

Bureau of Mines  
Report of Investigations 5037



ESTIMATE OF KNOWN RECOVERABLE RESERVES  
OF COKING COAL IN HARLAN COUNTY, KY.

BY JOSEPH J. WALLACE, JAMES J. DOWD, RAYMOND G. TRAVIS,  
R. F. ABERNETHY, AND D. A. REYNOLDS

United States Department of the Interior—March 1954

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UNITED STATES DEPARTMENT OF THE INTERIOR  
Douglas McKay, Secretary  
BUREAU OF MINES  
J. J. Forbes, Director

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March 1954



## FOREWORD

Since its creation by Congress in 1910, the Bureau of Mines has borne a heavy responsibility for technical progress in the mining, preparation, and utilization of our national fuel reserves. Similarly, it has pioneered in scientific studies leading to better health and safety in mining and more efficient conservation of fuel resources.

Conservation means a full but prudent use of the national resources with avoidance of waste. Conservation requires an inventory to determine the extent, availability, and condition of our resources, for without these facts it is impossible for either industry or Government to plan for sustained production and maintenance of the industrial capacity so essential to our peacetime prosperity and wartime survival. This is true particularly of fuels needed for special purposes, such as metallurgical coking coals that must possess certain favorable properties. Heavy use of our limited reserves of good coking coal has resulted in severe depletion and, in some areas, exhaustion of the thickest and best beds.

At the request of the Munitions Board, Department of Defense, the Bureau of Mines made preliminary arrangements early in 1948 for an investigation of known minable reserves of coal that were or could be made suitable for the manufacture of metallurgical coke. In August of that year, actual field work began in the low- and medium-volatile coking coal fields of the Appalachian region, specifically central Pennsylvania and southern West Virginia. As both the economic and technologic factors that determine whether a particular coal can be used for producing metallurgical coke will vary with changing conditions, the investigation was planned to cover three phases:

1. Determination, from available data, of coal reserves with coking properties that occur in beds thick enough and within depths considered economically minable by present methods, together with such additional reserves as may become economically minable under future conditions of improved technology and greater need.

2. Study of the preparation characteristics of the reserves thereby developed to determine (a) which coals are suitable under present standards for producing metallurgical coke either as mined or after beneficiation by conventional preparation methods, and (b) which coals would require special and more intensive treatment in mining, preparation, or both.

3. Study of the carbonizing properties of the reserves thus developed to determine the yield and quality of coke, gas, and chemical products that can be obtained from coals carbonized singly and in blends.

This report is one in a series, by counties, covering in detail the estimated known minable coking-coal reserves determined under the first phase of the investigation. It also includes a general assessment of the carbonizing properties of the most important beds and a table of analyses of typical coals from the county. Publications will be issued later covering in more detail the preparation and carbonization data upon completion of the extensive laboratory work involved in these phases of the survey.

The estimates of coking-coal reserves in these reports were derived from data made available to the Bureau of Mines by coal companies, landowners, Federal, State, and municipal engineers, geologists, land-record officials, and others having authentic records of the occurrence and characteristics of the coal in the respective counties. All of the data were assembled from mine maps, records of core drilling, test pitting and trenching, and related sources of information, for no new core-drilling or geologic exploration was undertaken. Consequently, there are areas covered by these reports wherein the known data now available are inadequate to estimate reserves of measured and indicated coal, as these are defined in the reports. Geologic data also indicate the presence of large reserves of inferred coal in many of these areas, but no estimates of inferred reserves are presented in these reports. As their titles indicate, they include only known, minable reserves of measured and indicated coal and not total estimated reserves of coal. Therefore, any comparison of these and other coal-reserve estimates should be made with this distinction clearly understood.

The percentage recovery shown in these reports is a weighted average, based on the thickness of clean coal, less all partings 3/8-inch or more thick, recovered from the mined-out areas in each bed. Thus, it is an over-all net areal percentage recovery that, in many cases, will be lower than the recovery estimated by operators who eliminate from their calculations coal pillars left at property boundaries, under roads, and elsewhere. It is based on all coal removed since the beginning of mining operations and therefore may vary from that of recent operations in which recovery either has been improved substantially by technologic advances or has declined, owing to flooding or other conditions that make it expedient to leave more coal in the ground. As the estimates are dated and represent a factual record of all past operations in the particular area, the percentage recovery and estimate of minable coal may be adjusted by operators to suit their particular conditions at any given time.

These county reports are being published as rapidly as the available data can be found and analyzed. Later, in cooperation with the Federal Geological Survey, results of these studies will be combined with those from a complete geologic investigation of all coal reserves in the areas considered. Then, reports can be published, by States, giving estimates of total reserves, including the geologically inferred reserves that have been omitted herein.

This investigation was made possible only through the complete cooperation of the coal operators, landowners, and others who have made available to the Bureau their confidential records and data relating to mining operations, drill-core and test-pit operations, etc. This cooperation and assistance is appreciated and is gratefully acknowledged. To protect the confidence of data from private records, the Bureau of Mines is assembling and publishing the

estimates on a county-wide basis only and will not release any supplementary or more detailed information.

This investigation will serve a triple purpose:

1. By providing an inventory of known, minable reserves of coking coal that are or can be made suitable for the manufacture of metallurgical coke.

2. By providing an inventory of known minable reserves of coal with coking properties but unsuited for metallurgical coking-coal use by present standards and techniques because of high sulfur, high ash, or weakly coking properties. When warranted by economic and technologic developments, these reserves later may be adapted to metallurgical use by suitable preparation, blending, carbonizing, or metallurgical techniques.

3. By ascertaining the approximate location and magnitude of areas in which geologic data indicate the presence of inferred reserves but where exploratory work has been too limited to determine measured and indicated reserves. It is in these areas that more intensive exploratory work is needed in the future to complete the coking-coal inventory.

The first of these objectives is of prime importance for the present and immediate future, and the second for the more distant future. Accomplishment of the third objective will be of major aid to both industry and State and Federal agencies in more effectively planning and executing coal exploratory and testing investigations.

RALPH L. BROWN  
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ESTIMATE OF KNOWN RECOVERABLE RESERVES OF COKING  
COAL IN HARLAN COUNTY, KY.

by

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## CONCLUSIONS

1. The investigation shows that nine coal beds have been mined in Harlan County, of which the Harlan and Upper Elkhorn No. 3 are the most important from the standpoint of present production. Of less importance are the Hindman, Flag, Haddix, Wax, Fire Clay, Amburgy, and Upper Elkhorn No. 2. The Harlan, Upper Elkhorn No. 3, and Upper Elkhorn No. 2 beds contain the largest remaining known reserves.

2. Known measured and indicated reserves in all beds, based on a minimum thickness of 14 inches and 1,800 tons per acre-foot of coal in place, are estimated at 2,138 million short tons as of January 1, 1952. Of this total, 1,956 million short tons is in beds 28 inches and more thick. Areas in each bed were omitted from the estimate because available data relative to the bed characteristics are too meager for making an estimate that conforms with the definitions of measured and indicated coal adopted for this study. Should future drilling or development prove reserves in these areas, such reserves should be added to the total estimated reserves.

3. Recoverable reserves of coal have been estimated in beds 28 inches and more thick. This thickness is about the minimum now being mined by hand loading onto conveyors in the Appalachian region. The weighted average percentage of recovery for all beds in Harlan County, as determined by this investigation, is 57.4. This percentage is based on the total thickness of coal (less partings 3/8 inch or more thick) in the bed rather than on the thickness of the coal mined. Based on the weighted average percentage of recovery for all beds in Harlan County, the recoverable reserves are estimated to be 1,122 million short tons as of January 1, 1952.

4. Harlan County coals are classified as high-volatile A bituminous rank.

5. Harlan County coals are generally low in ash and sulfur and yield an excellent coke when blended with coals of higher rank.

## INTRODUCTION

The investigation to evaluate the reserves of coking coal was planned to cover three phases: (1) Estimation of known measured and indicated recoverable reserves of all coking coal; (2) study of methods of upgrading marginal coals through effective preparation; and (3) study of carbonizing properties of coals and coal blends not now widely used for metallurgical coke making.

This is the eighteenth of a series of reports giving results of studies by counties under part (1) of the investigation. (See appendix.) This report covers Harlan County, Ky., which comprises parts of Cornettsville, Whitesburg, northeast quarter of Cumberland Gap (30'), Harlan, Nolansburg, Big Stone Gap, Middlesboro, Hagan, and southeast quarter of Jonesville (30') quadrangles. (See fig. 1.)

A base map for each bed in each quadrangle was made to the scale 1 inch equals 1,200 feet. Maps of mines, locations of drill holes, bed and total coal thicknesses, and the outcrop of the bed were plotted on the maps. With all available data plotted, isopach lines were drawn to limit areas of known unmined reserves in beds 0 to 14 inches thick, 14 to 28 inches thick, 28 to 42 inches thick, and over 42 inches thick. These areas of coal reserves also were divided into "measured" and "indicated" categories. All areas in each thickness range and in each category, mined-out areas, areas excluded from the estimate but which may contain reserves based only on geologic inference, and areas outside of the outcrop were measured by planimeter on the base maps. Estimates of total reserves 14 inches and more thick for individual beds were prepared from these data.

#### ACKNOWLEDGMENTS

The information contained in this report could not have been obtained without the whole-hearted cooperation of the officials of the companies and individual landowners whose property records were studied, and their cooperation and the courtesies extended are gratefully acknowledged. The advice and assistance of the Coal Resources Committees of both the National Bituminous Coal Advisory Council and American Institute of Mining and Metallurgical Engineers, members of the staffs of the Federal Geological Survey, Kentucky Geological Survey, and Kentucky Department of Mines and Minerals, coal-operator associations, and consulting mining engineers are appreciated. The investigation was made under the general supervision of the chief, Bituminous Coal Mining Branch, Mining Division, Region VIII, Bureau of Mines, Pittsburgh, Pa., and the cooperation of the staff assigned to this study is acknowledged.

#### PREMISES AND DEFINITIONS OF TERMS USED

An estimate of coal reserves is the opinion of an individual or group of individuals based on certain premises and limitations adopted for that estimate. Therefore, in order to make a comparison between estimates, it is necessary to compare not only the final results but also the premises on which the estimates are based. The definitions "measured" coal and "indicated" coal used in this report have been agreed upon by the Bureau of Mines and the Federal Geological Survey. The premises and definitions of terms follow:

Coking coal. - All bituminous coals in the Appalachian region are potentially coking; and, therefore, until the carbonization tests in part (3) of the study have been completed to determine the coking quality of the coals, all known reserves of coal in the county are included as coking coal. This should not be construed to mean that all coals included in this report are suitable for the manufacture of metallurgical coke according to present-day standards. However, the general trend is toward the use of lower quality coals for metallurgical purposes.

Unit area. - The unit area used in estimating reserves is the 5-minute rectangle of the 15-minute topographic quadrangle. The estimates for the nine 5-minute rectangles of a quadrangle are combined on a county basis.

Bed-thickness range. - Reserves in each coal bed are tabulated in bed-thickness ranges, as follows:

14 to 28 inches

28 to 42 inches

42 inches and more

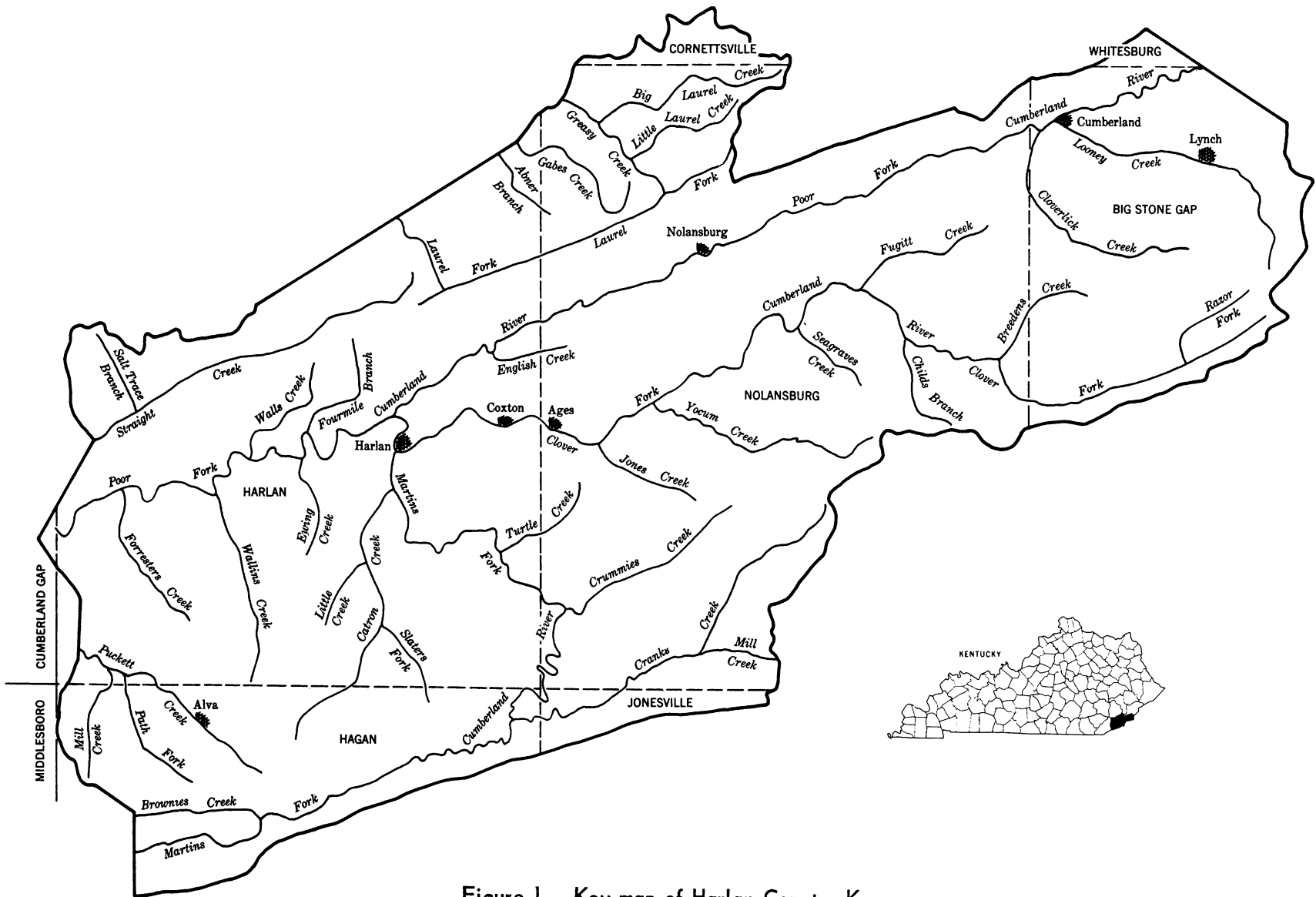


Figure 1. - Key map of Harlan County, Ky.



These measurements represent total bed thickness, including all coal and partings in the bed. If the top or bottom bench of a coal bed is separated from the remainder of the bed by a parting of equal or greater thickness and usually is not mined, such bench and partings are omitted in determining the bed thickness.

Measured coal. - Measured coal is coal for which tonnage is computed from dimensions revealed in outcrops, mine workings, and drill holes. The points of observation and measurements are so closely spaced and the thickness and extent of the coal are so well-defined that the computed tonnage is judged to be accurate within 20 percent or less of the true tonnage. Although the spacing of the points of observation necessary to demonstrate continuity of coal will vary in different regions according to the habit of the coal beds, the points of observation are, in general, about 1/2 mile apart. The outer limit of a block of measured coal, therefore, shall be about 1/4 mile from the last point of positive information (that is, roughly, one-half the distance between points of observation).

Where no data are available other than measurements along the outcrop, but where the continuity of the outcrop is measured in miles and suggests the presence of coal at great distances in from the outcrop, a smooth line drawn roughly 1/2 mile in from the outcrop shall be used to mark the limit under cover of a block of coal that can also be classed as measured.

Indicated coal. - Indicated coal is coal for which tonnage is computed partly from specific measurements and partly from projection of visible data for a reasonable distance on geologic evidence. In general, the points of observation are about 1 mile apart but may be as much as 1-1/2 miles for beds of known geologic continuity. For example, if drilling on 1/2-mile centers has proved a block of measured coal of fairly uniform thickness and extent, the area of measured coal, according to the judgment of the estimator, is larger than the actual area of drilling by as much as 1/4 mile on all sides. If, from geologic evidence, the bed is believed to have greater continuity, the area of measured coal is surrounded by a belt of indicated coal, which, according to the judgment of the appraiser, may be as much as 1-1/2 miles wide.

Where no data are available other than measurements along the outcrops, but where the continuity of the outcrop is measured in miles and suggests the presence of coal at great distances in from the outcrop, two lines drawn roughly parallel to the outcrop, one 1/2 mile in from the outcrop and one 2 miles in from the outcrop, define a block of coal that may be classed as indicated.

Inferred coal. - As no estimate of reserves has been made from geologic inference alone, inferred coal is not included in this report. This category often contains the largest reserves.

Areas excluded from estimate. - In each bed are areas in which coal may be present but for which reserves have not been estimated. There are too few or no bed sections from drill holes, mine workings, or coal outcrops in the area on which to base estimates that would qualify under the definitions of "measured" or "indicated" reserves. These areas may contain additional geologically inferred reserves, and thus correspond approximately to areas of inferred reserves.

Overburden. - All known reserves in Harlan County are under less than 2,000 feet of overburden.

Thickness of coal. - In computing the volume of reserves in each thickness category for each bed, the total thickness of clean coal in the bed section is used.

If the top or bottom bench of coal described under definition of "bed-thickness range" usually is not mined, the thickness of the bench is not used to compute the volume of reserves. A weighted average thickness in each thickness category for each 5-minute rectangle of each bed is computed.

Weight of coal. - Estimated coal in place is based on 1,800 short tons per acre-foot.

Percentage of recovery. - The weighted average percentage of recovery is computed for each bed in each quadrangle. The total number of tons of coal produced from each mine is obtained from either the mine operator or the published reports of the Kentucky Department of Mines and Minerals. An estimate is made of the tons of coal originally in place in the mined-out area of each mine. The percentage of recovery for each mine is the ratio of the total number of tons produced from a mine (to January 1, 1952, the date of this estimate) to the total tons originally in place in the mined-out area. The weighted average percentage of recovery for all mines in the same bed in a quadrangle is the percentage of recovery used in calculating recoverable reserves for that bed in the quadrangle.

All coal remaining for any reason within the mined-out area of a mine is considered a loss. No distinction is made between avoidable or unavoidable losses. Included in these losses is some coal considered too thin to mine, also coal that legally is required to be left unmined, such as coal under some highways, railroads, rivers, coal left to protect gas and oil wells, and coal left in barrier pillars between mines and adjacent to property boundaries.

Recoverable reserves. - The recoverable reserves are estimated tons of unmined coal in beds 28 inches and more thick, as of the date of the estimate, multiplied by the percentage of recovery. Twenty-eight inches is about the minimum thickness of coal being mined mechanically (hand-loaded conveyors). Some areas in some of the beds in this county may not be considered economically minable at present because of conditions considered adverse today.

#### COAL RESERVES

Detailed estimates of known measured and indicated reserves of coal in Harlan County, Ky., as of January 1, 1952, are given in tables 1 to 13, inclusive.

Table 14 is a recapitulation by beds in Harlan County. Reserves in all beds 14 inches and more thick are estimated to be 2,137,885,000 short tons as of January 1, 1952. Of this total, 1,956,335,000 short tons is in beds 28 inches and more thick.

The weighted average percentage of recovery for each bed, or the estimated percentage recovery where no production records are available, is shown in column 19 of tables 1 to 13, inclusive. The highest average percentage of recovery is 69.7 for the Upper Elkhorn No. 2 and Upper Elkhorn No. 1 beds in the Hagan quadrangle, and the lowest is estimated at 40.0 for the D, Lower Split of Harlan, and Elkhorn Leader beds.

The weighted average percentage of recovery for all the beds in the county is 57.4. Based on this recovery, the known recoverable reserves 28 inches and more thick in Harlan County are estimated to be 1,122,328,000 short tons as of January 1, 1952. It must be remembered that these estimates are the known reserves only. Extensive drilling to procure additional information may prove larger reserves in the county.



HARLAN COUNTY

TABLE 1. - RESERVES IN HINDMAN BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				19 Percentage recoverable, including all mining losses	20 Estimated recoverable reserves 28" and more thick, thousands of tons
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
Nolansburg .....	117,305	14,762	89,838	32	10,873	5,085	5,788	Measured Indicated	41	123	602	3,218	4,438	33,391	5,081	36,732	5,040	36,609		19,293
								Total	-	-	707	3,409	-	-	707	3,409	707	3,409	52.7	1,796
Big Stone Gap ..	40,543	-	28,392	-	12,151	56	12,095	Measured Indicated	389	1,464	440	2,116	11,100	115,126	11,929	118,706	11,540	117,242		61,787
								Total	-	-	166	822	-	-	166	822	166	822	2/52.7	433
								Measured Indicated	430	1,587	1,042	5,334	15,538	148,517	17,010	155,438	16,580	153,851		81,080
								Total	-	-	873	4,231	-	-	873	4,231	873	4,231	52.7	2,229
Total .....	157,848	14,762	118,230	32	23,024	5,141	17,883	Total	430	1,587	1,915	9,565	15,538	148,517	17,883	159,669	17,453	158,082	52.7	83,309

HARLAN COUNTY

TABLE 2. - RESERVES IN FLAG BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				19 Percentage recoverable, including all mining losses	20 Estimated recoverable reserves 28" and more thick, thousands of tons
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
Cornettsville ..	2,557	-	-	-	2,557	-	2,557	Measured Indicated	-	-	71	405	829	5,845	900	6,250	900	6,250		3,294
								Total	13	41	642	3,311	1,002	6,312	1,657	9,664	1,644	9,623	2/52.7	5,071
Harlan .....	100,948	12,837	87,042	679	390	-	390	Measured Indicated	-	-	-	-	173	1,249	173	1,249	173	1,249		658
								Total	-	-	91	382	126	888	217	1,270	217	1,270	2/52.7	670
Nolansburg .....	115,505	7,275	88,019	738	19,473	2,212	17,261	Measured Indicated	1,009	3,185	5,960	32,737	2,705	19,372	9,674	55,294	8,665	52,109		27,461
								Total	236	779	4,028	21,147	3,323	18,193	7,587	40,119	7,351	39,340	52.7	20,732
Big Stone Gap ..	40,543	4,428	26,701	142	9,272	-	9,272	Measured Indicated	1,726	4,919	1,819	9,041	3,785	28,293	7,330	42,253	5,604	37,334		19,675
								Total	-	-	1,632	9,465	310	2,193	1,942	11,658	1,942	11,658	2/52.7	6,144
								Measured Indicated	2,735	8,104	7,850	42,183	7,492	54,759	18,077	105,046	15,342	96,942		51,088
								Total	249	820	6,393	34,305	4,761	27,586	11,403	62,711	11,154	61,891	52.7	32,617
Total .....	259,553	24,540	201,762	1,559	31,692	2,212	29,480	Total	2,984	8,924	14,243	76,488	12,253	82,345	29,480	167,757	26,496	158,833	52.7	83,705

HARLAN COUNTY

TABLE 3. - RESERVES IN HADDIX BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				19 Percentage recoverable, including all mining losses	20 Estimated recoverable reserves 28" and more thick, thousands of tons
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
Harlan .....	100,948	20,653	80,268	-	27	-	27	Measured Indicated	-	-	-	-	27	150	27	150	27	150		79
								Total	-	-	-	-	27	150	27	150	27	150	2/52.7	79
Nolansburg .....	115,505	39,118	66,629	-	9,758	961	8,797	Measured Indicated	82	246	976	5,221	6,223	43,859	7,281	49,326	7,199	49,080		25,865
								Total	-	-	452	2,245	1,064	7,589	1,516	9,834	1,516	9,834	52.7	5,183
								Measured Indicated	82	246	976	5,221	6,250	44,009	7,308	49,476	7,226	49,230		25,944
								Total	-	-	452	2,245	1,064	7,589	1,516	9,834	1,516	9,834	52.7	5,183
Total .....	216,453	59,771	146,897	-	9,785	961	8,824	Total	82	246	1,428	7,466	7,314	51,598	8,824	59,310	8,742	59,064	52.7	31,127

1/ No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

2/ Estimated

HARLAN COUNTY

TABLE 4. - RESERVES IN WAX BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, <sup>1/</sup> acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
Nolansburg .....	115,505	29,204	77,161	-	9,140	861	8,279	Measured Indicated	1,894 1,338	6,029 3,910	1,566 865	7,789 4,542	2,020 596	12,120 3,576	5,480 2,799	25,938 12,028	3,930 1,916	20,786 9,278		10,954 4,890
								Total	3,232	9,939	2,431	12,331	2,616	15,696	8,279	37,966	5,846	30,064	52.7	15,844
								Measured Indicated	1,894 1,338	6,029 3,910	1,566 865	7,789 4,542	2,020 596	12,120 3,576	5,480 2,799	25,938 12,028	3,930 1,916	20,786 9,278		10,954 4,890
Total .....	115,505	29,204	77,161	-	9,140	861	8,279	Total	3,232	9,939	2,431	12,331	2,616	15,696	8,279	37,966	5,846	30,064	52.7	15,844

HARLAN COUNTY

TABLE 5. - RESERVES IN FIRE CLAY BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, <sup>1/</sup> acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
Harlan .....	100,948	21,608	73,220	825	5,295	3,089	2,206	Measured Indicated	-	-	778	4,176	807 621	7,647 4,443	1,585 621	11,823 4,443	1,585 621	11,823 4,443		7,827 2,941
								Total	-	-	778	4,176	1,428	12,090	2,206	16,266	2,206	16,266	66.2	10,768
Nolansburg .....	115,505	52,908	48,514	987	13,096	1,134	11,962	Measured Indicated	331 3,135	1,142 11,704	1,972 3,463	10,399 18,377	1,968 1,093	12,098 6,837	4,271 7,691	23,639 36,918	3,940 4,556	22,497 25,214		14,893 16,692
								Total	3,466	12,846	5,435	28,776	3,061	18,935	11,962	60,557	8,496	47,711	2/66.2	31,585
Big Stone Gap ..	40,543	34,270	3,462	161	2,650	35	2,615	Measured Indicated	2,076 539	5,857 1,885	-	-	-	-	2,076 539	5,857 1,885	-	-		-
								Total	2,615	7,742	-	-	-	-	2,615	7,742	-	-	-	-
Hagan .....	32,677	-	30,665	-	2,012	1,157	855	Measured Indicated	-	-	109	638	746	5,576	855	6,214	855	6,214		4,114
								Total	-	-	109	638	746	5,576	855	6,214	855	6,214	66.2	4,114
								Measured Indicated	2,407 3,674	6,999 13,589	2,859 3,463	15,213 18,377	3,521 1,714	25,321 11,280	8,787 8,851	47,533 43,246	6,380 5,177	40,534 29,657		26,834 19,633
Total .....	289,673	108,786	155,861	1,973	23,053	5,415	17,638	Total	6,081	20,588	6,322	33,590	5,235	36,601	17,638	90,779	11,557	70,191	66.2	46,467

HARLAN COUNTY

TABLE 6. - RESERVES IN AMBURGY BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, <sup>1/</sup> acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
Harlan .....	100,948	73,600	25,684	-	1,664	266	1,398	Measured Indicated	-	-	-	-	943 455	7,026 3,276	943 455	7,026 3,276	943 455	7,026 3,276		4,630 2,159
								Total	-	-	-	-	1,398	10,302	1,398	10,302	1,398	10,302	65.9	6,789
Nolansburg .....	115,505	62,059	37,352	-	16,094	569	15,525	Measured Indicated	158 1,189	450 3,389	4,874 5,836	27,444 28,970	2,549 919	18,168 6,076	7,581 7,944	46,062 38,435	7,423 6,755	45,612 35,046		30,651 23,551
								Total	1,347	3,839	10,710	56,414	3,468	24,244	15,525	84,497	14,178	80,658	67.2	54,202
Big Stone Gap ...	40,543	40,247	-	-	296	-	296	Measured Indicated	-	-	-	-	133 -	978 -	133 163	978 660	133 163	978 660		636 429
								Total	-	-	163	660	133	978	296	1,638	296	1,638	2/65.0	1,065
								Measured Indicated	158 1,189	450 3,389	4,874 5,999	27,444 29,630	3,625 1,374	26,172 9,352	8,657 8,562	54,066 42,371	8,499 7,373	53,616 38,982		35,917 26,139
Total .....	256,996	175,906	63,036	-	18,054	835	17,219	Total	1,347	3,839	10,873	57,074	4,999	35,524	17,219	96,437	15,872	92,598	67.0	62,056

<sup>1/</sup> No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

<sup>2/</sup> Estimated

HARLAN COUNTY

TABLE 7. - RESERVES IN D BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, <sup>1/</sup> acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
Nolansburg .....	115,505	109,270	5,177	-	1,058	-	1,058	Measured Indicated	262	550	339	1,627	457	4,044	1,058	6,221	796	5,671		2,268
								Total	262	550	339	1,627	457	4,044	1,058	6,221	796	5,671	2/40.0	2,268
Big Stone Gap ..	40,543	25,362	6,665	-	8,516	-	8,516	Measured Indicated	201	693	6,617	33,897	1,698	12,111	8,516	46,701	8,315	46,008		18,403
								Total	201	693	6,617	33,897	1,698	12,111	8,516	46,701	8,315	46,008	2/40.0	18,403
								Measured Indicated	463	1,243	6,956	35,524	2,155	16,155	9,574	52,922	9,111	51,679		20,671
Total .....	156,048	134,632	11,842	-	9,574	-	9,574	Total	463	1,243	6,956	35,524	2,155	16,155	9,574	52,922	9,111	51,679	2/40.0	20,671

HARLAN COUNTY

TABLE 8. - RESERVES IN UPPER ELKHORN NO. 3 BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, <sup>1/</sup> acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
Harlan .....	100,948	42,618	53,969	-	4,361	-	4,361	Measured Indicated	1,950	6,425	968	4,843	856	5,649	2,918	11,268	968	4,843		2,664
								Total	1,950	6,425	1,555	7,749	856	5,649	4,361	19,823	2,411	13,398	2/55.0	7,369
Nolansburg .....	115,418	26,710	38,019	171	50,518	13,869	36,649	Measured Indicated	4,665	15,422	17,868	91,707	2,330	15,620	24,863	122,749	20,198	107,327		69,870
								Total	4,836	16,038	29,483	149,454	2,330	15,620	36,649	181,112	31,813	165,074	65.1	107,463
Big Stone Gap ..	40,543	-	6,345	-	34,198	8,412	25,786	Measured Indicated	432	1,685	6,664	31,662	7,923	70,997	15,019	104,344	14,587	102,659		53,588
								Total	432	1,685	17,431	88,189	7,923	70,997	25,786	160,871	25,354	159,186	52.2	83,095
								Measured Indicated	7,047	23,532	25,500	128,212	10,253	86,617	42,800	238,361	35,753	214,829		126,122
Total .....	256,909	69,328	98,333	171	89,077	22,281	66,796	Total	7,218	24,148	48,469	245,392	11,109	92,266	66,796	361,806	59,578	337,658	58.6	197,927

HARLAN COUNTY

TABLE 9. - RESERVES IN ELKHORN LEADER BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, <sup>1/</sup> acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
Nolansburg .....	115,505	104,556	6,235	2,583	2,131	-	2,131	Measured Indicated	1,844	4,906	287	1,464	-	-	2,131	6,370	287	1,464		586
								Total	1,844	4,906	287	1,464	-	-	2,131	6,370	287	1,464	2/40.0	586
Big Stone Gap ...	40,543	29,965	6,326	1,062	3,190	-	3,190	Measured Indicated	1,476	4,415	1,714	9,273	-	-	3,190	13,688	1,714	9,273		3,709
								Total	1,476	4,415	1,714	9,273	-	-	3,190	13,688	1,714	9,273	2/40.0	3,709
								Measured Indicated	3,320	9,321	2,001	10,737	-	-	5,321	20,058	2,001	10,737		4,295
Total .....	156,048	134,521	12,561	3,645	5,321	-	5,321	Total	3,320	9,321	2,001	10,737	-	-	5,321	20,058	2,001	10,737	2/40.0	4,295

<sup>1/</sup> No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

<sup>2/</sup> Estimated

HARLAN COUNTY

TABLE 10. - RESERVES IN UPPER ELKHORN NO. 2 BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
Harlan .....	100,948	46,024	51,939	61	2,924	533	2,391	Measured Indicated	1,531	5,196	206	896	131	1,041	1,868	7,133	337	1,937		1,181
								Total	1,531	5,196	635	2,762	225	1,676	2,391	9,634	860	4,438	61.0	2,707
Nolansburg .....	115,505	56,597	32,375	825	25,708	1,491	24,217	Measured Indicated	2,743	9,182	8,932	41,559	2,839	19,526	14,514	70,267	11,771	61,085		32,314
								Total	2,743	9,182	18,635	87,901	2,839	19,526	24,217	116,609	21,474	107,427	52.9	56,829
Big Stone Gap ..	40,543	4,296	4,888	-	31,359	2,449	28,910	Measured Indicated	497	1,789	11,380	62,935	3,045	20,240	14,922	84,964	14,425	83,175		43,417
								Total	1,970	6,501	12,018	63,096	-	-	13,988	69,597	12,018	63,096	52.2	32,936
Hagan .....	32,677	4,300	22,114	9	6,254	1,655	4,599	Measured Indicated	98	309	355	1,864	2,263	17,793	2,716	19,966	2,618	19,657		13,701
								Total	-	-	465	2,441	1,418	11,371	1,883	13,812	1,883	13,812	69.7	9,627
Jonesville .....	10,223	10,034	-	-	189	-	189	Measured Indicated	189	510	-	-	-	-	189	510	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
								Measured Indicated	5,058	16,986	20,873	107,254	8,278	58,600	34,209	182,840	29,151	165,854		90,613
								Total	1,970	6,501	22,615	113,745	1,512	12,006	26,097	132,252	24,127	125,751	54.6	68,604
Total .....	299,896	121,251	111,316	895	66,434	6,128	60,306	Total	7,028	23,487	43,488	220,999	9,790	70,606	60,306	315,092	53,278	291,605		159,217

HARLAN COUNTY

TABLE 11. - RESERVES IN HARLAN BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, 1/ acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
Harlan .....	100,948	24,774	48,280	152	27,742	15,548	12,194	Measured Indicated	2,192	6,317	5,598	31,174	2,261	15,945	10,051	53,436	7,859	47,119		31,994
								Total	618	1,761	1,525	9,150	-	-	2,143	10,911	1,525	9,150	67.9	6,213
Nolansburg .....	115,505	43,389	27,593	41	44,482	11,062	33,420	Measured Indicated	4,928	17,408	8,231	44,347	10,683	98,449	23,842	160,204	18,914	142,796		90,533
								Total	-	-	2,078	9,375	7,500	60,585	9,578	69,960	9,578	69,960	63.4	44,354
Big Stone Gap ..	40,543	3,882	4,528	321	31,812	6	31,806	Measured Indicated	1,182	3,723	5,700	28,060	7,928	55,351	14,810	87,134	13,628	83,411		54,217
								Total	66	208	11,675	53,985	5,255	35,226	16,996	89,419	16,930	89,211	2/65.0	57,987
Hagan .....	32,677	289	18,543	-	13,845	5,449	8,396	Measured Indicated	46	145	4,041	23,908	4,309	27,882	8,396	51,935	8,350	51,790		36,098
								Total	-	-	-	-	-	-	-	-	-	-	69.7	-
Jonesville .....	4,037	3,944	-	-	93	-	93	Measured Indicated	93	209	-	-	-	-	93	209	-	-		-
								Total	-	-	-	-	-	-	-	-	-	-	-	-
								Measured Indicated	8,441	27,802	23,570	127,489	25,181	197,627	57,192	352,918	48,751	325,116		212,842
								Total	684	1,969	15,278	72,510	12,755	95,811	28,717	170,290	28,033	168,321	65.1	108,554
Total .....	293,710	76,278	98,944	514	117,974	32,065	85,909	Total	9,125	29,771	38,848	199,999	37,936	293,438	85,909	523,208	76,784	493,437		321,396

1/ No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

2/ Estimated

HARLAN COUNTY

TABLE 12. - RESERVES IN LOWER SPLIT OF HARLAN BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		
	Area of quadrangle in county, acres	Areas excluded from estimate, <sup>1/</sup> acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons		
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick					
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons				
Big Stone Gap ..	40,543	10,717	4,582	485	24,759	-	24,759	Measured Indicated	4,686	14,664	5,110	25,294	3,073	23,508	12,869	63,466	8,183	48,802		19,521		
								Total	11,890	34,184	-	-	-	-	11,890	34,184	-	-			-	-
								Measured Indicated	4,686	14,664	5,110	25,294	3,073	23,508	12,869	63,466	8,183	48,802			2/40.0	19,521
Total	11,890	34,184	-	-	-	-	11,890	34,184	-	-	-	-										
Total .....	40,543	10,717	4,582	485	24,759	-	24,759	Total	16,576	48,848	5,110	25,294	3,073	23,508	24,759	97,650	8,183	48,802	2/40.0	19,521		

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TABLE 13. - RESERVES IN LOWER ELKHORN BED, January 1, 1952

Quadrangle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Area of quadrangle in county, acres	Areas excluded from estimate, <sup>1/</sup> acres	Area outside outcrop, acres	Underlain by coal 0" to 14" thick, acres	Coal over 14" thick, in place originally, acres	Mined out, acres	Coal over 14" thick remaining, acres	Measured Indicated	Estimated coal reserves, in tons of 2,000 lb.						Total reserves, in tons of 2,000 lb.				Percentage recoverable, including all mining losses	Estimated recoverable reserves 28" and more thick, thousands of tons
									14" to 28" thick		28" to 42" thick		Over 42" thick		14" and more thick		28" and more thick			
									Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons	Acres	Thousands of tons		
Harlan .....	100,948	99,258	809	-	881	-	881	Measured Indicated	-	-	881	4,757	-	-	881	4,757	881	4,757	2/50.0	2,379
								Total	-	-	881	4,757	-	-	881	4,757	881	4,757		
Nolansburg .....	115,505	115,237	-	-	268	-	268	Measured Indicated	-	-	268	1,407	-	-	268	1,407	268	1,407	2/50.0	703
								Total	-	-	268	1,407	-	-	268	1,407	268	1,407		
Big Stone Gap ..	40,543	21,669	-	1,105	17,769	-	17,769	Measured Indicated	547	1,646	2,834	14,568	4,310	45,314	7,691	61,528	7,144	59,882	2/50.0	29,941
								Total	-	-	-	-	10,078	87,539	10,078	87,539	10,078	87,539		
Total .....	256,996	236,164	809	1,105	18,918	-	18,918	Measured Indicated	547	1,646	3,983	20,732	4,310	45,314	8,840	67,692	8,293	66,046	2/50.0	76,793
								Total	-	-	-	-	10,078	87,539	10,078	87,539	10,078	87,539		
Total .....	256,996	236,164	809	1,105	18,918	-	18,918	Total	547	1,646	3,983	20,732	14,388	132,853	18,918	155,231	18,371	153,585	2/50.0	76,793

<sup>1/</sup> No information available from core drilling, mine workings, or coal outcrops on which to base estimates of measured and indicated reserves. These areas may contain additional geologically inferred reserves.

<sup>2/</sup> Estimated

TABLE 14. - Recapitulation of reserves, Harlan County, Ky., January 1, 1952

Bed	Thousands of tons		Recoverable <sup>1/</sup>	
	In beds 14" and more thick	In beds 28" and more thick	Percentage	Thousands of tons
Hindman .....	159,669	158,082	52.7	83,309
Flag .....	167,757	158,833	52.7	83,705
Haddix .....	59,310	59,064	52.7	31,127
Wax .....	37,966	30,064	52.7	15,844
Fire Clay .....	90,779	70,191	66.2	46,467
Amburgy .....	96,437	92,598	67.0	62,056
D .....	52,922	51,679	<sup>2/</sup> 40.0	20,671
Upper Elkhorn No. 3 .....	361,806	337,658	58.6	197,927
Elkhorn Leader .....	20,058	10,737	<sup>2/</sup> 40.0	4,295
Upper Elkhorn No. 2 .....	315,092	291,605	54.6	159,217
Harlan .....	523,208	493,437	65.1	321,396
Lower Split of Harlan .....	97,650	48,802	<sup>2/</sup> 40.0	19,521
Lower Elkhorn .....	155,231	153,585	<sup>2/</sup> 50.0	76,793
<b>Total .....</b>	<b>2,137,885</b>	<b>1,956,335</b>	<b>57.4</b>	<b>1,122,328</b>

<sup>1/</sup> Based on reserves 28 inches and more thick.

<sup>2/</sup> Estimated.

COAL BEDS

The coal beds occurring in Harlan County for which reserves have been estimated are, in descending order:

<u>Name of bed</u>	<u>Other names of bed</u>
Hindman	High Splint*, No. 9, Hindman No. 9
Flag	No. 7, Flag No. 7, Hazard No. 7, No. 11 (Va.), Morris*
Haddix	Pardee*, No. 10 (Va.), Smith
Wax	High Cliff*, No. 9 (Va.)
Fire Clay	Wallins Creek*, Dean
Amburgy	Low Splint*, Creech, No. 6 (Va.)
D	
Upper Elkhorn No. 3	Taggart, Keokee, Darby*
Elkhorn Leader	Taggart Marker*
Upper Elkhorn No. 2	Collier
Harlan	Upper Elkhorn No. 1, Wilson
Lower Split of Harlan	
<u>Lower Elkhorn</u>	Imboden*, Shelby Gap

\*These names probably more widely used in Harlan County.

The Hindman bed is in the Allegheny series, and all the other beds are in the underlying Pottsville series, Pennsylvania period.

The Pine Mountain fault crosses the northwest part of the county in a northeast-southwest direction, dividing the county into two distinct physiographic areas.<sup>2/</sup> North of the Pine Mountain fault, the topography is very rugged, making the approach very difficult. There has been some prospecting, but the limited known information

<sup>2/</sup> Miller, R., and Withers, S., Structural Geologic Map of Harlan County: Kentucky Geol. Survey, Series VI, 1927.

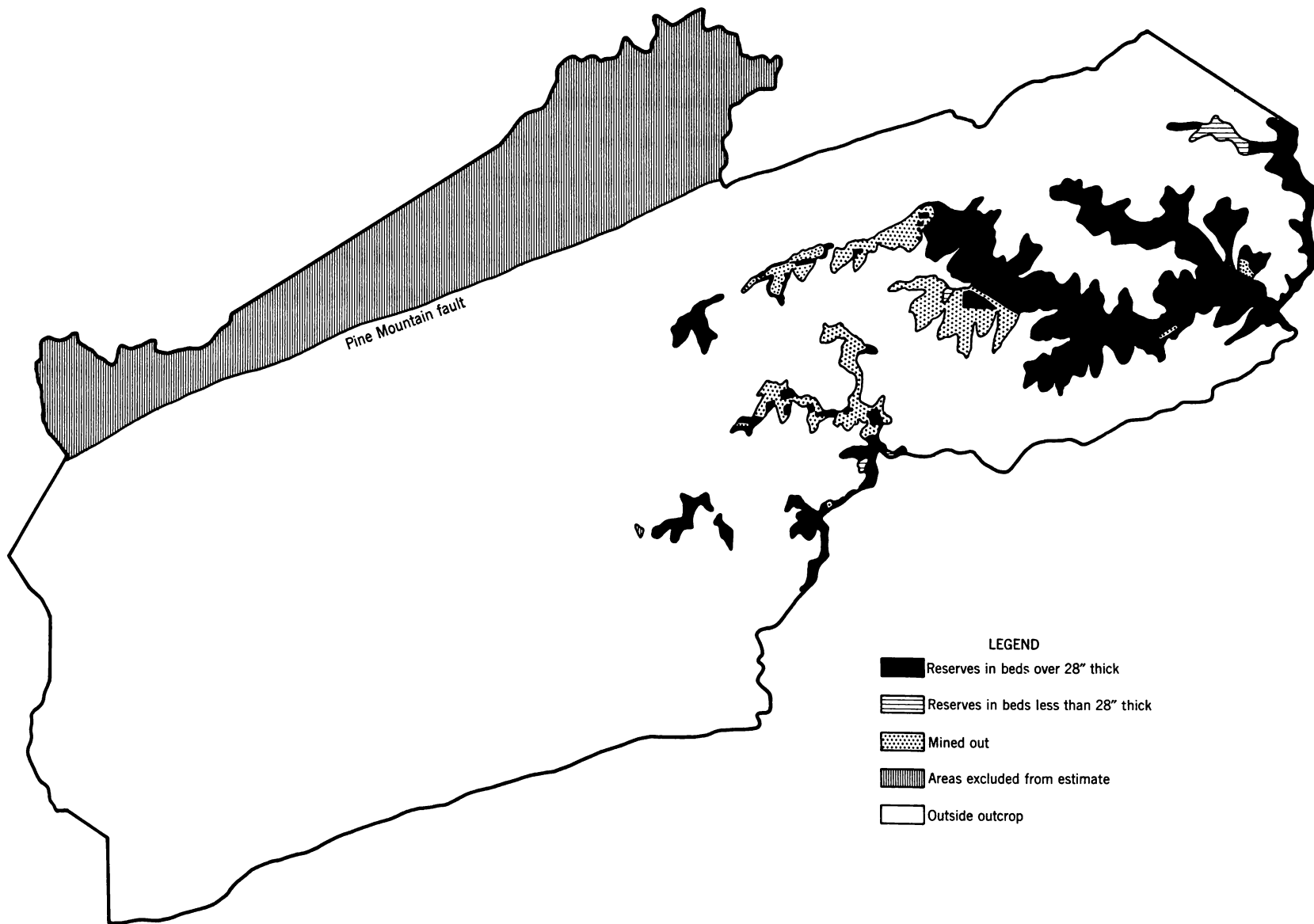


Figure 2. - Hindman bed, Harlan County, Ky., January 1, 1952.





indicates that the coals are thin and irregular. However, additional prospecting and drilling may show coals of workable thickness.

The major coal-producing beds in Harlan County are the Harlan and Upper Elkhorn No. 3. Of less importance are the Hindman, Flag, Haddix, Wax, Fire Clay, Amburgy, and Upper Elkhorn No. 2. The Harlan and Upper Elkhorn No. 3 beds contain the largest remaining known reserves.

Other coal beds occur in the county but they either are not minable under present conditions, or the information concerning them is insufficient to make an estimate of the reserves.

Maps have been prepared for the Hindman, Flag, Haddix, Wax, Fire Clay, Amburgy, D, Upper Elkhorn No. 3, Elkhorn Leader, Upper Elkhorn No. 2, Harlan, Lower Split of Harlan, and Lower Elkhorn. (See figs. 2 to 14, inclusive.)

The characteristics of the mapped coal beds are shown by bed sections furnished by the owners, lessees of the coal, and published reports of the Kentucky Geological Survey.<sup>6/7/</sup> All bed sections given are within the areas of recoverable reserves 28 inches and more thick (black areas on the maps).

Descriptions of the coal beds that have been mapped and bed sections selected to show the irregularities of the beds in areas of known recoverable reserves follow:

Hindman Bed

(See fig. 2 and table 1)

The Hindman is the highest bed stratigraphically being mined in Harlan County. It occurs high in the hilltops; therefore, the areal extent is confined to the eastern and central parts of the county. Generally, it is thick and persistent, where present, and contains few partings. It occurs about 100 feet above the Flag bed. Sections of the bed in areas of known recoverable reserves follow:

Eastern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	<u>29</u>	COAL .....	<u>103</u>
Thickness .....	29	Thickness .....	103
COAL .....	2	COAL .....	8
Fire clay .....	1/2	Fire clay .....	1-1/2
COAL .....	<u>80</u>	COAL .....	<u>69</u>
Thickness .....	<u>82-1/2</u>	Thickness .....	<u>78-1/2</u>

<sup>6/</sup> Crider, A. F., The Coals of Letcher County: Kentucky Geol. Survey IV Series, vol. IV, pt. I, 1916, 234 pp.

<sup>7/</sup> Hodge, James M., Report on the Upper Cumberland Coal Field: Kentucky Geol. Survey Bull. 13, 1912, 223 pp.

Hodge, James M., Report on the Coals of the Three Forks of the Kentucky River: Kentucky Geol. Survey Bull. 11, 1910, 280 pp.

<u>Material</u>	<u>Inches</u>
COAL .....	36
Slate .....	19
COAL .....	40
Coal and slate .....	7-1/2
COAL .....	11-1/2
Slate .....	1
COAL .....	1-1/2
Thickness .....	116-1/2

<u>Material</u>	<u>Inches</u>
COAL .....	5
Slate .....	1/2
COAL .....	46-1/2
Fire clay .....	3
COAL .....	34-1/2
Thickness .....	89-1/2

Central Part of County

<u>Material</u>	<u>Inches</u>
Laminated coal .....	4-1/2
COAL .....	13
Fire clay .....	5-1/2
Slate .....	6
COAL .....	6-1/2
Fire clay .....	1-1/2
COAL .....	4
Rash .....	1-1/2
COAL .....	4
Thickness .....	46-1/2
COAL .....	53
Thickness .....	53
COAL .....	10
Slate .....	5
COAL .....	40
Thickness .....	55

<u>Material</u>	<u>Inches</u>
COAL .....	22
Shale .....	13
COAL .....	3
Shale .....	1
COAL .....	16
Thickness .....	55
COAL .....	3
Laminated coal .....	10
COAL .....	18
Parting .....	6
COAL .....	16
Thickness .....	53
COAL .....	34
Thickness .....	34

Flag Bed

(See fig. 3 and table 2)

The Flag bed occurs about 390 feet above the Haddix. Like the Hindman, it occurs high in the hilltops. Generally, it is single- or double-bedded. Sections of the bed in areas of known recoverable reserves follow:

Northern Part of County

<u>Material</u>	<u>Inches</u>
COAL .....	39
Thickness .....	39
COAL .....	23
Slate .....	1-1/2
COAL .....	4-1/2
Rash .....	1/2
COAL .....	4
Clay .....	1
COAL .....	1-1/2
Thickness .....	36

<u>Material</u>	<u>Inches</u>
COAL .....	30
Thickness .....	30
COAL .....	21-1/2
Slate .....	1/2
COAL .....	10
Clay .....	1-1/2
COAL .....	3
Thickness .....	36-1/2
COAL .....	7
Shale .....	2
COAL .....	40
Thickness .....	49

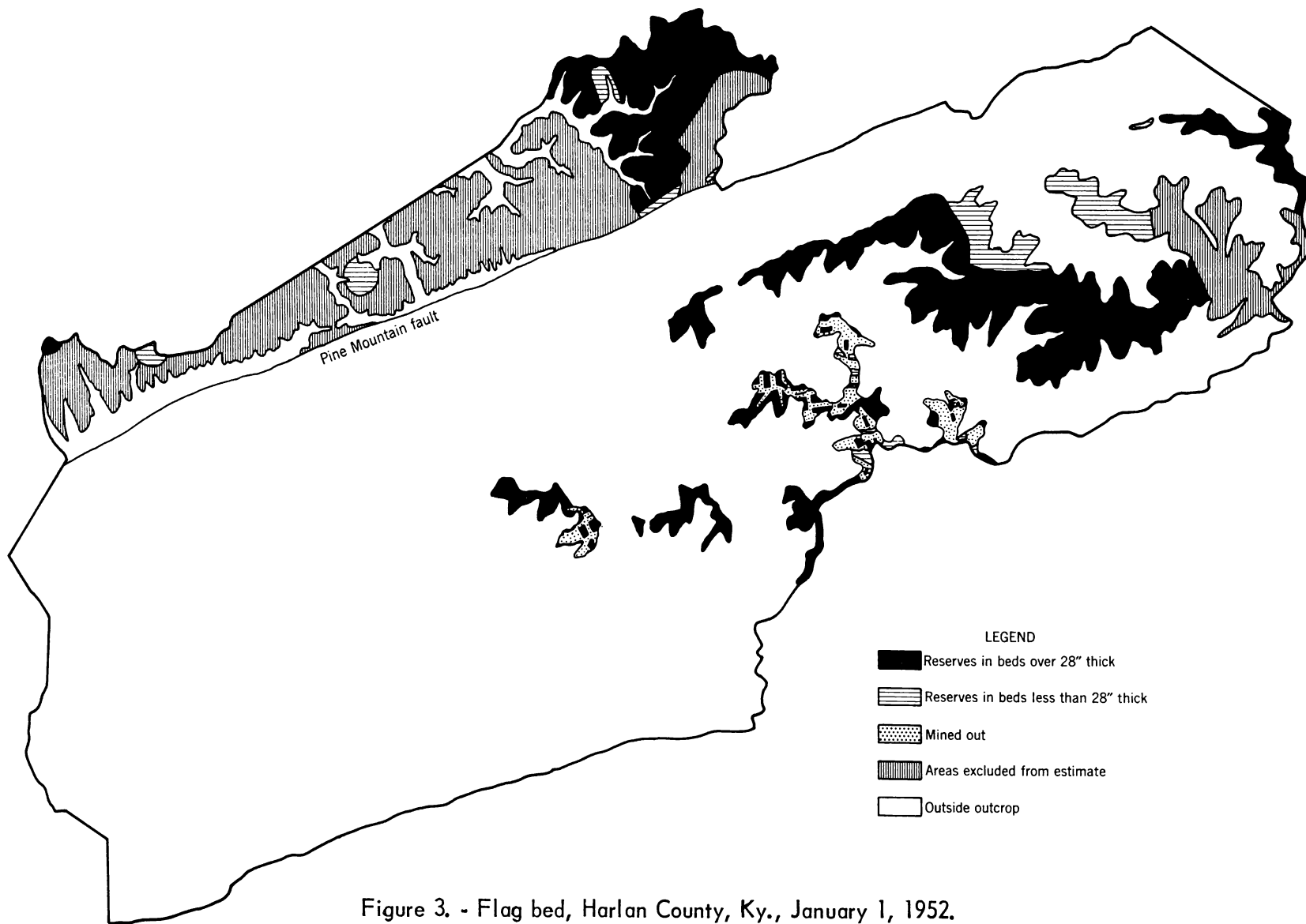


Figure 3. - Flag bed, Harlan County, Ky., January 1, 1952.



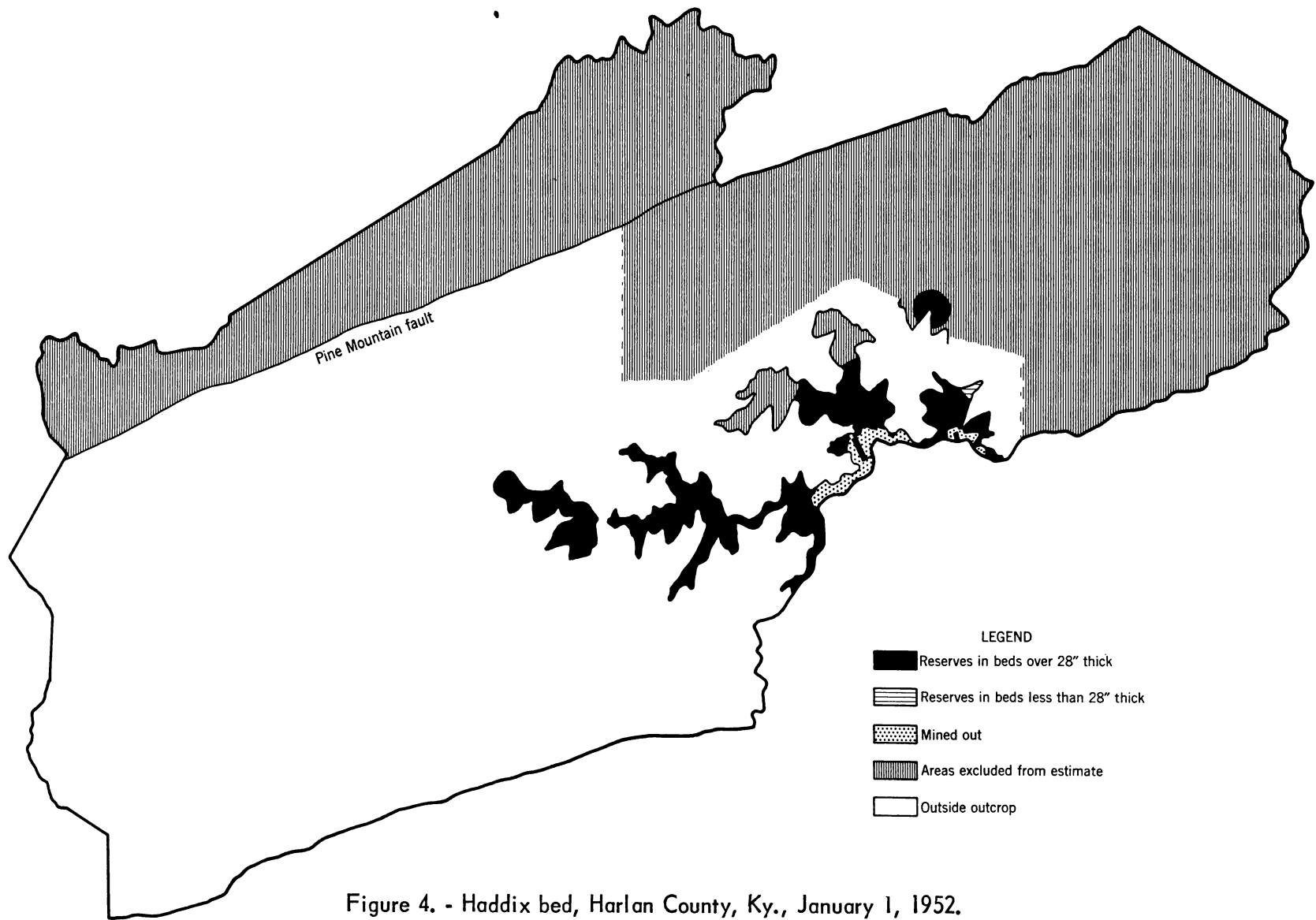


Figure 4. - Haddix bed, Harlan County, Ky., January 1, 1952.



Central Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	14	COAL .....	9
Shale .....	3	Fire clay .....	1/4
COAL .....	<u>43</u>	COAL .....	35
Thickness .....	60	Shale .....	1
COAL .....	16	COAL .....	<u>6</u>
Shale .....	4	Thickness .....	51-1/4
COAL .....	<u>27</u>	COAL .....	<u>52</u>
Thickness .....	47	Thickness .....	52
COAL .....	10	COAL .....	<u>35</u>
Shale .....	1/2	Thickness .....	35
COAL .....	<u>36</u>		
Thickness .....	46-1/2		

Eastern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	12	COAL .....	10
Shale .....	13	Shale .....	3
COAL .....	<u>58</u>	COAL .....	16
Thickness .....	83	Shale .....	2
COAL .....	33-1/2	COAL .....	10
Fire clay .....	1-3/4	Rash .....	1/2
COAL .....	<u>2-1/2</u>	COAL .....	<u>46</u>
Thickness .....	37-3/4	Thickness .....	87-1/2
COAL .....	<u>48</u>	COAL .....	<u>30</u>
Thickness .....	48	Thickness .....	30

Haddix Bed

(See fig. 4 and table 3)

The Haddix bed occurs about 330 feet above the Fire Clay. It is well developed in the central part of the county, and is being mined near the Virginia border where it usually has two partings. Farther west, the bed contains three or more partings. Sections of the bed in areas of known recoverable reserves follow:

Central Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	2-1/2	COAL .....	25
Shale .....	2	Shale .....	23
COAL .....	4	COAL .....	39
Shale .....	1/4	Shale .....	2
COAL .....	2-3/4	COAL .....	12
Shale .....	3-1/2	Thickness .....	101
COAL .....	21		
Shale .....	1	COAL .....	11-1/2
COAL .....	8	Fire clay .....	2
Shale .....	2-1/2	COAL .....	29-1/2
COAL .....	11	Fire clay .....	2-1/2
Shale .....	2	COAL .....	2-1/2
COAL .....	10	Thickness .....	48
Thickness .....	70-1/2		
COAL .....	8	COAL .....	2-1/2
Shale .....	8	Shale .....	1-1/2
COAL .....	9	COAL .....	6
Shale .....	18	Shale .....	1
COAL .....	37	COAL .....	38
Thickness .....	80	Thickness .....	49

Wax Bed

(See fig. 5 and table 4)

The Wax bed occurs at an interval varying from 10 to 60 feet below the Haddix and about 270 feet above the Fire Clay. It is well developed in the southeastern part of the county where it is being mined. It is from 3 to 5 feet thick with a small parting in the lower half of the bed. Sections of the bed in areas of known recoverable reserves follow:

Southeastern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	22	COAL .....	22
Parting .....	2	Parting .....	1
COAL .....	18	COAL .....	13
Thickness .....	42	Thickness .....	36
COAL .....	6	COAL .....	37
Fire clay .....	3	Parting .....	3
COAL .....	19	COAL .....	18
Fire clay .....	1/4	Thickness .....	58
COAL .....	4-3/4		
Thickness .....	33		



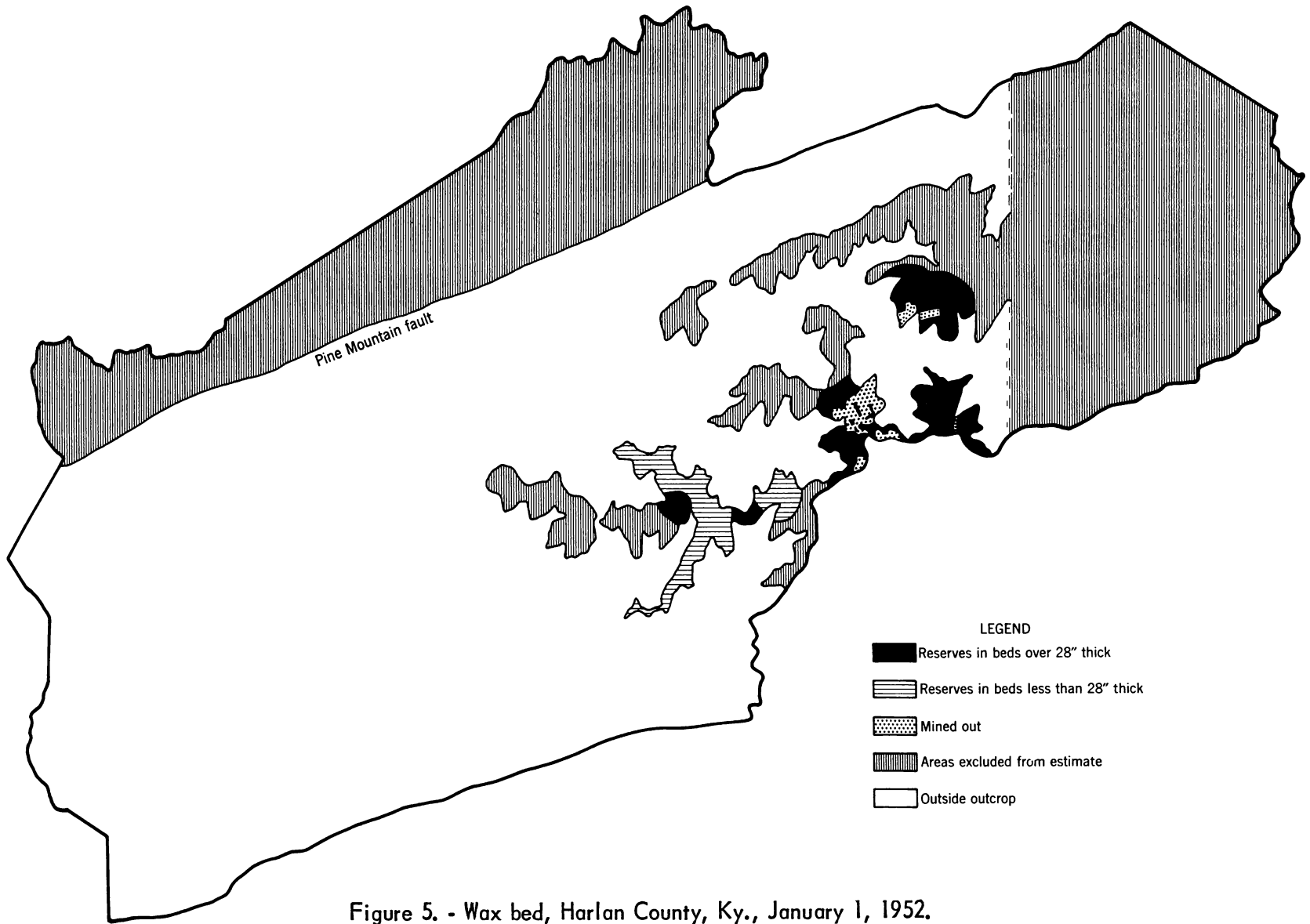


Figure 5. - Wax bed, Harlan County, Ky., January 1, 1952.



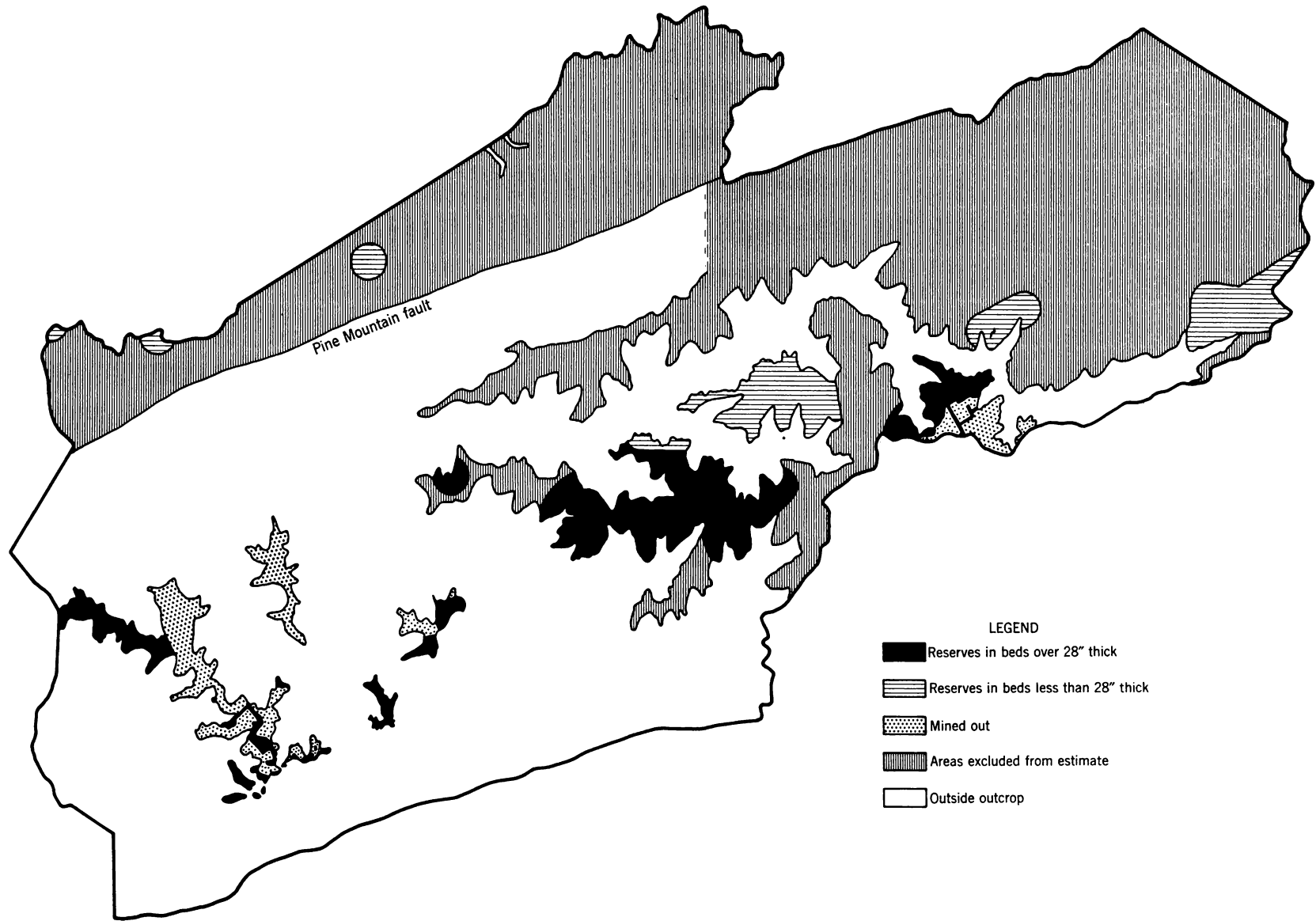


Figure 6. - Fire Clay bed, Harlan County, Ky., January 1, 1952.



## Fire Clay Bed

(See fig. 6 and table 5)

The Fire Clay bed occurs about 280 feet above the Amburgy. It is best developed in the central and western parts of the county. Locally, this bed attains a thickness of 9 feet in the western part of the county. North of the Pine Mountain fault, three diamond-drill holes show the presence of coal less than 14 inches thick. Sections of the bed in areas of known recoverable reserves follow:

### Central Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
Laminated coal .....	9	COAL .....	2
Shale .....	7-1/2	Clay .....	1
COAL .....	22	COAL .....	26
Jack rock .....	4-1/2	Clay .....	1/2
COAL .....	10	Bony coal .....	1/2
Bone .....	2	COAL .....	11
Thickness .....	<u>55</u>	Clay .....	1-1/2
COAL .....	27	COAL .....	13
Flint fire clay .....	3	Bony coal .....	1
COAL .....	14	COAL .....	3
Thickness .....	<u>44</u>	Thickness .....	<u>59-1/2</u>
Laminated coal .....	4-1/2	Laminated coal .....	8
COAL .....	12-1/2	COAL .....	4-1/2
Laminated coal .....	14	Shale .....	2-1/4
COAL .....	14	COAL .....	21
Thickness .....	<u>45</u>	Fire clay .....	1/4
COAL .....	33	COAL .....	<u>13-1/2</u>
Shale .....	8	Thickness .....	<u>49-1/2</u>
COAL .....	12		
Thickness .....	<u>53</u>		

### Western Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	45	COAL .....	28
Shale .....	1	Clay .....	3
COAL .....	7-1/2	COAL .....	23
Shale .....	1-1/2	Fire clay .....	11
COAL .....	2	COAL .....	11
Thickness .....	<u>57</u>	Shale .....	3
COAL .....	34	COAL .....	3
Parting .....	6	Shale .....	2
COAL .....	11	COAL .....	<u>25</u>
Thickness .....	<u>51</u>	Thickness .....	<u>109</u>
COAL .....	81		
Fire clay .....	7		
COAL .....	15		
Thickness .....	<u>103</u>		

Amburgy Bed

(See fig. 7 and table 6)

The Amburgy bed occurs about 230 feet above the Upper Elkhorn No. 3. It occurs multiple bedded, and the thickness usually ranges from 3 to 5 feet. It is well developed in the central and eastern parts of the county. Sections of the bed in areas of known recoverable reserves follow:

Central Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	8	COAL .....	11
Shale .....	1	Parting .....	1/2
COAL .....	6	COAL .....	<u>25</u>
Shale .....	1	Thickness .....	36-1/2
COAL .....	5		
Bone .....	1	COAL .....	47
COAL .....	27-1/2	Shale .....	7
Shale .....	3	COAL .....	<u>4-1/2</u>
COAL .....	<u>5</u>	Thickness .....	58-1/2
Thickness .....	57-1/2		
COAL .....	3	COAL .....	8
Shale .....	1	Parting .....	1-1/2
COAL .....	29	COAL .....	6
Shale .....	1	Parting .....	1-1/2
COAL .....	2	COAL .....	<u>43</u>
Shale .....	1	Thickness .....	60
COAL .....	<u>1</u>		
Thickness .....	38		

Eastern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	15	COAL .....	10
Shale .....	5	Shale .....	1
COAL .....	<u>17</u>	COAL .....	13
Thickness .....	37	Shale .....	3
		COAL .....	<u>11</u>
COAL .....	27	Thickness .....	38
Parting .....	15		
COAL .....	<u>18</u>		
Thickness .....	60	COAL .....	9
		Shale .....	3
COAL .....	16	COAL .....	10-1/2
Parting .....	3	Fire clay .....	1
COAL .....	<u>9</u>	COAL .....	<u>7-1/2</u>
Thickness .....	28	Thickness .....	31

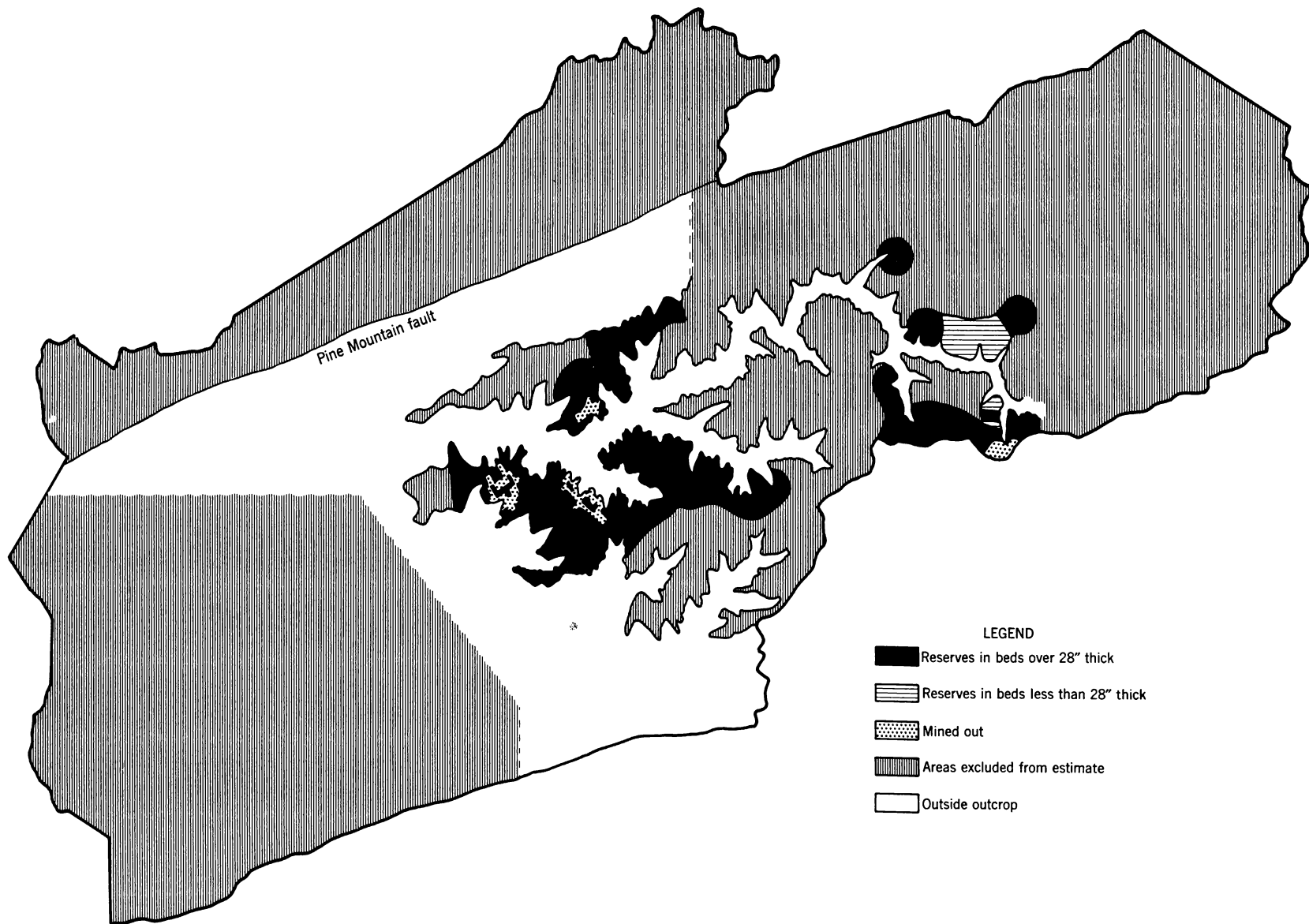


Figure 7. - Amburgy bed, Harlan County, Ky., January 1, 1952.





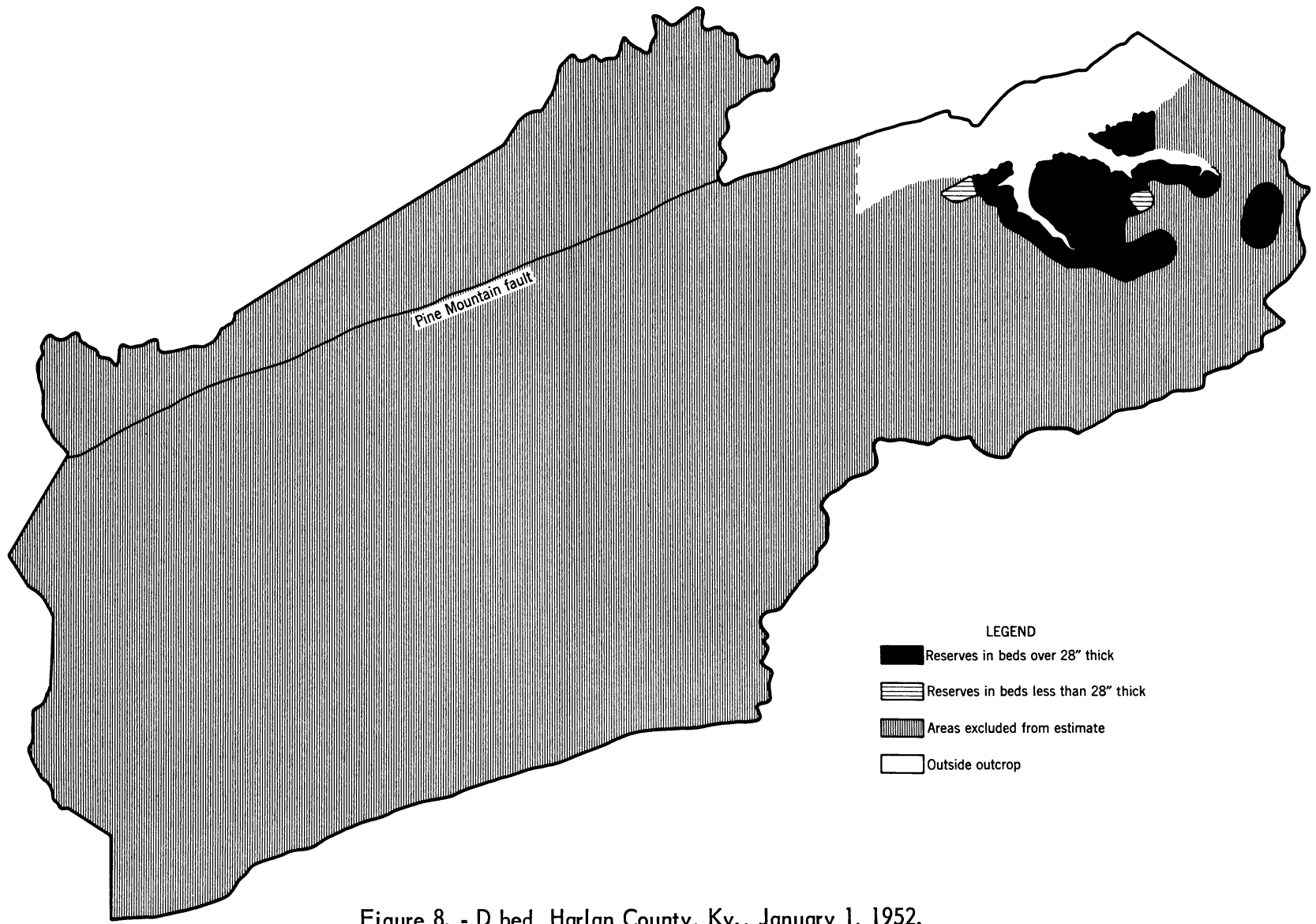


Figure 8. - D bed, Harlan County, Ky., January 1, 1952.



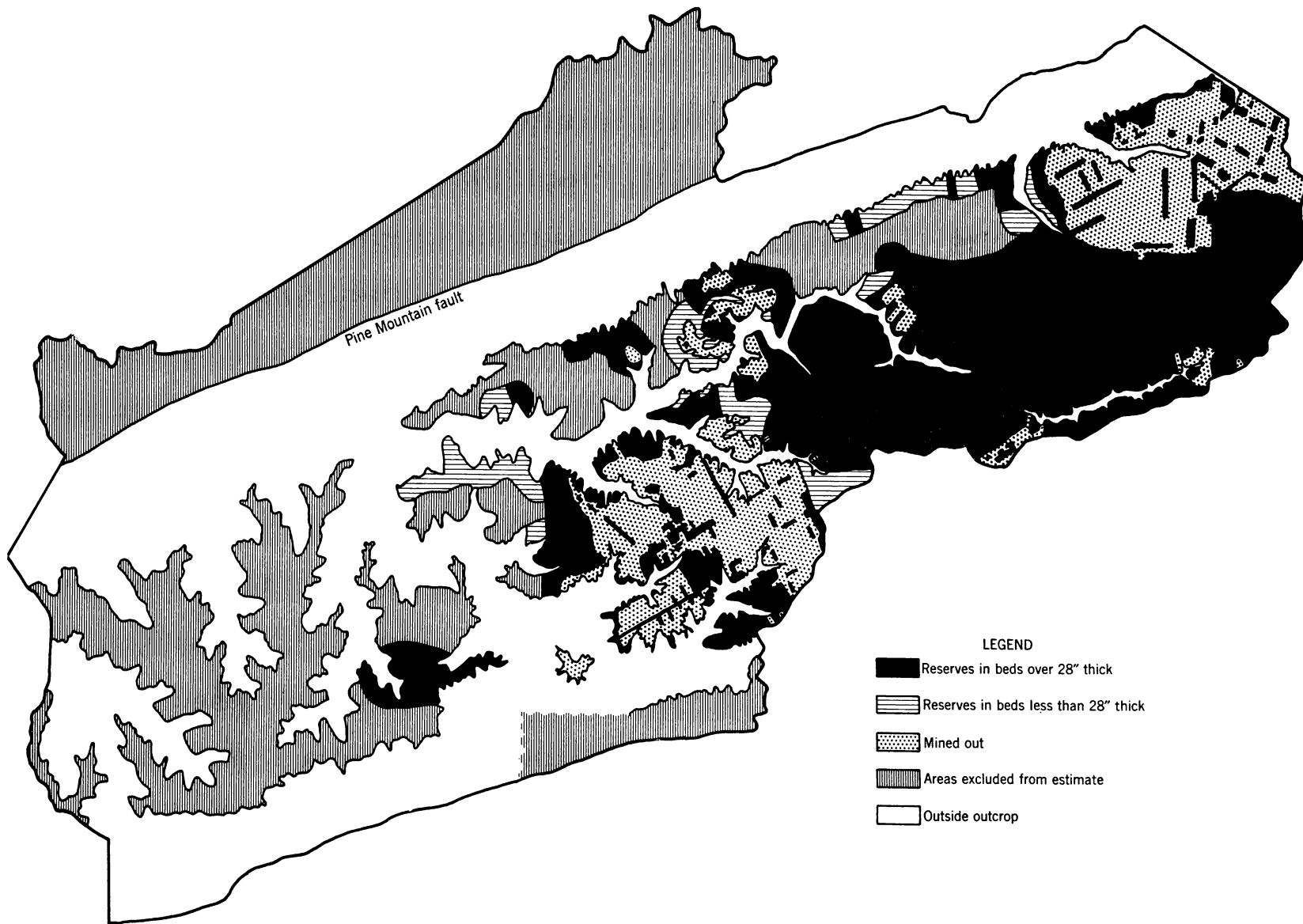


Figure 9. - Upper Elkhorn No. 3 bed, Harlan County, Ky., January 1, 1952.



D Bed

(See fig. 8 and table 7)

The D bed occurs from 10 to 60 feet above the Upper Elkhorn No. 3. The known recoverable reserves are in the eastern part of the county. It is multiple bedded and contains one or more partings. In this area, the seams below are being mined first. When the overburden is less than 100 feet, cracks have developed on the surface, indicating that part of this bed may be broken and not minable. In calculating the known recoverable reserves, 40 was used as the estimated percentage of recovery. Bed sections in areas of known recoverable reserves follow:

Eastern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	36	COAL .....	2
Shale .....	1/2	Bone .....	1-1/4
COAL .....	11	COAL .....	35-1/4
Shale .....	3	Shale .....	3/4
COAL .....	1	COAL .....	5
Shale .....	3	Bony coal .....	1/2
COAL .....	10	Bone .....	1/4
Thickness .....	<u>64-1/2</u>	Thickness .....	<u>45</u>
COAL .....	29	COAL .....	38
Shale .....	3/4	Shale .....	6
COAL .....	9	COAL .....	12
Thickness .....	<u>38-3/4</u>	Thickness .....	<u>56</u>
COAL .....	20	COAL .....	14
Shale and coal .....	5	Shale .....	1
COAL .....	7	COAL .....	32
Thickness .....	<u>32</u>	Thickness .....	<u>47</u>

Upper Elkhorn No. 3 Bed

(See fig. 9 and table 8)

The Upper Elkhorn No. 3 bed occurs about 400 feet above the Lower Elkhorn. From the standpoint of production and known recoverable reserves, it ranks second in importance to the Harlan bed in this county. The known recoverable reserves are in the central and eastern parts of the county. Generally, this bed occurs free of partings. However, it does split into two benches in places and in a short distance reappear as a single bench. Bed sections in areas of known recoverable reserves follow:

Central Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	<u>56</u>	COAL .....	<u>30</u>
Thickness .....	56	Thickness .....	30
COAL .....	18	COAL .....	5
Shale .....	6	Shale .....	5
COAL .....	12	COAL .....	24
Thickness .....	<u>36</u>	Thickness .....	<u>34</u>

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	34	COAL .....	30
Fire clay .....	1	Rash .....	3
COAL .....	11	COAL .....	3
Thickness .....	<u>46</u>	Thickness .....	<u>36</u>

Eastern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	28	COAL .....	47
Thickness .....	<u>28</u>	Thickness .....	<u>47</u>
COAL .....	20	COAL .....	10
Clay .....	1	Shale .....	2
COAL .....	43	COAL .....	44
Thickness .....	<u>64</u>	Thickness .....	<u>56</u>

Elkhorn Leader Bed

(See fig. 10 and table 9)

The Elkhorn Leader occurs about 20 feet below the Upper Elkhorn No. 3. It is not an important bed in this county. Diamond drilling shows the bed to be erratic in thickness. Four holes show the bed to be of minable thickness. Bed sections in areas of known recoverable reserves follow:

Eastern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	24	COAL .....	27
Parting .....	2	Shale .....	3
COAL .....	10	COAL .....	3
Thickness .....	<u>36</u>	Thickness .....	<u>33</u>
COAL .....	35	COAL .....	40
Thickness .....	<u>35</u>	Thickness .....	<u>40</u>

Upper Elkhorn No. 2 Bed

(See fig. 11 and table 10)

The Upper Elkhorn No. 2 bed occurs about 325 feet above the Lower Elkhorn. Generally, it is multiple bedded in the southern and central parts of the county and occurs as a single bed in the eastern part of the county. Bed sections in areas of known recoverable reserves follow:

Southwestern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	16	COAL .....	15
Shale .....	2	Shale .....	3-1/2
COAL .....	3	COAL .....	13-1/2
Shale .....	3	Rash .....	1
COAL .....	7	COAL .....	32-1/2
Thickness .....	<u>31</u>	Thickness .....	<u>65-1/2</u>

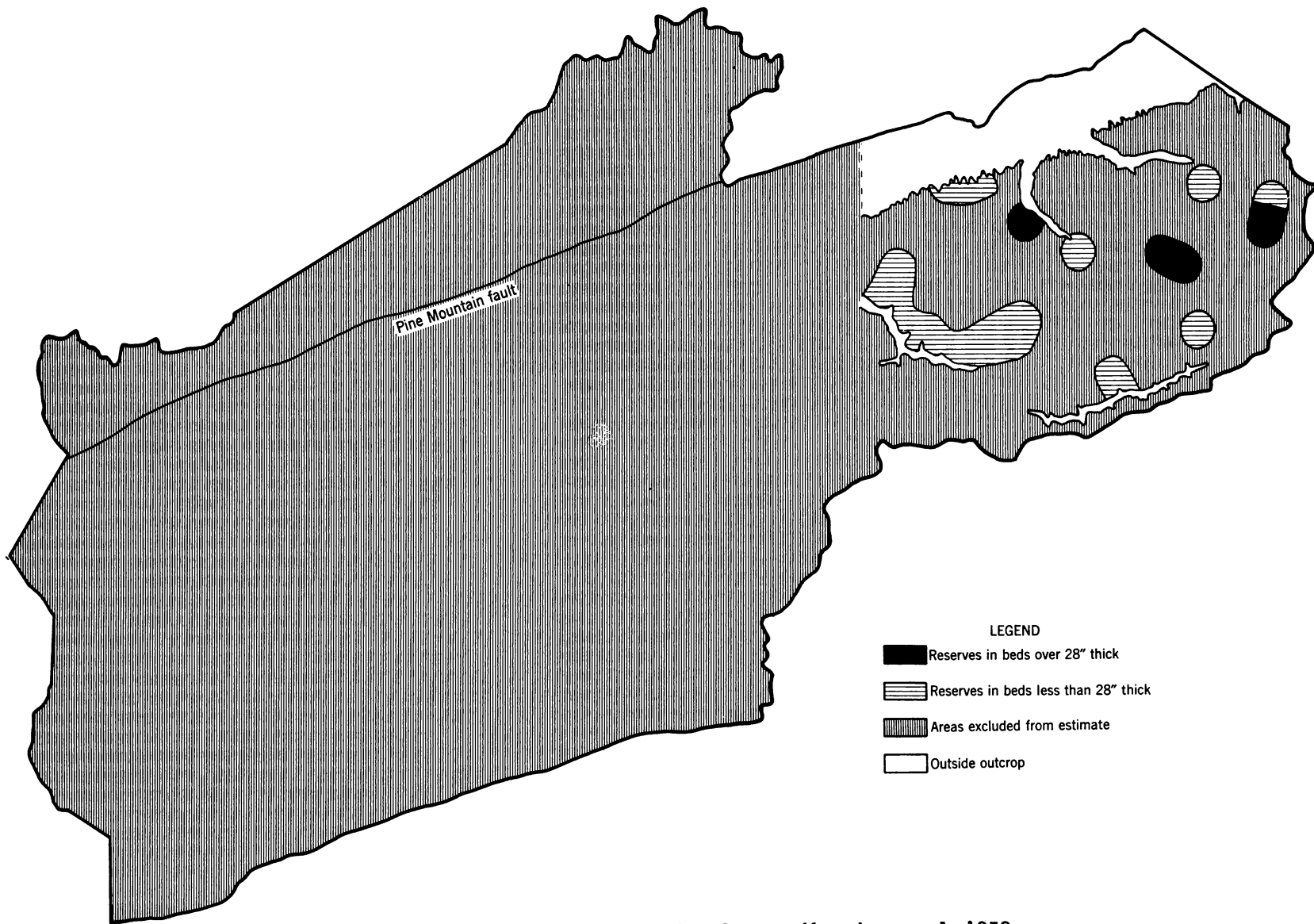


Figure 10. - Elkhorn Leader bed, Harlan County, Ky., January 1, 1952.





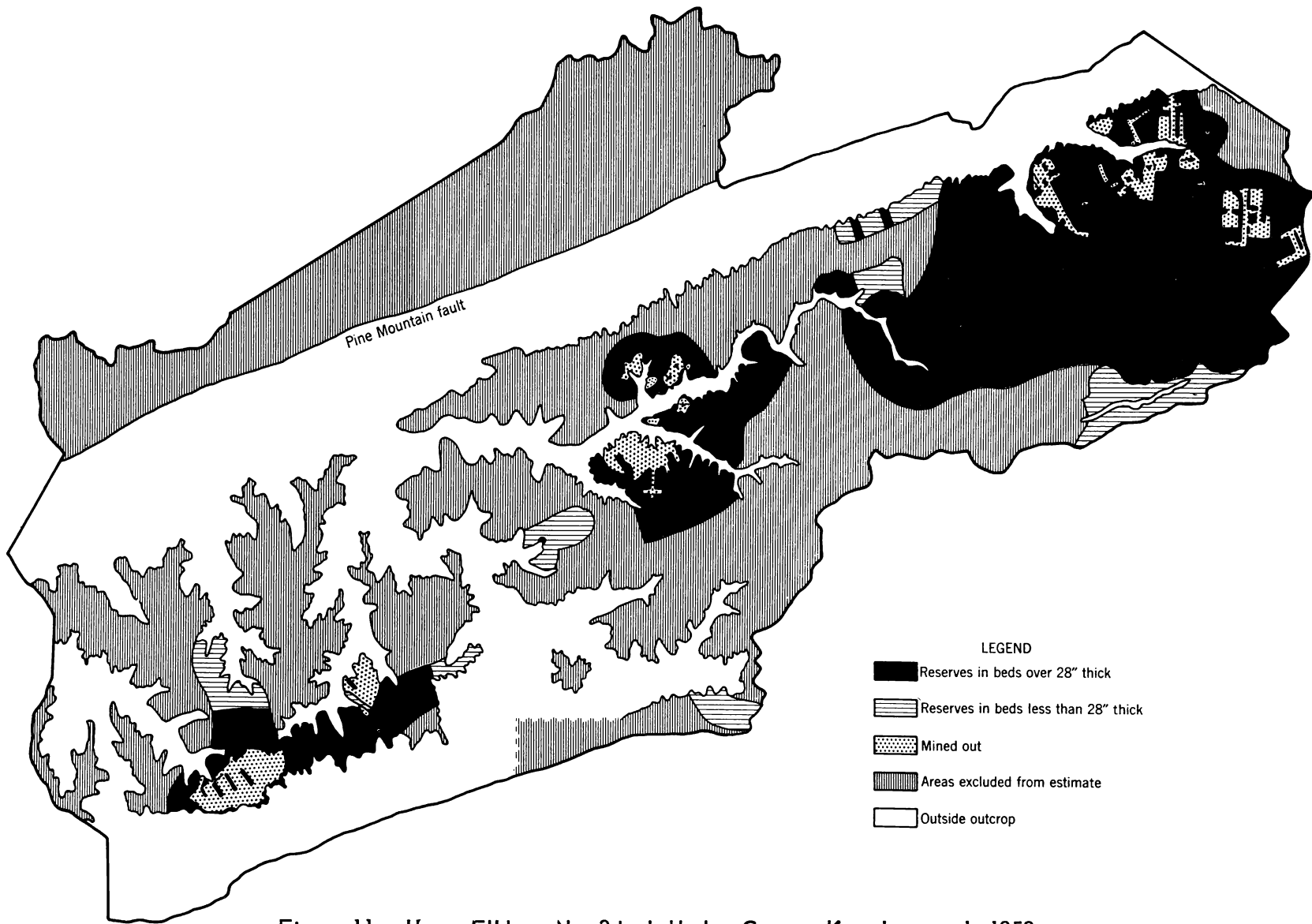


Figure 11. - Upper Elkhorn No. 2 bed, Harlan County, Ky., January 1, 1952



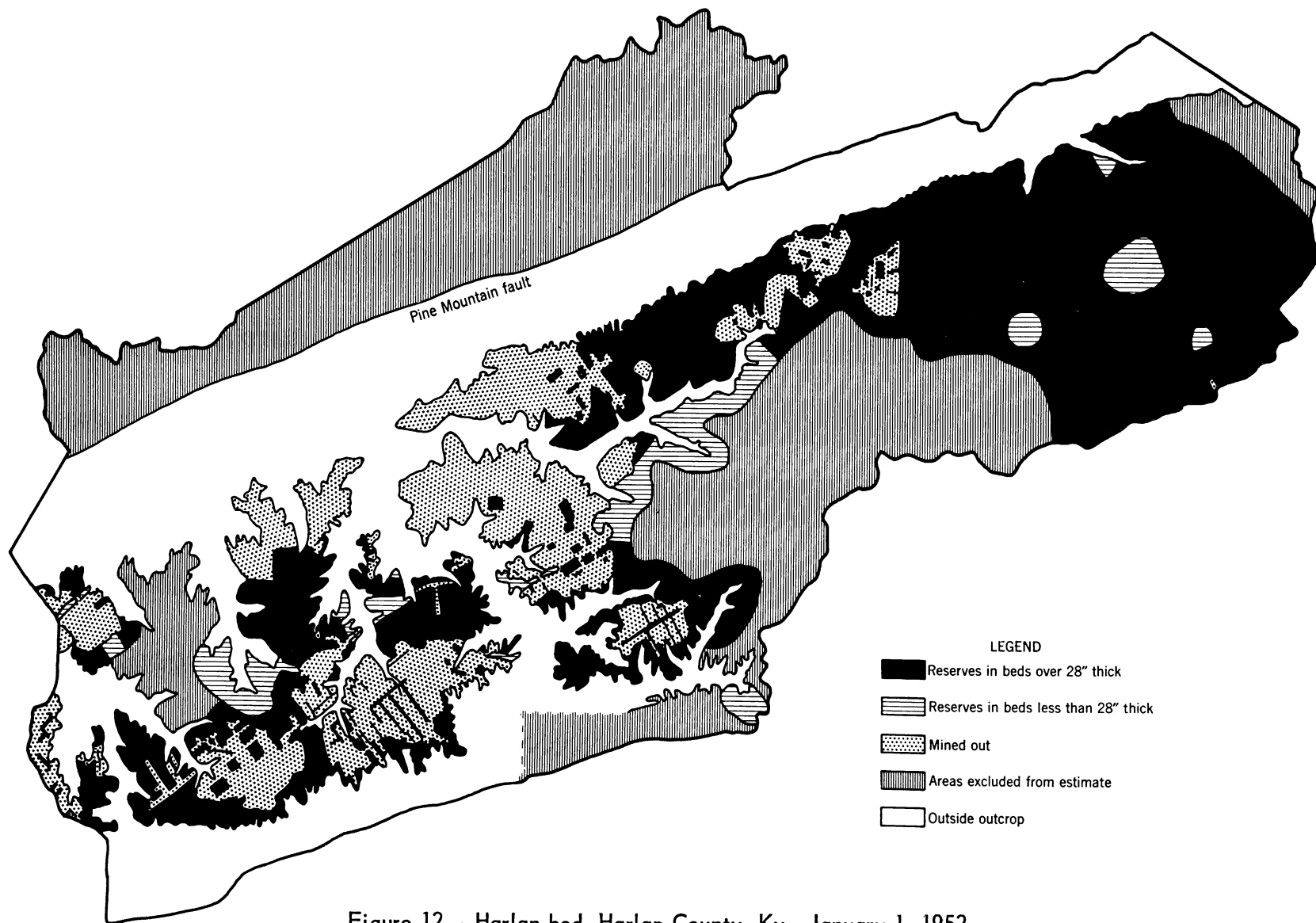


Figure 12. - Harlan bed, Harlan County, Ky., January 1, 1952.



<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	15-3/4	COAL .....	9
Shale .....	2-1/4	Parting .....	15
COAL .....	11	COAL .....	<u>42</u>
Clay .....	20	Thickness .....	66
COAL .....	<u>24-3/4</u>		
Thickness .....	73-3/4		

Central Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	26	COAL .....	13
Shale .....	7	Shale .....	1
COAL .....	5-1/2	COAL .....	<u>18</u>
Shale .....	4-1/2	Thickness .....	32
COAL .....	<u>7-1/2</u>		
Thickness .....	50-1/2	COAL .....	32
COAL .....	<u>30</u>	Parting .....	4
Thickness .....	30	COAL .....	<u>6</u>
		Thickness .....	42

Eastern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	15	COAL .....	17
Shale .....	4	Shale .....	11
COAL .....	<u>38</u>	COAL .....	<u>11</u>
Thickness .....	57	Thickness .....	39
COAL .....	<u>47</u>	COAL .....	8-1/2
Thickness .....	47	Fire clay .....	1-1/2
COAL .....	<u>28</u>	COAL .....	<u>42</u>
Thickness .....	28	Thickness .....	52

Harlan Bed

(See fig. 12 and table 11)

The Harlan bed occurs about 200 feet above the Lower Elkhorn. It is the most important bed from the standpoint of production and known recoverable reserves. Going east from Nolansburg quadrangle into Big Stone Gap quadrangle, the bed splits into two distinct beds by shale and sandstone ranging in thickness from 2 to 40 feet. Because of this thick parting, recoverable reserves have been estimated for the upper and lower splits of the Harlan and treated as separate beds. Bed sections in areas of known recoverable reserves follow:

Southwestern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	21	COAL .....	48
Shale .....	12	Thickness .....	48
COAL .....	<u>21</u>		
Thickness .....	54	COAL .....	<u>28</u>
		Thickness .....	28
COAL .....	13		
Shale .....	2	COAL .....	11-1/2
COAL .....	<u>19</u>	Shale .....	1/4
Thickness .....	34	COAL .....	8
		Shale .....	1/4
COAL .....	18	COAL .....	<u>15</u>
Rash .....	3/4	Thickness .....	35
COAL .....	<u>24</u>		
Thickness .....	42-3/4		

Central Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	10	COAL .....	22
Shale .....	1	Shale .....	14
COAL .....	<u>23</u>	COAL .....	<u>16</u>
Thickness .....	34	Thickness .....	52
COAL .....	<u>53</u>	COAL .....	12
Thickness .....	53	Shale .....	14
		COAL .....	36
COAL .....	<u>31</u>	Shale .....	1
Thickness .....	31	COAL .....	<u>18</u>
		Thickness .....	81
COAL .....	3		
Shale .....	1	COAL .....	9
COAL .....	5	Shale .....	2
Coal and shale .....	6	COAL .....	12
COAL .....	3	Shale .....	12
Shale .....	6-1/2	COAL .....	<u>12</u>
COAL .....	<u>26-1/2</u>	Thickness .....	47
Thickness .....	51		

Eastern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	24-1/2	COAL .....	12
Shale .....	2	Shale .....	1
COAL .....	<u>27-1/2</u>	COAL .....	18
Thickness .....	54	Shale .....	8
		COAL .....	5-1/2
COAL .....	17	Shale .....	3
Shale .....	3	COAL .....	3
COAL .....	9	Shale .....	2
Shale .....	3	COAL .....	4
COAL .....	<u>23</u>	Shale .....	2
Thickness .....	55	COAL .....	<u>14</u>
		Thickness .....	72-1/2

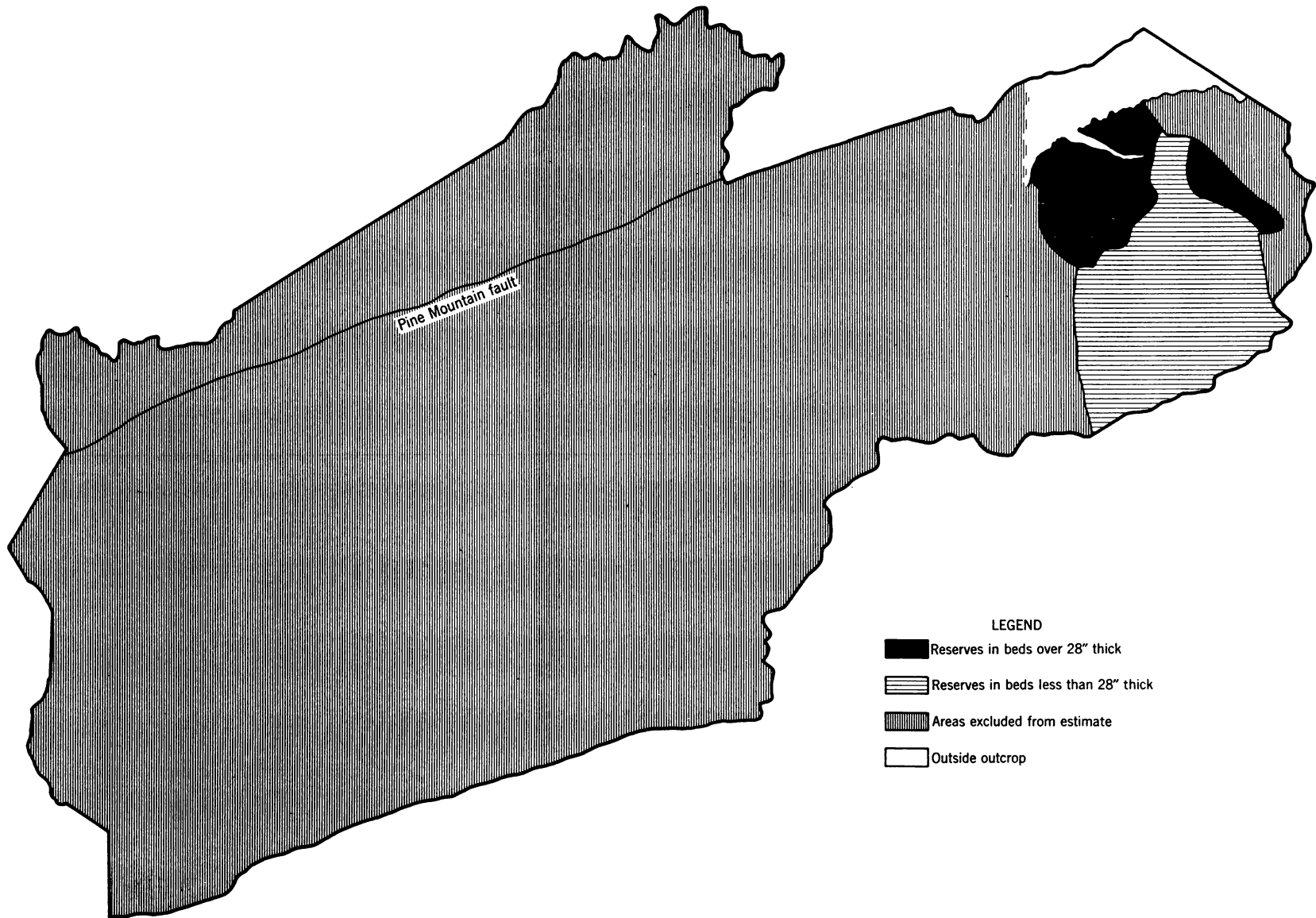


Figure 13. - Lower split of Harlan bed, Harlan County, Ky., January 1, 1952.





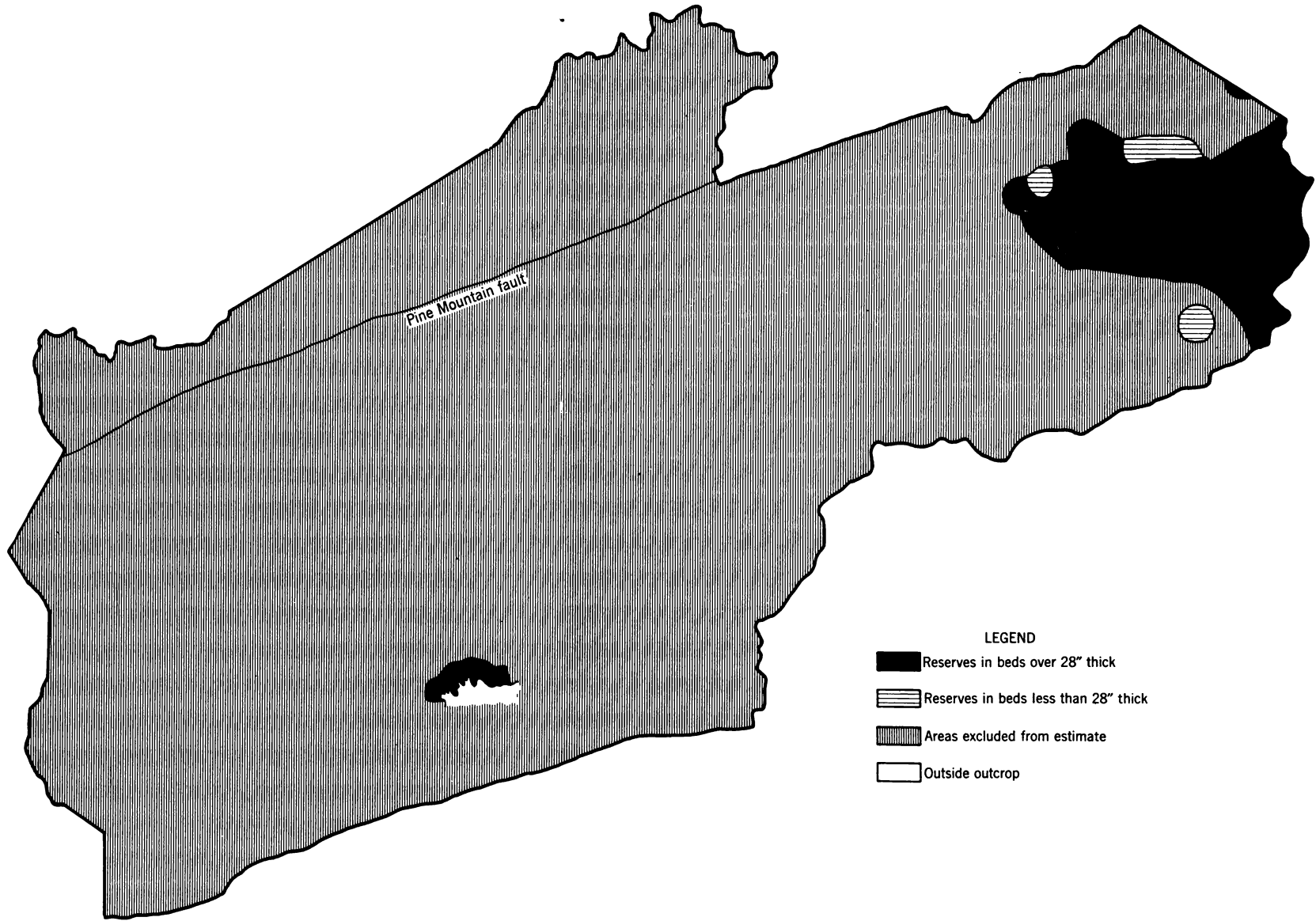


Figure 14. - Lower Elkhorn bed, Harlan County, Ky., January 1, 1952.



<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	28	COAL .....	17
Fire clay .....	2	Shale .....	10
COAL .....	8	COAL .....	27
Thickness .....	<u>38</u>	Thickness .....	<u>54</u>
COAL .....	16		
Shale .....	3		
COAL .....	13		
Thickness .....	<u>32</u>		

Lower Split of Harlan Bed

(See fig. 13 and table 12)

The Lower Split of Harlan bed occurs 2 to 40 feet below the upper split. Owing to this small interval, either the upper or lower bench will be lost in mining unless great care is taken in mining. A conservative figure of 40 percent recovery was used in estimating the known recoverable reserves. Bed sections in areas of known recoverable reserves follow:

Eastern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	9	COAL .....	28
Shale .....	1	Shale .....	15
COAL .....	3	COAL .....	33
Shale .....	2	Thickness .....	<u>76</u>
COAL .....	<u>38</u>		
Thickness .....	53		
COAL .....	<u>56</u>	COAL .....	<u>28</u>
Thickness .....	56	Thickness .....	28

Lower Elkhorn Bed

(See fig. 14 and table 13)

The Lower Elkhorn bed is below drainage level in Harlan County, except for the southern part of the county. Outcrop sections show clean coal from 29 to 40-1/2 inches. In the eastern part of the county, where it has been explored by drilling, the coal is clean and thick near the county line. Farther west, the bed is split by numerous partings. Bed sections in areas of known recoverable reserves follow:

Eastern Part of County

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	15-3/4	COAL .....	3
Coal and bone .....	3/4	Bone .....	1
COAL .....	2-3/4	Shale .....	1-1/2
Coal and bone .....	4-3/4	Bone .....	1/4
COAL .....	15-1/2	COAL .....	24-1/2
Shale .....	1/2	Bone .....	2
Coal and bone .....	3/4	COAL .....	2
COAL .....	4-3/4	Thickness .....	<u>34-1/4</u>
Thickness .....	<u>45-1/2</u>		

<u>Material</u>	<u>Inches</u>	<u>Material</u>	<u>Inches</u>
COAL .....	20	COAL .....	<u>36</u>
Bony coal .....	2-1/2	Thickness .....	36
COAL .....	2	COAL .....	<u>71</u>
Bone .....	3/4	Thickness .....	71
COAL .....	21-1/4	COAL .....	10
Bone .....	1/2	Shale .....	38
COAL .....	6-1/4	COAL .....	55-1/2
Bone .....	1-1/2	Shale .....	1-1/2
Shale .....	2	COAL .....	<u>4</u>
COAL .....	9-1/4	Thickness .....	109
Bone .....	3		
COAL .....	<u>3-3/4</u>		
Thickness .....	72-3/4		

#### ANALYSES OF HARLAN COUNTY COALS

The chemical analyses in table 15 are arranged stratigraphically for some of the major coal-producing beds and alphabetically according to the nearest town for each bed. They represent mine and tippie samples and were first published in Bureau of Mines Technical Paper 652, Analyses of Kentucky Coals. The coal, classified according to rank belongs in the high-volatile A bituminous group.

#### COKING PROPERTIES OF HARLAN COUNTY COALS

Eastern Kentucky coals are important in the iron and steel industries because they generally are low in ash and sulfur and yield an excellent coke when blended with coals of higher rank. They were coked many years in beehive ovens, and in 1918 ovens of this type in Kentucky yielded over 300,000 tons of coke.<sup>8/</sup> Today, their importance in the metallurgical field is indicated by the fact that in 1952 they constituted 13.4 percent of all coal carbonized in this country for the production of metallurgical coke.<sup>9/</sup> In this same year, the Harlan coal field, which is largely in Harlan County, supplied 5,862,067 tons, or 48.2 percent of the 12,171,787 tons of Kentucky coal shipped to coke plants in various parts of the United States.

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<sup>8/</sup> Tyron, F. G., Use and Distribution of Kentucky Coals: Bureau of Mines Tech. Paper 308, 1922, pp. 11-15.

<sup>9/</sup> Otero, Maxine M., DeCarlo, J. A., and Corgan, J. A., Coke and Coal Chemicals in 1952: Bureau of Mines Mineral Market Report, M.M.S. 2186, 1953, 25 pp.

TABLE 15. - Analyses of Harlan County coals

Location	Bed	Kind of sample <sup>1/</sup>	Size	As-received Moist.	Dry basis				
					Vol.	F.C.	Ash	Sul.	B.t.u.
1	2	3	4	5	6	7	8	9	10
Closplint	Hindman No. 9	M	-	4.0	40.0	56.5	3.5	0.6	14,380
Do.	do.	T	Plus 5-inch	3.9	38.8	57.3	3.9	.6	14,350
Do.	do.	T	5- by 2-inch	3.8	39.1	57.0	3.9	.4	14,320
Do.	do.	T	2-inch by 0	4.5	39.5	55.6	4.9	.5	14,210
High Splint	do.	M	-	4.8	37.6	56.1	6.3	.8	13,830
Louellen	do.	T	Plus 6-inch	4.4	38.3	58.1	3.6	.6	14,370
Do.	do.	T	6- by 2-inch	4.1	39.6	56.3	4.1	.6	14,230
Do.	do.	T	2-inch by 0	4.6	39.2	55.9	4.9	.7	14,060
Coalgood	Amburgy	T	Plus 6-inch	4.3	35.4	56.9	7.7	.8	13,600
Do.	do.	T	6- by 2-inch	4.2	37.9	56.4	5.7	1.0	13,980
Do.	do.	T	2-inch by 0	5.0	37.1	54.2	8.7	.9	13,490
Elcomb	do.	T	Plus 6-inch	2.5	37.2	55.8	7.0	1.0	14,100
Do.	do.	T	6- by 3-inch	2.4	37.7	56.0	6.3	.9	14,230
Do.	do.	T	3- by 1-inch	2.7	37.2	54.6	8.2	.9	13,960
Do.	do.	T	1-inch by 0	4.5	35.7	55.9	8.4	1.0	13,880
High Splint	do.	M	-	3.7	39.3	56.3	4.4	.7	14,360
Benham	Upper Elkhorn No. 3	M	-	2.5	38.5	59.1	2.4	.5	14,960
Evarts	do.	M	-	3.2	37.8	58.5	3.7	.8	14,460
Kenvir	do.	M	-	3.6	37.6	58.5	3.9	.7	14,520
Liggett	do.	M	-	3.2	37.7	56.1	6.2	1.1	14,090
Lynch	do.	M	-	2.5	35.5	60.3	4.2	.6	14,660
Ages	Upper Elkhorn No. 1 (Harlan)	M	-	2.8	38.0	57.6	4.4	1.1	14,350
Chevrolet	do.	M	-	2.6	37.7	58.7	3.6	.8	14,500
Coalgood	do.	M	-	2.9	38.6	57.9	3.5	.9	14,530
Do.	do.	T	Plus 6-inch	2.6	39.8	57.1	3.1	.8	14,690
Do.	do.	T	6- by 2-inch	2.5	39.1	57.4	3.5	.8	14,630
Do.	do.	T	2-inch by 0	3.4	36.7	56.9	6.4	.9	14,120
Coxton	do.	M	-	3.0	37.8	58.2	4.0	.9	14,380
Harlan	do.	M	-	2.8	38.4	58.3	3.3	.7	14,570
High Splint	do.	M	-	2.9	38.3	55.6	6.1	1.2	14,110
Lejunior	do.	M	-	3.0	37.4	56.7	5.9	1.1	14,120
Liggett	do.	M	-	3.7	38.3	59.3	2.4	.8	14,620
Yancey	do.	M	-	2.8	37.9	58.7	3.4	.7	14,560

<sup>1/</sup> M = mine sample; T = tipple sample.

The Elkhorn-bed coals, which yield most of the coal mined in Harlan County, contain relatively high proportions of volatile matter; consequently, they yield "fingery" coke when carbonized singly. However, both the size and stability of their coke are increased markedly by blending with low-volatile coking coals because blending minimizes fissuring. A sample of Elkhorn No. 1 (Harlan) from the Path Fork mine, Harlan County, yielded metallurgical-grade coke when carbonized as a blend with 20 percent Pocahontas No. 3 in Bureau of Mines pilot-scale coking tests.<sup>10/</sup> This sample contained 4.0 percent ash and 0.7 percent sulfur as carbonized. Pilot-scale carbonization tests also were made on Elkhorn No. 3-bed (Taggart) coal from Nos. 30 and 31 mines, Lynch, Harlan County, which ranked higher in the high-volatile A classification than the Path Fork coal.<sup>11/</sup> The blend of this coal with 20 percent Pocahontas No. 3 yielded coke that qualified both physically and chemically for blast furnace use. The coke-making property of the blend was improved only slightly by raising the proportion of low-volatile coal to 30 percent.

As the alternate name High Splint indicates, the Hindman bed contains a high proportion of splint that causes this coal to be hard and of low friability. Bureau of Mines investigations have shown that the minable coal in this bed at Closplint, Harlan County, is 53 percent splint and 14 percent semisplint and that this preponderance of splinty constituents affects the coking properties of the bed.<sup>12/</sup> In low-temperature assays of splint and bright coal separated manually from the column sample, the former yielded more coke and less gas and tar. The composite sample, which included both coal types, attained low fluidity in the plastic state but yielded well-fused coke when carbonized as a blend with 20 to 30 percent of the strongly coking, low volatile, Beckley-bed coal. Oxidation tests of this coal showed that its relative tendency to heat spontaneously in storage is high; therefore, significant degradation of its coke-making property probably would occur if it were stockpiled for long periods.<sup>13/</sup>

The Flag, Haddix, Fire Clay, and Amburgy coals of Harlan County are generally similar to the Elkhorns. They are relatively low in ash and sulfur, rank as high-volatile A bituminous, and contain the layers of splint that characterize the coal beds in this field. Presumably, these coals are suitable for metallurgical use if coked as blends with higher-rank coking coals.

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- <sup>10/</sup> Davis, J. D., Reynolds, D. A., Brewer, R. E., Wolfson, D. E., Naugle, B. W., Frederic, W. H., and Birge, G. S., Carbonizing Properties: Eastern Kentucky Coals from Elkhorn No. 1, Elkhorn No. 2, Leatherwood, and Harlan Beds: Bureau of Mines Bull. 511, 1952, 33 pp.
- <sup>11/</sup> Davis, J. D., Reynolds, D. A., Sprunk, G. C., and Holmes, C. R., Carbonizing Properties and Petrographic Composition of Taggart-Bed Coal from Mines 30 and 31, Lynch, Harlan County, Ky., and the Effect of Blending This Coal with Pocahontas No. 3- and No. 4-Bed Coals: Bureau of Mines Tech. Paper 650, 1943, 45 pp.
- <sup>12/</sup> Fieldner, A. C., Davis, J. D., Reynolds, D. A., Selvig, W. A., Sprunk, G. C., and Auvil, H. S., Carbonizing Properties and Petrographic Composition of High Splint-Bed Coal from the Closplint Mine, Closplint, Harlan County, Ky.: Bureau of Mines Tech. Paper 599, 1939, 38 pp.
- <sup>13/</sup> Elder, J. L., Schmidt, L. D., Steiner, W. A., and Davis, J. D., Relative Spontaneous Heating Tendencies of Coals: Bureau of Mines Tech. Paper 681, 1945, 24 pp.

APPENDIX

Completed reports giving results of studies by counties under part (1) of the investigation follow:

- DOWD, JAMES J., TURNBULL, LOUIS A., TOENGES, ALBERT L., COOPER, H. M., ABERNETHY, R. F., REYNOLDS, D. A., and FRASER, THOMAS. Estimate of Known Recoverable Reserves of Coking Coal in Cambria County, Pa. Bureau of Mines Rept. of Investigations 4734, 1950, 25 pp.
- DOWD, JAMES J., TURNBULL, LOUIS A., TOENGES, ALBERT L., COOPER, H. M., ABERNETHY, R. F., REYNOLDS, D. A., and CRENTZ, WILLIAM A. Estimate of Known Recoverable Reserves of Coking Coal in Indiana County, Pa. Bureau of Mines Rept. of Investigations 4757, 1950, 22 pp.
- DOWD, JAMES J., TURNBULL, LOUIS A., TOENGES, ALBERT L., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Pike County, Ky. Bureau of Mines Rept. of Investigations 4792, 1951, 34 pp.
- DOWD, JAMES J., TURNBULL, LOUIS A., TOENGES, ALBERT L., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Armstrong County, Pa. Bureau of Mines Rept. of Investigations 4801, 1951, 16 pp.
- DOWD, JAMES J., TURNBULL, LOUIS A., TOENGES, ALBERT L., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Westmoreland County, Pa. Bureau of Mines Rept. of Investigations 4803, 1951, 16 pp.
- DOWD, JAMES J., TURNBULL, LOUIS A., TOENGES, ALBERT L., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Fayette County, Pa. Bureau of Mines Rept. of Investigations 4807, 1951, 19 pp.
- DOWD, JAMES J., TURNBULL, LOUIS A., TOENGES, ALBERT L., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Floyd County, Ky. Bureau of Mines Rept. of Investigations 4813, 1951, 16 pp.
- DOWD, JAMES J., TOENGES, ALBERT L., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Jefferson County, Pa. Bureau of Mines Rept. of Investigations 4840, 1952, 18 pp.
- DOWD, JAMES J., TOENGES, ALBERT L., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Raleigh County, W. Va. Bureau of Mines Rept. of Investigations 4893, 1952, 37 pp.
- DOWD, JAMES J., TOENGES, ALBERT L., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Knott County, Ky. Bureau of Mines Rept. of Investigations 4897, 1952, 20 pp.
- WALLACE, JOSEPH J., DOWD, JAMES J., TAVENNER, WILLIAM H., PROVOST, JOHN M., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in McDowell County, W. Va. Bureau of Mines Rept. of Investigations 4924, 1952, 26 pp.
- WALLACE, JOSEPH J., DOWD, JAMES J., TAVENNER, WILLIAM H., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Wyoming County, W. Va. Bureau of Mines Rept. of Investigations 4966, 1953, 39 pp.

- WALLACE, JOSEPH J., DOWD, JAMES J., WILLIAMS, LLOYD, ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Allegany County, Md. Bureau of Mines Rept. of Investigations 4970, 1953, 18 pp.
- WALLACE, JOSEPH J., DOWD, JAMES J., BOWSHER, JOHN A., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Somerset County, Pa. Bureau of Mines Rept. of Investigations 4998, 1953, 20 pp.
- WALLACE, JOSEPH J., DOWD, JAMES J., TRAVIS, RAYMOND G., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Letcher County, Ky. Bureau of Mines Rept. of Investigations 5016, 1953, 26 pp.
- WALLACE, JOSEPH J., DOWD, JAMES J., PROVOST, JOHN M., ABERNETHY, R. F., and REYNOLDS, D. A. Estimate of Known Recoverable Reserves of Coking Coal in Allegheny County, Pa. Bureau of Mines Rept. of Investigations 5003, 1953, 16 pp.
- WILLIAMS, L., LOWE, ROBERT W., CARMAN, EVERETT P., CRENTZ, WILLIAM L., and TURNBULL, LOUIS A. Estimate of Known Recoverable Reserves of Coking Coal in Putnam County, Tenn., Carbonization and Preparation Properties of the Coal. Bureau of Mines Rept. of Investigations





