43.15	18	46.96	Apr. 6	41.42
27	38.70	July 14	44.40	Dec. 3	46.09	20	41.46
Mar. 13	38.11	28	45.23	15	44.55	May 4	42.69
25	31.77	Aug. 8	45.33	30	45.00	20	39.73
Apr. 8	39.71	25	45.27	Jan. 13, 1953	43.47	June 8	39.19
21	41.12	Sept. 9	45.75	27	42.43	19	42.74
May 5	37.61	22	46.17	Feb. 10	43.05	[c]30	43.71
19	39.33	Oct. 7	46.45	23	39.81		

[c] Measurement discontinued.

Well 8250-3740-3. Owner: L. H. Dotson

Date	Water level	Date	Water level	Date	Water level	Date	Water level
Nov. 14, 1950	15.26	July 17, 1951	15.80	Mar. 25, 1952	14.47	Nov. 18, 1952	18.87
29	14.75	31	16.07	Apr. 8	15.17	Dec. 3	18.23
Dec. 11	13.95	Aug. 14	16.16	21	15.15	15	17.36
22	14.87	Sept. 4	16.20	May 5	14.97	30	17.22
Jan. 2, 1951	15.56	11	15.94	19	15.17	Jan. 13, 1953	15.39
15	14.75	25	15.58	June 2	14.86	27	14.77
29	15.02	Oct. 9	16.72	18	16.36	Feb. 10	15.55
Feb. 12	14.17	23	17.48	30	16.78	23	14.86
26	14.16	Nov. 6	16.53	July 14	17.09	Mar. 9	14.58
Mar. 12	14.09	20	16.23	28	19.44	23	14.56
26	14.24	Dec. 4	15.74	Aug. 8	17.65	Apr. 6	14.58
Apr. 9	14.26	18	14.83	25	18.19	20	14.82
23	14.69	Jan. 2, 1952	15.08	Sept. 9	19.94	May 4	15.18
May 7	14.34	16	15.13	22	18.43	22	13.98
22	15.02	30	14.76	Oct. 7	18.77	June 8	15.39
June 4	15.42	Feb. 18	14.78	20	18.78	19	17.71
19	15.25	27	16.01	Nov. 4	18.64	[c]30	16.23
July 3	15.75	Mar. 12	14.92				

[c] Measurement discontinued.

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky

Well 8245-3735-5

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Sample log of water well (collected by author). Static water level: 36.97 ft below land surface.			
Quaternary system:			
Alluvium:			
No record	30	30	
Silt, dark-yellowish-orange, slightly sandy, micaceous	20	50	
No record, but probably silt	10	60	
Silt, light-olive-gray, slightly sandy, micaceous	5	65	
Sand, light-olive-gray, medium-grained, predominantly angular to subangular quartz grains, some muscovite, contains angular to subangular sandstone, siltstone, and ironstone pebbles averaging 4 mm in diameter	2	67	
Silt, light-olive-gray, slightly sandy, micaceous; water, a little at 71 ft	4	71	
Pennsylvanian system:			
Breathitt formation:			
Sandstone, yellowish-gray, fine- to medium-grained, predominantly angular quartz, some biotite, limonite, muscovite, and pyrite	2	73	
Sandstone, yellowish-gray, fine-grained, predominantly angular quartz, some limonite and muscovite	2	75	
Sandstone, as above, and medium-gray siltstone	7	82	
Siltstone, medium-gray, micaceous, and sandstone, as above; water at 91 ft	9	91	
Siltstone, medium- to light-gray, micaceous, hard	3	94	
Sandstone, yellowish-gray, very fine grained, predominantly angular quartz, some muscovite; contains light- to medium-gray micaceous siltstone and coal; gas	6	100	

Well 8245-3735-82

Type of record: Driller's log of gas well.
Altitude of land surface: 721 ft above mean sea level.

Quaternary system: Soil	37	37	
Pennsylvanian system:			
Breathitt formation:			
Slate	35	72	
Sand	23	95	
Slate; water at 80 ft	20	115	
Breathitt and Lee formations: Sand and slate	514	629	Complete record not given here. Total depth 651 ft.

Well 8245-3735-105

Type of record: Driller's log of gas well.
Altitude of land surface: 632 ft above mean sea level.

Quaternary system:			
Alluvium:			
Surficial material (of drillers)	10	10	
Sand; water at 80 ft	79	89	
Pennsylvanian system:			
Breathitt formation:			
Slate	6	95	
Sand	49	144	
Breathitt and Lee formations: Slate and sand	421	565	Complete record not given here. Total depth 2,036 ft.

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8245-3735-118

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of gas well. Altitude of land surface: 731 ft above mean sea level.			
Quaternary system: Surficial material (of drillers)	28	28	
Pennsylvanian system:			
Breathitt formation:			
Sand; water	32	60	
Slate	5	65	
Sand	40	105	
Coal	2	107	
Sand	123	230	
Slate	5	235	
Shale	97	332	
Sand	18	350	
Slate	190	540	
Lee formation: Sand	20	560	Complete record not given here. Total depth 880 ft.

Well 8245-3740-86

Formation	Thickness (feet)	Thickness (inches)	Depth (feet)	Depth (inches)	Remarks
Type of record: Driller's log of water well drilled as a core hole. Static water level: 50.78 ft below land surface. Altitude of land surface: 703.5 ft above mean sea level.					
Quaternary system: Surficial material (of drillers)	5	0	5	0	
Pennsylvanian system:					
Breathitt formation:					
Sandstone	9	9	14	9	
Sandstone, brown	2	9	17	6	
Sandstone, gray	3	0	20	6	
Shale, blue, sandy	7	11	28	5	
Sandstone	6	10	35	3	
Slate	0	10	36	1	
Sandstone	11	7	47	8	
Shale, blue, sandy	32	7	80	3	
Coal	0	10	81	1	
Fire clay, sandy	1	3	82	4	
Shale, blue, sandy	5	1	87	5	
Coal	0	4	87	9	
Slate, black	0	10	88	7	
Shale, blue, sandy	2	10	91	5	
Sandstone with shale streaks	13	3	104	8	
Slate, black	3	0	107	8	
Coal	1	3	108	11	
Slate	0	4	109	3	
Coal	0	8	109	11	
Fire clay, sandy	1	2	111	1	
Shale, dark, sandy	2	0	113	1	
Sandstone	5	4	118	5	
Shale, gray, sandy	5	8	124	1	
Slate, black	1	8	125	9	
Sandstone	3	8	129	5	
Shale, blue	4	4	133	9	
Shale with sandstone streaks	9	11	143	8	
Sandstone	8	0	151	8	
Shale, blue, sandy	18	4	170	0	

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8245-3740-128

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Sample log of water well (collected by driller). Static water level: 10.06 ft below land surface.			
Quaternary system: Clay (reported)	20	20	
Pennsylvanian system:			
Breathitt formation:			
Sandstone, yellowish-gray, very fine grained, predominantly angular quartz, some limonite and muscovite	5	25	
Siltstone, medium- and dark-gray, micaceous	5	30	
Siltstone, as above	5	35	
Siltstone, as above	5	40	
Siltstone, medium-gray, micaceous	5	45	
Siltstone, dark-gray, micaceous; water	5	50	

Well 8245-3740-130

Type of record: Sample log of water well (collected by driller).
Static water level: 10.71 ft below land surface.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system:			
Alluvium: No record	28	28	
Pennsylvanian system:			
Breathitt formation:			
Sandstone, light-olive-gray, fine- to medium-grained, composed of angular quartz, some light-olive-gray micaceous siltstone and coal present	2	30	
Siltstone, light-olive-gray, limonitic, micaceous, some coal present	2	32	
Siltstone, dark, olive, and greenish-gray, limonitic, micaceous	3	35	
Siltstone, as above	3	38	
Siltstone, medium-dark-gray, limonitic, micaceous	2	40	
Siltstone, dark- and olive-gray, limonitic, micaceous; water	2	42	

Well 8245-3740-135

Type of record: Sample log of water well (collected by author).
Static water level: 13 ft below land surface (reported).

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system:			
Alluvium:			
Silt and clay, grayish-orange, micaceous, contains about 25 percent very fine to medium-grained sand	10	10	
Silt and clay, as above, except contains about 50 percent very fine to medium-grained sand	10	20	
Silt and clay, gray and grayish-orange, micaceous, contains about 40 percent very fine to medium-grained sand	3	23	
Silt and clay, yellowish-gray, micaceous, contains about 30 percent very fine and fine-grained sand	5	28	
Silt and clay, as above, except contains about 10 percent very fine grained sand	4	32	
Silt and clay, as above, except contains about 10 percent very fine and fine-grained sand	5	37	
Silt and clay, as above; water at 40 ft	3	40	
Sand, yellowish-gray, fine- and medium-grained, predominantly subangular quartz with some biotite, limonite and muscovite, contains about 15 percent sandstone and ironstone gravel	7	47	

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8245-3740-135—Continued

Formation	Thickness (feet)	Depth (feet)	Remarks
Pennsylvanian system:			
Breathitt formation:			
Sandstone, light-olive-gray, medium-grained, predominantly angular quartz with some biotite, limonite and muscovite	3	50	
Sandstone, yellowish-gray, medium-grained, well cemented, predominantly angular to subangular quartz with some biotite, hematite, limonite, and muscovite; water at 53 ft	3	53	
Sandstone, yellowish-gray, fine- and medium-grained, predominantly angular to subangular quartz with some limonite and muscovite	3	56	
Sandstone, yellowish-gray, fine- and medium-grained, friable, angular to subangular quartz with a little limonite and muscovite; water	4	60	

Well 8245-3740-162

Type of record: Driller's log of gas well.
Altitude of land surface: 723 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Soil	38	38	
Pennsylvanian system:			
Breathitt formation:			
Slate and shells; water, two 10-inch bailers per hour at 46 ft	44	82	
Coal	2	84	
Slate	6	90	
Sand	50	140	
Coal	2	142	
Sand	13	155	
Slate and shells	39	194	
Sand	41	235	
Slate	185	420	
Lee formation:			
Salt sand (of drillers); water, two 8-inch bailers per hr at 490 ft; water, hole full, at 545 ft.	160	580	Complete record not given here. Total depth 861 ft.

Well 8245-3740-163

Type of record: Sample log of water well (collected by author).
Static water level: 42.82 ft below land surface.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system:			
Alluvium:			
Silt and clay, grayish-orange, micaceous, contains about 15 percent very fine and fine-grained sand	7	7	
Silt and clay, as above, except contains about 30 percent very fine and fine-grained sand	2	9	
Silt and clay, as above, except contains about 40 percent very fine and fine-grained sand	6	15	
Silt and clay, as above, except contains about 45 percent very fine and fine-grained sand	5	20	
Sand, grayish-orange, very fine and fine-grained, consists of angular, iron-stained quartz grains and a little mica, contains about 40 percent silt and clay	5	25	
Sand, grayish-orange, very fine and fine-grained, consists of angular, iron-stained quartz grains and a little coal, feldspar, limonite and muscovite; contains about 40 percent silt and clay	5	30	

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8245-3740-163—Continued

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system—Continued			
Alluvium—Continued			
Sand, as above, except contains 35 percent silt and clay	5	35	
Sand, grayish-orange, very fine to medium-grained, consists of angular quartz grains, some iron stained, and a little coal, feldspar and limonite; contains about 20 percent silt and clay	5	40	
Sand, pale-yellowish-brown, fine- and medium-grained, consists of angular to subangular quartz grains, some iron stained, and a little coal, feldspar and limonite; contains about 20 percent silt and very fine grained sand	3	43	
Sand, as above, except contains about 15 percent silt and very fine grained sand; water	7	50	
Sand, yellowish-gray, fine- and medium-grained, consists of angular to subangular quartz grains, a few iron stained, and coal and feldspar; contains about 20 percent silt and very fine grained sand	7	57	
Sand, yellowish-gray, fine- and medium-grained, consists of angular to subangular quartz grains, and some coal and feldspar; contains about 15 percent silt and very fine grained sand	3	60	
Sand, yellowish-gray, medium-grained, consists of angular to subangular quartz grains and a very little coal; contains about 15 percent silt and fine-grained sand	5	65	
Sand, yellowish-gray, fine- and medium-grained, consists of angular to subangular quartz grains; contains about 15 percent silt and very fine sand, and about 5 percent sandstone gravel	5	70	
Sand, dusky-yellow, fine- and medium-grained, consists of angular to subangular quartz grains, some iron stained; coal, hematite and limonite; contains about 45 percent clay, silt, and very fine grained sand, coal pebbles up to 15 mm in sample	5	75	
Sand, dusky-yellow, fine- and medium-grained, consists of angular to subangular quartz grains, most slightly iron stained; contains about 15 percent silt and very fine grained sand	2	77	
Sand, dusky-yellow, fine- to coarse-grained, consists of angular to subangular iron-stained quartz grains and some limonite and muscovite; about 20 percent of sample silt and very fine grained sand, about 10 percent of sample consists of very coarse grained sand and gravel	3	80	
Sand, dusky-yellow, fine- and medium-grained, as above, except not so much iron staining and about 20 percent of sample consists of coarse-grained sand and gravel	4	84	
Sand, as above, except about 40 percent of sample consists of clay, silt, and very fine grained sand; about 15 percent of sample consists of coarse- and very coarse grained sand and gravel	1	85	
Pennsylvanian system:			
Breathitt formation:			
Coal, black, pyritiferous, and dark-gray siltstone; sample contains some sand or sandstone	2	87	
Coal, black, pyritiferous, and some dark-gray siltstone and sandstone	3	90	
Siltstone, medium-light-gray, micaceous, some coal, as above, present	2	92	
Siltstone, medium-light-gray, micaceous	1	93	

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8245-3740-163—Continued

Formation	Thickness (feet)	Depth (feet)	Remarks
Pennsylvanian system —Continued			
Breathitt formation—Continued			
Sandstone, light-olive-gray, fine-grained, well-cemented, consists of angular to subangular quartz grains, a few stained with limonite; some limonite, muscovite, and dark-gray siltstone; water	5	98	

Well 8245-3740-166

Type of record: Driller's log of gas well.
Altitude of land surface: 687 ft above mean sea level.

Quaternary system: Surficial material (of drillers)	10	10	
Pennsylvanian system:			
Breathitt formation:			
Slate; water, 4 bailers per hr, at 125 ft	145	155	
Sand	35	190	
Slate	85	275	
Sand	25	300	
Slate	175	475	
Lee formation:			
Sand; water, hole full, at 575 ft; brine analysis of this water made by Kentucky Geological Survey	189	664	Complete record not given here. Total depth 885 ft.

Well 8245-3740-167

Type of record: Driller's log of gas well.
Altitude of land surface: 762 ft above mean sea level.

Quaternary system: Sand and gravel	25	25	
Pennsylvanian system:			
Breathitt formation:			
Sand; water, 1 bailer per hr, at 70 ft	45	70	
Slate; water, 1 bailer per hr at 135 ft	65	135	
Coal	3	138	
Slate	30	168	
Coal	2	170	
Slate; water, 3 bailers per hr, at 220 ft	50	220	
Sand	10	230	
Slate	140	370	
Sand	25	395	
Slate	25	420	
Sand	35	455	
Slate	120	575	
Lee formation:			
Sand; gas, show, at 590 ft; water at 685 ft; water, hole full, at 745 ft; brine analysis of this water made by Kentucky Geological Survey	225	800	Complete record not given here. Total depth 2,231 ft.

Well 8245-3740-168

Type of record: Driller's log of gas well.
Altitude of land surface: 632 ft above mean sea level.

Quaternary system:			
Alluvium: Soil and sand	85	85	

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8245-3740-168—Continued

Formation	Thickness (feet)	Depth (feet)	Remarks
Pennsylvanian system:			
Breathitt formation:			
Slate	5	90	
Coal; water, from 90 to 94 ft	4	94	
Sand	133	227	
Slate and shells	293	520	
Lee formation: First Salt sand	247	767	Complete record not given here. Total depth 1,968 ft.

Well 8245-3740-170

Type of record: Driller's log of gas well.
Altitude of land surface: 662 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system:			
Alluvium:			
Soil	5	5	
Sand and gravel	20	25	
Pennsylvanian system:			
Breathitt formation:			
Sand	7	32	
Slate	11	43	
Sand; water, 2 bailers per hr, at 48 ft	10	53	
Slate	10	63	
Sand	12	75	
Slate	3	78	
Sand, broken	32	110	
Slate	5	115	
Coal; water, hole full, from 115 to 118 ft	3	118	
Slate	15	133	
Sand	36	169	
Slate	57	226	
Lime	14	240	
Sand; water, 1 bailer per hr, from 250 to 260 ft	40	280	
Slate	2	282	
Sand	28	310	
Slate and shells	133	443	
Lee formation (?):			
Salt sand (of drillers); water, from 500 to 510 ft; water, hole full, at 525 ft; brine analysis of this water made by Kentucky Geological Survey	185	628	
Slate and shells	39	667	
Sand; gas at 669 ft	24	691	
Slate and shells	49	740	
Sand; gas, from 744 to 745 ft	75	815	
Mississippian system:			
Pennington shale:			
Slate and shells	35	850	
Maxon sand (of drillers); water, 1 bailer per hr, from 878 to 885 ft; brine analysis of this water made by Kentucky Geological Survey	47	897	
Slate	2	899	
Sand; water, hole full from 901 to 917 ft	19	918	
Glen Dean limestone (?):			
Black lime	22	940	
Warsaw(?)-Gasper formations - (Renault-Paint Creek formations of western Kentucky):			
Big lime (of drillers); gas, from 1,015 to 1,017 ft	127	1,067	

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky— Continued

Well 8245-3740-171

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of gas well.			
Altitude of land surface: 632 ft above mean sea level.			
Quaternary system:			
Alluvium:			
Slate	35	35	
Quicksand; water, river, from 50 to 62 ft	27	62	
Pennsylvanian system:			
Breathitt formation:			
Slate	3	65	
Sand, broken; water, fresh, from 68 to 75 ft; chemical analysis of water available	20	85	
Sand	27	112	
Slate	5	117	
Sand	5	122	
Slate	123	245	
Sand	48	293	
Slate	92	385	
Sand, broken	50	435	
Slate and shells	10	445	
Lee formation:			
Salt sand (of drillers); gas, show from 405 to 415 ft; water, salt, from 490 to 525 ft; filled up, 200 ft in 2 hr; chemical analysis of water available	155	600	Complete record not given here. Total depth 1,035 ft.

Well 8245-3740-174

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of test well.			
Altitude of land surface: 609 ft above mean sea level.			
Quaternary system:			
Alluvium: Sand and gravel	30	30	
Pennsylvanian system:			
Breathitt formation:			
Slate	10	40	
Sand; water, hole full	10	50	
Slate and shale	50	100	
Sand	40	140	
Slate	50	190	
Sand; water, hole full	20	210	
Slate	25	235	
Coal	10	245	
Slate and shells	15	260	
Coal	4	264	
Slate; gas, little	126	390	
Lee formation:			
Sand; gas	50	440	Complete record not given here. Total depth 1,783 ft.

Well 8245-3740-175

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of gas well.			
Altitude of land surface: 796 ft above mean sea level.			
Quaternary system: Surficial material (of drillers)	16	16	
Pennsylvanian system:			
Breathitt formation:			
Sand	18	34	
Slate; water, hole full, from 50 to 56 ft	22	56	

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8245-3740-175—Continued

Formation	Thickness (feet)	Depth (feet)	Remarks
Pennsylvanian system—Continued			
Breathitt formation—Continued			
Sand	24	80	
Coal	2	82	
Slate	24	106	
Sand	37	143	
Coal	2	145	
Slate	153	298	
Sand	7	305	
Slate	85	390	
Sand	110	500	
Slate	120	620	
Lee formation:			
Sand; gas at 675 ft; water at 760 ft	205	825	Complete record not given here. Total depth 1,315 ft.

Well 8245-3740-176

Type of record: Driller's log of oil well.
Altitude of land surface: 749 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Clay	16	16	
Pennsylvanian system:			
Breathitt formation:			
Sand	26	42	
Coal	3	45	
Sand	23	68	
Slate; water, hole full, at 85 ft	177	245	
Sand	30	275	
Slate	75	350	
Sand; oil, show, at 360 ft	40	390	
Slate; gas, show, at 397 ft	25	415	
Sand	30	445	
Slate	129	574	
Lee formation: Sand	26	600	Complete record not given here. Total depth, 1,219 ft.

Well 8245-3740-177

Type of record: Driller's log of gas well.
Altitude of land surface: 655 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Sand and gravel	32	32	
Pennsylvanian system:			
Breathitt formation:			
Coal	2	34	
Shale	33	67	
Coal	3	70	
Slate; water, hole full, at 80 ft	90	160	
Sand	30	190	
Slate	75	265	
Sand	20	285	
Slate	180	465	
Lee formation:			
Salt sand (of drillers); water, 1 bailer per hr, at 520 ft; water, 2 bailers per hr, at 560 ft; water, hole full, at 595 ft	180	645	Complete record not given here. Total depth, 2,058 ft.

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8245-3740-178

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of gas well. Altitude of land surface: 687 ft above mean sea level.			
Quaternary system: Sand and gravel	36	36	
Pennsylvanian system:			
Breathitt formation:			
Sand; water, hole full, at 45 ft	22	58	
Slate	102	160	
Coal	2	162	
Slate	24	186	
Sand	41	227	
Slate	48	275	
Sand	20	295	
Slate	40	335	
Sand	40	375	
Slate	140	515	
Lee formation:			
Sand	37	552	
Slate	4	556	
Sand; water, 1½ bailers per hr, at 585 ft; water, hole full, at 620 ft	129	685	
Slate	15	700	
Sand	170	870	
Mississippian system:			
Pennington shale:			
Slate	2	872	
Sand; water, hole full, at 895 to 900 ft; brine analysis of this water made by Kentucky Geological Survey	86	958	
Slate	7	965	
Glen Dean limestone(?):			
Lime	30	995	
Warsaw(?)-Gasper formations - (Renault-Paint Creek formations of western Kentucky):			
Big lime	118	1,113	Complete record not given here. Total depth 2,097 ft.

Well 8245-3740-188

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of gas well. Altitude of land surface: 625 ft above mean sea level.			
Quaternary system:			
Alluvium: Surficial material (of drillers)	50	50	
Pennsylvanian system:			
Breathitt formation:			
Slate; water, hole full, at 70 ft	25	75	
Sand	25	100	
Breathitt and Lee formations: Slate and sand	701	801	Complete record not given here. Total depth 2,780 ft.

Well 8245-3740-189

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of gas well. Altitude of land surface: 610 ft above mean sea level.			
Quaternary system:			
Alluvium:			
Surficial material (of drillers)	20	20	
Blue clay	22	42	

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8245-3740-189—Continued

Formation	Thickness (feet)	Depth (feet)	Remarks
Pennsylvanian system:			
Breathitt formation:			
Sand; water, hole full, at 50 ft	15	57	
Slate	31	88	
Coal	2	90	
Slate	72	162	
Sand	16	178	
Slate, light	52	230	
Slate, black	75	305	
Lime shells	10	315	
Slate, light	30	345	
Lee formation:			
Sand; water, half a bailer per hr, at 430 ft	90	435	Complete record not given here. Total depth 1,876 ft.

Well 8245-3740-192

Type of record: Driller's log of gas well.
Altitude of land surface: 645 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Surficial material (of drillers)	20	20	
Pennsylvanian system:			
Breathitt formation:			
Sand	35	55	
Coal	3	58	
Slate; water, 3 bailers per hr, at 120 ft; water, 4 bailers per hr, at 180 ft	202	260	
Sand	40	300	
Slate	50	350	
Sand	15	365	
Slate	75	440	
Lee formation:			
Salt sand (of drillers); water, 2½ bailers per hr, at 490 ft; water at 530 to 540 ft; water, big, at 560 to 570 ft	192	632	Complete record not given here. Total depth 2,754 ft.

Well 8245-3740-193

Type of record: Driller's log of test well.
Altitude of land surface: 626 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system:			
Alluvium:			
Soil	10	10	
Fire clay	27	37	
Pennsylvanian system:			
Breathitt formation:			
Slate; water at 38 ft	53	90	
Coal	2	92	
Slate	8	100	
Sand; water at 127 ft; water, salt, at 130 ft	30	130	
Slate	300	430	
Lee formation:			
Salt sand (of drillers)	185	615	Complete record not given here. Total depth 2,871 ft.

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8245-3740-197

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of test well. Altitude of land surface: 745 ft above mean sea level.			
Quaternary system:			
Alluvium: Soil; water, hole full at 18 ft	18	18	
Pennsylvanian system:			
Breathitt formation:			
Sand	14	32	
Slate; water, hole full at 73 ft	41	73	
Coal	3	76	
Slate	30	106	
Sand	13	119	
Slate	22	141	
Sand	5	146	
Slate	28	174	
Sand	34	208	
Slate	162	370	
Sand	8	378	
Slate and shells	57	435	
Lee formation:			
Sand	157	592	Complete record not given here. Total depth 2,834 ft.

Well 8245-3740-198

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of test well. Altitude of land surface: 642 ft above mean sea level.			
Quaternary system:			
Alluvium:			
Soil	5	5	
Quicksand	15	20	
Creek gravel	15	35	
Pennsylvanian system:			
Breathitt formation:			
Slate, blue	5	40	
Sand	30	70	
Slate	24	94	
Coal	1	95	
Slate	43	138	
Sand	17	155	
Lime	10	165	
Slate	25	190	
Lime shells	10	200	
Slate	80	280	
Sand; gas, small show at 290 ft	20	300	
Break	3	303	
Sand	35	338	
Slate	20	358	
Lee formation:			
Salt sand (of drillers); water, fresh, a little at 420 ft; water, more at 460 ft; water, hole full at 465 ft	162	520	Complete record not given here. Total depth 812 ft.

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8245-3740-199

Type of record: Driller,s log of gas well.
Altitude of land surface: 657 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Soil	10	10	
Pennsylvanian system:			
Breathitt formation:			
Slate	40	50	
Sand; water at 60 ft	20	70	
Slate	20	90	
Coal	5	95	
Slate; gas, show at 105 ft	55	150	
Sand	42	192	
Slate	143	335	
Slate and shells; gas, show at 340 ft	10	345	
Lee formation:			
Salt sand (of drillers); gas at 405 ft	155	500	Complete record not given here. Total depth 774 ft.

Well 8245-3740-200

Type of record: Driller's log of test well.
Altitude of land surface: 729 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Surficial material (of drillers)	10	10	
Pennsylvanian system:			
Breathitt formation:			
Slate	64	74	
Coal; water, 2 bailers per hr at 78 ft	4	78	
Slate and shells	52	130	
Sand; water, hole full at 145 ft	34	164	
Slate and shells	281	445	
Lee formation:			
Sand; water, a little at 470 ft; water, hole full at 560 to 568 ft	177	622	Complete record not given here. Total depth 893 ft.

Well 8245-3740-201

Type of record: Driller's log of gas well.
Altitude of land surface: 677 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Surficial material (of drillers)	20	20	
Pennsylvanian system:			
Breathitt formation:			
Sand	10	30	
Slate; water, 4 bailers per hr at 68 ft	65	95	
Lime shells	19	114	
Sand; water, hole full at 115 ft	14	128	
Slate and shells	84	212	
Sand	18	230	
Slate and shells	172	402	
Lee formation:			
Sand; gas, show at 404 to 416 ft; water, 2 bailers per hr at 505 ft	138	540	Complete record not given here. Total depth 819 ft.

Logs of wells and test borings in the Prestonsburg quadrangle Kentucky—Continued

Well 8245-3740-202

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of gas well. Altitude of land surface: 791 ft above mean sea level.			
Quaternary system: Surficial material (of drillers)	15	15	
Pennsylvanian system:			
Breathitt formation:			
Sand	33	48	
Slate; water, 2 bailers per hr at 110 ft	77	125	
Sand	20	145	
Slate	53	198	
Sand	36	234	
Slate	74	308	
Sand	42	350	
Slate	130	480	
Slate and shells	42	522	
Lee formation:			
Sand; gas, little at 524 to 530 ft	76	598	Complete record not given here. Total depth 958 ft.

Well 8245-3740-206

Type of record: Driller's log of gas well.
Altitude of land surface: 615 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system:			
Alluvium: Gravel; water, hole full at 40 ft	50	50	
Pennsylvanian system:			
Breathitt formation:			
Slate and shells	110	160	
Sand; water, hole full at 210 ft	65	225	
Slate and shells	160	385	
Lee formation:			
Sand	20	405	
Slate and shells	35	440	
Sand	115	555	Complete record not given here. Total depth 1,901 ft.

Well 8245-3740-207

Type of record: Driller's log of gas well.
Altitude of land surface: 736 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Soil	15	15	
Pennsylvanian system:			
Breathitt formation:			
Slate	15	30	
Coal	3	33	
Sand; water, hole full at 50 ft	27	60	
Slate	70	130	
Sand	19	149	
Slate	66	215	
Sand	43	258	
Slate and shells	156	414	
Lee formation:			
Sand; water, two 8-inch bailers per hr at 420 ft; water, hole full at 485 ft	164	578	Complete record not given here. Total depth 837 ft.

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8250-3735-24

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of gas well. Altitude of land surface: 642 ft above mean sea level.			
Quaternary system: Soil	5	5	
Pennsylvanian system:			
Breathitt formation:			
Sand; water, fresh, at 35 ft	45	50	
Mud	60	110	
Sand	50	160	
Slate	25	185	
Sand; water, fresh, at 225 ft	50	235	
Slate	50	285	
Sand	20	305	
Slate	15	320	
Lee formation: Sand	235	555	Complete record not given here. Total depth 829 ft.

Well 8250-3735-37

Type of record: Driller's log of test well.
Altitude of land surface: 715 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Pennsylvanian system:			
Breathitt formation:			
Slate	45	45	
Coal; water, fresh, at 50 ft	5	50	
Sand	5	55	
Slate	30	85	
Lime	8	93	
Slate and sand	307	400	
Lee formation(?):			
Lime	10	410	
Sand and slate	245	655	Complete record not given here. Total depth 853 ft.

Well 8250-3735-45

Type of record: Driller's log of gas well.
Altitude of land surface: 753 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Surficial material (of drillers); at 12 ft	15	15	
Pennsylvanian system:			
Breathitt formation:			
Sand	15	30	
Shale	7	37	
Slate	6	43	
Sand; water at 60 ft	20	63	
Breathitt and Lee formations: Slate and sand	554	617	Complete record not given here. Total depth 2,085 ft.

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8250-3735-49

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of test well. Altitude of land surface: 690 ft above mean sea level.			
Quaternary system: Gravel	22	22	
Pennsylvanian system;			
Breathitt formation:			
Slate; water at 65 ft	73	95	
Sand	30	125	
Slate	80	205	
Sand	40	245	
Slate	5	250	
Lime	5	255	
Slate	65	320	
Sand	20	340	
Slate	45	385	
Lee formation: Sand	25	410	Complete record not given here. Total depth 927 ft.

Well 8250-3735-50

Type of record: Driller's log of test well.
Altitude of land surface: 762 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Gravel	30	30	
Pennsylvanian system:			
Breathitt formation:			
Slate	25	55	
Coal	2	57	
Sand; water at 65 ft	8	65	
Slate	4	69	
Sand	16	85	
Slate	28	113	
Sand	37	150	
Slate	6	156	
Sand	24	180	
Slate	20	200	
Lime	5	205	
Slate	20	225	
Sand	30	255	
Slate	25	280	
Lime	8	288	
Slate	22	310	
Sand	15	325	
Slate	49	374	
Lime	11	385	
Slate	45	430	
Lee formation: Salt sand (of drillers); water, salt, at 470 ft	88	518	Complete record not given here. Total depth 941 ft.

Well 8250-3735-51

Type of record: Driller's log of test well.
Altitude of land surface; 840 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Gravel	25	25	
Pennsylvanian system:			
Breathitt formation:			
Slate	75	100	
Sand	45	145	

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky— Continued

Well 8250-3735-51—Continued

Formation	Thickness (feet)	Depth (feet)	Remarks
Pennsylvanian system —Continued			
Breathitt formation—Continued			
Slate	80	225	
Sand; water, 2 bailers per hr at 234 ft	40	265	
Slate	50	315	
Lime	30	345	
Slate	5	350	
Sand	14	364	
Slate	124	488	
Lee formation(?): Sand	157	645	Complete record not given here. Total depth 1,260 ft.

Well 8250-3735-53

Type of record: Driller's log of gas well.
Altitude of land surface: 683 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system:			
Alluvium: Surficial material (of drillers)	35	35	
Pennsylvanian system:			
Breathitt formation:			
Slate	32	67	
Coal; water, hole full at 70 ft	3	70	
Broken sand	33	103	
Coal	3	106	
Slate	44	150	
Sand	50	200	
Slate	30	230	
Coal	3	233	
Slate, white	7	240	
Sand; oil, show at 245 ft	20	260	
Slate	20	280	
Sand	10	290	
Slate	75	365	
Lee formation: Salt sand (of drillers); gas, show at 390 ft.	100	465	Complete record not given here. Total depth 2,656 ft.

Well 8250-3735-55

Type of record: Driller's log of gas well.
Altitude of land surface: 658 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system:			
Alluvium: Soil	33	33	
Pennsylvanian system:			
Breathitt formation:			
Slate	7	40	
Coal	3	43	
Slate	207	250	
Sand	25	275	
Slate	55	330	
Lee formation: Sand; water, hole full at 340 ft	110	440	Complete record not given here. Total depth 2,648 ft.

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky— Continued

Well 8250-3735-56

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of test well. Altitude of land surface: 677 ft above mean sea level.			
Quaternary system:			
Soil	5	5	
Clay	20	25	
Pennsylvanian system:			
Breathitt formation:			
Slate; water at 62 ft	37	62	
Coal	2	64	
Slate	11	75	
Sand	30	105	
Slate	10	115	
Sand	10	125	
Slate	45	170	
Sand	40	210	
Slate	20	230	
Sand, broken	115	345	
Lee formation:			
Sand; water at 360 ft	35	380	
Slate and shells	22	402	
Salt sand (of drillers)	83	485	Complete record not given here. Total depth 3,041 ft.

Well 8250-3735-57

Type of record: Driller's log of test well.
Altitude of land surface: 861 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Sand and gravel	16	16	
Pennsylvanian system:			
Breathitt formation:			
Sand	19	35	
Slate; water, hole full at 45 ft	10	45	
Coal	2	47	
Slate	88	135	
Sand	23	158	
Slate	12	170	
Sand	45	215	
Slate	50	265	
Sand	35	300	
Slate	5	305	
Sand	15	320	
Slate	150	470	
Lee formation: Sand	82	552	Complete record not given here. Total depth 2,757 ft.

Well 8250-3735-58

Type of record: Driller's log of test well.
Altitude of land surface: 750 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system:			
Soil	7	7	
Clay	8	15	
Pennsylvanian system:			
Breathitt formation:			
Sand	20	35	
Slate	15	50	

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8250-3735-58—Continued

Formation	Thickness (feet)	Depth (feet)	Remarks
Pennsylvanian system—Continued			
Breathitt formation—Continued			
Sand, broken; water at 55 ft; gas, show at 95 ft	95	145	
Slate	15	160	
Sand	40	200	
Slate; water at 205 ft	52	252	
Coal	3	255	
Slate	117	372	
Lee formation(?): Sand; gas and oil, show at 375 ft	178	550	Complete record not given here. Total depth 2,783 ft.

Well 8250-3735-60

Type of record: Driller's log of gas well.
Altitude of land surface: 883 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Soil	44	44	
Pennsylvanian system:			
Breathitt formation:			
Slate	8	52	
Coal; water, hole full from 52 to 55 ft	3	55	
Slate and shells	31	86	
Coal	3	89	
Slate and shells	114	203	
Sand	24	227	
Slate and shells	69	296	
Sand	49	345	
Slate and shells	151	496	
Lee formation: Sand; water, hole full from 605 to 615 ft.	198	694	Complete record not given here. Total depth 940 ft.

Well 8250-3735-61

Type of record: Driller's log of gas well.
Altitude of land surface: 830 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Soil	34	34	
Pennsylvanian system:			
Breathitt formation:			
Slate	11	45	
Coal; water, hole full from 45 to 48 ft	3	48	
Slate	12	60	
Sand	15	75	
Slate	13	88	
Coal	4	92	
Slate and shells	208	300	
Sand	39	339	
Slate and shells	146	485	
Lee formation:			
Salt sand (of drillers); gas, shows at 589 and 615 ft; water, hole full at 624 ft	220	705	Complete record not given here. Total depth 968 ft.

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky— Continued

Well 8250-3740-24

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of test well.			
Altitude of land surface: 798 ft above mean sea level.			
Quaternary system:			
Alluvium: Soil	14	14	
Pennsylvanian system:			
Breathitt formation:			
Slate and shells	52	66	
Coal; water, hole full from 66 to 69 ft	3	69	
Sand	51	120	
Slate	50	170	
Sand	35	205	
Slate and shells	132	337	
Lee formation(?): Salt sand (of drillers); water, 2 bailers per hr at 470 ft, and hole full at 500 ft	218	555	Complete record not given here. Total depth 875 ft.

Well 8250-3740-25

Type of record: Driller's log of test well.
Altitude of land surface: 778 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Soil	8	8	
Pennsylvanian system:			
Breathitt formation:			
Slate	117	125	
Coal	2	127	
Slate	7	134	
Sand	41	175	
Slate	270	445	
Lee formation: Salt sand (of drillers)	110	555	Complete record not given here. Total depth 951 ft.

Well 8250-3740-27

Type of record: Driller's log of gas well.
Altitude of land surface: 654 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Soil	16	16	
Pennsylvanian system:			
Breathitt formation:			
Slate; water, hole full at 20 ft	60	76	
Coal	2	78	
Slate	7	85	
Sand	65	150	
Slate	50	200	
Sand	23	223	
Slate	30	253	
Lee formation:			
Sand	142	395	
Slate	5	400	
Salt sand (of drillers); water, hole full at 420 ft	90	490	Complete record not given here. Total depth 774 ft.

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8250-3740-28

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of test well. Altitude of land surface: 674 ft above mean sea level.			
Quaternary system: Soil	15	15	
Pennsylvanian system:			
Breathitt formation:			
Sand; water, hole full at 35 ft	58	73	
Coal	2	75	
Slate	48	123	
Sand	42	165	
Slate	65	230	
Sand	15	245	
Slate	27	272	
Lee formation:			
Sand	108	380	
Slate	5	385	
Salt sand (of drillers); water, hole full at 445 ft	130	515	Complete record not given here. Total depth 854 ft.

Well 8250-3740-29

Type of record: Driller's log of gas well.
Altitude of land surface: 717 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Soil	21	21	
Pennsylvanian system:			
Breathitt formation:			
Slate and shells; water, hole full at 27 ft	24	45	
Sand	40	85	
Coal	2	87	
Sand	36	123	
Slate	63	186	
Sand	29	215	
Slate	107	322	
Lee formation(?)			
Sand; water, two 8-inch bailers per hr at 485 ft, and hole full at 525 ft	221	543	
Coal	4	547	
Slate	15	562	
Sand; gas, from 564 to 568 ft	9	571	

Well 8250-3740-31

Type of record: Driller's log of gas well.
Altitude of land surface: 664 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Soil	18	18	
Pennsylvanian system:			
Breathitt formation:			
Sand; water, hole full at 26 ft	22	40	
Coal	3	43	
Slate	59	102	
Sand	41	143	
Slate; gas, show at 190 ft	72	215	
Sand	21	236	
Slate	52	288	
Lee formation:			
Sand	24	312	
Slate and shells	16	328	
Salt sand (of drillers)	71	399	Complete record not given here. Total depth 776 ft.

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8250-3740-32

Formation	Thickness (feet)	Depth (feet)	Remarks
Type of record: Driller's log of gas well. Altitude of land surface: 783 ft above mean sea level			
Quaternary system: Soil	10	10	
Pennsylvanian system:			
Breathitt formation:			
Slate	18	28	
Sand; water, 2 bailers per hr at 32 ft	34	62	
Slate	18	80	
Sand; water, hole full at 103 ft	23	103	
Slate	12	115	
Sand	31	146	
Slate	7	153	
Coal	2	155	
Slate	50	205	
Sand	47	252	
Slate; gas, show at 294 ft	149	401	
Lee formation: Sand water, hole full at 560 ft	219	620	Complete record not given here. Total depth 819 ft.

Well 8250-3740-33

Type of record: Driller's log of test well.
Altitude of land surface: 800 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Soil	14	14	
Pennsylvanian system:			
Breathitt formation:			
Slate	26	40	
Sand; water, fresh, 1 bailer per hr at 45 ft	10	50	
Slate	21	71	
Coal	2	73	
Sand; water, fresh, hole full from 75 to 80 ft	34	107	
Slate	33	140	
Coal	3	143	
Sand	45	188	
Slate	6	194	
Sand	16	210	
Slate	36	246	
Sand	52	298	
Slate	71	369	
Sand	25	394	
Slate	41	435	
Lee formation: Salt sand (of drillers)	117	552	Complete record not given here. Total depth 937 ft.

Well 8250-3740-35

Type of record: Driller's log of gas well.
Altitude of land surface: 728 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system: Surficial material (of drillers)	10	10	
Pennsylvanian system:			
Breathitt formation:			
Coal	2	12	
Slate	10	22	
Coal	3	25	
Slate	4	29	
Sand; water, hole full at 44 ft	23	52	
Slate	8	60	

Logs of wells and test borings in the Prestonsburg quadrangle, Kentucky—Continued

Well 8250-3740-35—Continued

Formation	Thickness (feet)	Depth (feet)	Remarks
Pennsylvanian system—Continued			
Breathitt formation—Continued			
Sand	15	75	
Slate	27	102	
Coal	2	104	
Slate	3	107	
Coal	3	110	
Slate	15	125	
Coal	2	127	
Sand	28	155	
Slate	15	170	
Sand, broken	10	180	
Slate	60	240	
Sand, broken	10	250	
Slate	28	278	
Lee formation: Sand; water, 2 bailers per hr at 440 ft	222	500	Complete record not given here. Total depth 714 ft.

Well 8250-3740-36

Type of record: Driller's log of gas well.
Altitude of land surface: 780 ft above mean sea level.

Formation	Thickness (feet)	Depth (feet)	Remarks
Quaternary system:			
Alluvium: Surficial material (of drillers)	33	33	
Pennsylvanian system:			
Breathitt formation:			
Sand; water, hole full at 38 ft	7	40	
Slate	25	65	
Sand	10	75	
Slate and shells	40	115	
Sand	68	183	
Shale, sandy	32	215	
Slate and shells	80	295	
Lime	17	312	
Lee formation: Sand; gas, show at 325 ft; water, hole full at 440 ft	213	525	Complete record not given here. Total depth 770 ft.

Measured sections in the Prestonsburg quadrangle, Kentucky

Section 1 located at hill north of Prestonsburg along U. S. Highway 23. Measured from near the highway bridge to the summit of the hill.

	Feet
Pennsylvanian system:	
Breathitt formation:	
Sandstone, light-olive-gray; fine-grained, micaceous	2.0
Concealed	2.4
Claystone, very pale orange; sandy; root impressions	.5
Coal, black, shaly	.3
Claystone, medium-gray, iron-stained; plant impressions	2.0
Claystone, dark-yellowish-orange, iron-stained; sandy at base; plant impressions	1.4
Sandstone, pale-yellowish-brown and light-brownish-gray; very fine grained; iron-stained; micaceous; basal 2 ft massive, rest of unit weak and shaly	11.7
Siltstone, light-olive-gray, iron-stained; shaly	10.6
Sandstone, pale-yellowish-brown; very fine grained, micaceous	.3
Siltstone, pale-yellowish-brown; platy and shaly	2.5
Sandstone, pale-yellowish-brown; very fine grained, micaceous, hard; weathers to medium dark gray	10.4
Siltstone, light-olive-gray and pale-yellowish-brown; micaceous, shaly; weathers to pale brown	.8
Sandstone, pale-yellowish-brown, iron-stained; fine-grained, micaceous, hard; weathers to medium gray	.6
Siltstone, dark gray at base, middle and upper parts light or yellowish gray; very sandy in places, especially toward top; micaceous, shaly, very hard; cut by high-angle coal vein, contains carbonized plant impressions, especially near top	4.3
Coal, black, bone, white efflorescence and moderate-reddish-brown stain on weathered surface	.15
Coal, dark-gray, bone, white efflorescence or moderate-reddish-brown stain on weathered surface	.05
Coal, black, shaly, white efflorescence or moderate-reddish-brown stain on weathered surface	.15
Claystone, medium to very light gray, micaceous	.4
Coal, black, shaly	.1
Claystone, white at top, grading downward into light brown and dark gray; blocky; plant impressions	1.9
Sandstone, medium-dark-gray; very fine grained, micaceous	.2
Claystone, pale-yellowish-brown; shaly, very weak, top 1 ft of unit sandy, micaceous, and contains iron nodules; unit contains coaly material	3.9
Coal, black, dark-yellowish-orange, iron oxide streaks at top	.1
Clay, light-olive-gray	1.5
Coal, black; shaly, weak	.7
Clay, medium-light-gray, stained pale yellowish orange; contains plant impressions coated with iron oxide	.6
Sandstone, yellowish-gray; fine-grained; ferruginous, weathers to moderate yellowish brown; micaceous, shaly, contains laminae of medium-dark-gray siltstone	4.6
Siltstone, medium-gray, sandy at top, ferruginous; weathers to pale yellowish brown; grades laterally into grayish-orange and dusky-brown claystone	3.2
Ironstone, dark-yellowish-orange and medium-dark-gray, concretionary	.3
Claystone, dark-gray and pale-yellowish-brown, iron-stained; blocky, soft, contains iron nodules; parts of unit show spheroidal weathering	6.0
Ironstone, dark-yellowish-orange, contains spirifers	.3
Claystone, grayish-olive-green and dark-gray, but very pale orange at top; iron-stained, hard, but soft at top of unit; contains abundant pelecypods, brachiopods, and gastropods; fossils preserved as iron-stained impressions, but a few original shells present, preservation fair; iron-stained plant fossils (stems) at base of unit	6.6
Clay, pale-yellowish-orange and dark-yellowish-orange, iron-stained, sandy, micaceous	.1
Sandstone. moderate-yellowish-brown, iron-stained; fine to very fine grained, micaceous, weak; weathers from olive gray to light olive gray	3.3
Claystone, pale-yellowish-brown and yellowish-gray; silty at top and base, micaceous; contains carbonized plant impressions, not well exposed	9.1
Sandstone, moderate-yellowish-brown, iron-stained; fine-grained, micaceous, massive	12.0
Claystone, moderate-yellowish-brown and medium-light-gray, stained grayish orange to dark yellowish orange with iron oxide; silty at top of unit; contains carbonized plant impressions	4.8

Measured sections in the Prestonsburg quadrangle, Kentucky—Continued

	Feet
Pennsylvanian system—Continued	
Breathitt formation—Continued	
Sandstone, medium-dark-gray, iron-stained; very fine grained, micaceous, weak, contains small iron oxide concretions, most of which range from one-eighth to one-fourth inch in diameter	.3
Claystone, medium-dark-gray, iron oxide stain; micaceous, shaly, weak; weathers to light gray	1.7
Coal, black; brittle, fractured	.9
Clay, light-gray, stained pale yellowish orange and moderate reddish brown with iron oxide; contains carbonized plant fragments	.6
Concealed	30.2
Sandstone, pale-yellowish-orange and very light gray; fine-grained, micaceous, weak	3.4
Claystone, pale-yellowish-brown; sandy and micaceous at top; abundant impressions of *Calamites*	1.2
Sandstone, moderate-yellowish-brown; fine-grained, micaceous, massive	4.6
Clay, dark-gray to grayish-black, with orange stain; thins to fraction of an inch	.1
Coal, black, blocky	.1
Clay, olive-gray, thins to fraction of an inch	.1
Coal, black, blocky	.2
Coal, black, weak, friable	.2
Mudstone, medium-, dark-, and brownish-gray; ranges from 0.1 to 0.4 ft in thickness	.3
Coal, black, fractured	.7
Claystone, greenish-gray; contains carbonized plant impressions; lower part of unit not well exposed, consists of greenish-gray and dark-gray mudstone	4.1
Sandstone, yellowish- and light- gray; fine-grained, micaceous, friable in places; upper part in beds one-half to 2 ft thick; lower part massive, cross-laminated	19.6
Siltstone, medium-gray; contains iron nodules averaging one-half inch in diameter; breaks into curved plates; grades downward into pinkish-white and light-olive-gray fine-grained sandstone	8.8
Coal, black; rotten; white efflorescence	1.1
Claystone, medium dark gray at top, grading downward into pale yellowish brown; middle of unit sandy, lower part silty; micaceous; contains plant impressions and brown lignite layer three-fourths inch thick	.7
Sandstone, yellowish-gray; medium-grained, massive; carbonized plant impressions at top of unit	6.6
Siltstone, light-olive-gray; micaceous, platy; grades downward into pale-yellowish-brown very fine grained sandstone	12.0
Sandstone, moderate-yellowish-brown to light and very light gray; fine-grained, cross-laminated, massive; base of unit contains ironstone conglomerate	11.4
Claystone, pale-yellowish-brown; micaceous, soft; cut out in some places	.1
Mudstone, dark-gray; micaceous, very fissile; partings stained with iron oxide; contains coal veinlets less than 1 inch thick; numerous plant impressions; white and orange efflorescence on weathered surface; ranges in thickness from a fraction of an inch to 3.2 ft	3.2
Coal, black; fractured, with seepage of "sulfur water"; yellow efflorescence on weathered surface	.8
Clay, very light gray; forms parting in coal	.1
Coal, black; fractured; yellow efflorescence on weathered surface	.7
Claystone, yellowish- and olive-gray; some parts silty, iron oxide concretions; contains abundant plant impressions coated with carbon or iron oxide	2.0
Sandstone, pale-yellowish-brown, yellowish-gray, and very light gray; medium- to fine-grained, micaceous; iron oxide concretions 1 to 2 inches in diameter in upper part of unit; cross-laminated, massive in lower part, becoming thin-bedded and platey toward top; contains lenses of grayish-orange medium-grained sandstone	41.6
Siltstone, pale-yellowish-brown and very light gray; sandy, micaceous, shaly and platy, fragments of carbonaceous matter and coal veinlets; contains thin iron-stained bands parallel to bedding, pencil fractures, spheroidal weathering	27.0
Coal, black; fracture faces stained with iron oxide	.8
Claystone, medium-light-gray, stained yellow and orange with iron oxide; contains carbonaceous material	.2
Sandstone, dark-yellowish-orange, white, and very light gray; medium-grained, micaceous, ferruginous; coal veinlets less than 1 inch thick, some parallel to cross-lamination; contains bands and streaks of iron oxide, 1 inch or less, parallel to bedding or adjacent to fractures; small nodules or pebbles of iron oxide an inch or less in diameter near base; cross-laminated, massive; near-vertical fractures with ground-water seepage; forms cliff in old quarry; weathers to dark yellowish brown	27.0

Measured sections in the Prestonsburg quadrangle, Kentucky— Continued

	Feet
Pennsylvanian system—Continued	
Breathitt formation—Continued	
Coal, black; fractured, weathered surface with yellow stains or white efflorescence; yields ground water as spring	2.2
Claystone, medium-gray, stained moderate brown with iron oxide; carbonized plant impressions, not well exposed	.8
Siltstone, medium-dark-gray and moderate-yellowish brown; micaceous, platy and shaly; some parts limy; contains large nodule of limy sandstone and some yellowish-gray fine-grained sandstone	26.9
Sandstone, pale-yellowish-brown and very light gray; medium-grained, micaceous; thin stringers of iron oxide and coal; cross-laminated, massive; contains a few sandstone casts of *Calamites* and other plant fossils about 2 ft long and covered with iron oxide; fossils 10 to 20 ft above base of unit; upper part of unit contains lenses of dark-gray micaceous siltstone	28.2
Siltstone, medium-dark-gray; sandy, micaceous, some parts limy; contains laminae high in iron oxide and silty limestone concretions	29.9
Coal (Elkhorn No. 3), black; contains partings of black, weak humic material less than an inch thick; yellow stains on weathered surface	3.9
Total	414.15

Section 2, on Middle Creek on State Highway 114, 0.6 mile southwest of the West Prestonsburg Post Office

	Feet
Pennsylvanian system:	
Breathitt formation:	
Coal (Elkhorn No. 3), black; base concealed	2.6
Concealed	12.5
Sandstone, yellowish-gray; fine-grained, micaceous; not well exposed	5.0
Siltstone, yellowish-gray, iron-stained; sandy, micaceous, shaly; most of unit concealed, thickness estimated	6.5
Coal, black; poorly exposed, thickness estimated	.8
Claystone, yellowish-gray, stained yellow with iron; plant impressions; grades downward into medium-dark-gray claystone	10.4
Coal, black	1.5
Claystone, medium gray with yellow and reddish-brown iron stains; contains carbonized plant impressions	1.3
Claystone, medium-dark-gray and dark-gray; coaly in places	.2
Claystone, olive gray at top, rest of unit greenish gray, stained dark yellowish orange with iron oxide; iron nodules, abundant plant impressions	2.3
Sandstone, yellowish-gray and moderate-yellowish-brown, iron-stained; fine-grained, micaceous	.5
Claystone, olive gray at top, rest of unit gray; top silty, base sandy; micaceous, blocky, contains limestone concretions 2 to 7 inches in diameter	8.0
Sandstone, very light gray, some iron stain; fine-grained, micaceous	9.2
Siltstone, olive-gray and light-olive-gray; sandy, micaceous, platy	6.2
Claystone, medium-dark-gray; shaly, hard; contains thin iron-stained limy layers	.4
Siltstone, dark-gray; very carbonaceous, slaty, hard; weathers to light gray with some iron oxide stains	1.2
Coal, black; platy	.1
Mudstone, medium-dark-gray; base sandy, micaceous, very crumbly; carbonized plant impressions; many ground-water seeps at top of unit	1.0
Sandstone, very light gray; fine-grained, micaceous, contains iron nodules and coal streaks	1.8
Siltstone, medium-gray; sandy, micaceous; basal part of unit contains sandstone layers 0.1 to 0.2 ft thick	7.4
Total	78.9

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