UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Text to accompany:

Open-File Report 79-777

1979

COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE SPRING CREEK RANCH QUADRANGLE, BIG HORN COUNTY, MONTANA

[Report includes 13 plates]

By

Colorado School of Mines Research Institute

This report has not been edited for conformity with U.S. Geological Survey editorial standards or stratigraphic nomenclature.

CONTENTS

ILLUSTRATIONS

[Plates are in pocket]

Page

TABLES

Conversion table

To convert	Multiply by	To obtain
feet	0.3048	meters (m)
miles	1.609	kilometers (km)
acres	0.40469	hectares (ha)
tons (short)	0.9072	metric tons (t)
short tons/acre-ft	7.36	metric tons/hectare-meter (t/ha-m)
Btu/lb	2.326	kilojoules/kilogram (kJ/kg)

INTRODUCTION

Purpose

This text is for use in conjunction with the Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) maps of the Spring Creek Ranch quadrangle, Big Horn County, Montana, (13 plates; U.S. Geological Survey Open-File Report 79-777). This set of maps was compiled to support the land-use planning work of the Bureau of Land Management in response to the Federal Coal Leasing Amendments Act of 1976 and to provide a systematic inventory of coal resources on Federal coal lands in Known Recoverable Coal Resource Areas (KRCRAs) in the western United States. The inventory includes only those beds of subbituminous coal that are 5 feet (1.5 m) or more thick and under less than 3,000 feet (914 m) of overburden and those beds of lignite that are 5 feet (1.5 m) or more thick and under less than 1,000 feet (305 m) of overburden.

Location

The Spring Creek Ranch 7 1/2-minute quadrangle is in eastern Big Horn County, Montana, about 34 miles (54.7 km) southeast of Hardin, Montana, a town in the valley of the Bighorn River near the confluence of the Bighorn River and the Little Bighorn River. Hardin is on U.S. Highway 212, U.S. Interstate Highway 90, and on the Chicago, Burlington, and Quincy Railroad.

Accessibility

The Spring Creek Ranch quadrangle is accessible from Hardin, Montana, by going first southward on U.S. Interstate Highway 90 and then eastward on U.S. Highway 212 for a total of about 39 miles (62.8 km) to the Rosebud Creek Road, thence southward on the Rosebud Creek Road about 15 miles (24.1 km), thence westward on an unimproved local road about 2 miles (3.2 km) to the eastern border of the quadrangle. The nearest mainline railroad is the Chicago, Burlington, and Quincy Railroad, which is about 12 miles (19.3 km) west of the quadrangle at

Lodge Grass, Montana. A branch of the railroad serves the Decker coal mine, which is about 16 miles (25.8 km) southeast of the quadrangle.

Physiography

The Spring Creek Ranch quadrangle is near the western edge of the Missouri Plateau Division of the Great Plains physiographic province where the nearly flat-lying strata of the plateau start to be upturned near the mountains. The quadrangle is on the eastern slope of the Wolf (Rosebud) Mountains which crest 1 to 3 miles (0.9 to 2.7 km) west of the quadrangle. The land surface is dissected and drained by four eastward-flowing tributaries of Rosebud Creek which flows northward about 0.5 to 1.5 miles (0.8 to 2.4 km) east of the quadrangle. The stream valleys have narrow flood plains from which the parallel interstream divides rise steeply about 500 feet (152 m) to rounded crests. The crests are devoid of trees which are generally limited to north-facing slopes in the northern part of the quadrangle.

The highest elevation, about 5,000 feet (1,524 m) is on an interstream divide in the southwestern part of the quadrangle. The lowest elevation, 3,800 feet (1,158 m), is close to the northeastern corner of the quadrangle. Topographic relief is about 1,200 feet (366 m).

Climate

The climate of Big Horn County is characterized by pronounced variations in seasonal precipitation and temperature. Annual precipitation in the region varies from less than 12 inches (30 cm) to about 16 inches (41 cm). The heaviest precipitation is from April to August. The largest average monthly precipitation is during June. Temperatures in eastern Montana range from as low as -50°F (-46°C) to as high as 110°F (43°C). The highest temperatures occur in July and the lowest in January; the mean annual temperature is about 45°F (7°C) (Matson and Blumer, 1973, p. 6).

Land status

The Boundary and Coal Data Map (pl. 2) shows the land ownership status within the Spring Creek Ranch quadrangle. All of the quadrangle except the eastern row of sections is within the Crow Indian Reservation. The two northeastern-most sections are within the Northern Cheyenne Indian Reservation. Federal coal lands are only found outside of the Indian Reservations. All of the land outside of the Indian Reservations is within the Northern Powder River Basin Known Recoverable Coal Resource Area (KRCRA). There were no outstanding Federal coal leases or prospecting permits recorded as of 1977.

GENERAL GEOLOGY

Previous work

Baker (1929, pl. 28) mapped that part of the Spring Creek Ranch quadrangle south and east of the Northern Cheyenne and Crow Indian Reservations as part of the northern extension of the Sheridan coal field. Matson and Blumer (1973, pls. 5-A, 5B, and 5C) remapped the coal beds in the same area.

Traces of coal outcrops shown by previous workers on planimetric maps that lack topographic control have been modified to fit the modern topographic map of the quadrangle.

Stratigraphy

A generalized columnar section of the coal-bearing rocks is shown on the Coal Data Sheet (pl. 3) of the CRO maps. The exposed bedrock units belong to the upper part of the Tongue River Member, the uppermost member of the Fort Union Formation (Paleocene).

The Tongue River Member is made up mainly of yellow sandstone, sandy shale, carbonaceous shale, and coal. Much coal has burned along outcrops, baking the overlying sandstone and shale and forming thick, reddish-colored clinker beds. The uppermost part of the Tongue River Member has been removed by erosion. The

uneroded lower part of the member is estimated to be as much as 1,500 feet (457 m) thick, but its exact thickness cannot be determined.

Coal and other rocks comprising the Tongue River Member were deposited in a continental environment at elevations of perhaps a few tens of feet (a few meters) above sea level in a vast area of shifting rivers, flood plains, sloughs, swamps, and lakes that occupied the area of the Northern Great Plains in Paleocene (early Tertiary) time.

Representative samples of the sedimentary rocks overlying and interbedded with minable coal beds in the eastern and northern Powder River Basin have been analyzed for their content of trace elements by the U.S. Geological Survey, and the results have been summarized by the U.S. Department of Agriculture and others (1974) and by Swanson (in Mapel and others, 1977, pt. A, p. 42-44). The rocks contain no greater amounts of trace elements of environmental concern than do similar rocks found throughout other parts of the western United States.

Structure

The Spring Creek Ranch quadrangle is in the western part of the Powder River structural basin. The coal beds and other strata in general dip eastward or southeastward at an angle of less than 2 degrees. In places this dip is modified by minor, low-relief folds and by faults as shown by the structure contour maps (pls. 4, 7, and 10). Some of the nonconformity in structure may be due to differential compaction and to irregularities in deposition of the coals and other beds as a result of their continental origin.

COAL GEOLOGY

The coal beds in the Spring Creek Ranch quadrangle are shown in outcrop on the Coal Data Map (pl. 1) and in section on the Coal Data Sheet (pl. 3). All of the mapped coal beds occur in the upper part of the Tongue River Member of the Fort Union Formation. No commercial coals are found below the Tongue River Member.

The lowermost recognized coal bed is the Wall coal bed. The Wall coal bed is overlain successively by a noncoal interval of 13 feet (4 m), a local coal bed, a noncoal interval of about 175 to 200 feet (53 to 61 m), the Canyon coal bed, a noncoal interval of about 200 feet (61 m), the Dietz 2 and 3 coal beds, a noncoal interval of about 200 feet (61 m), and the Anderson (Dietz 1) clinker bed.

The trace element content of coals in this quadrangle has not been determined; however, coals in the Northern Great Plains, including those in the Fort Union Formation in Montana, have been found to contain, in general, appreciably lesser amounts of most elements of environmental concern than coals in other areas of the United States (Hatch and Swanson, 1977, p. 147).

Wall coal bed

The Wall coal bed was named by Baker (1929, p. 37), probably from exposures of the coal along Wall Creek, a tributary of the Tongue River, about 19 miles (30.6 km) east of the Spring Creek Ranch quadrangle in the Birney quadrangle. This coal bed crops out only in the northeastern part of the quadrangle where it was mapped by Baker (1929, pl. 8) and by Matson and Blumer (1973, pl. 5-A). The coal is generally burned near the surface and there are no measurements of coal at the surface. The isopach and structure contour map of the Wall coal bed (pl. 10) was constructed by using the data in adjacent quadrangles. This map shows that the Wall coal bed ranges from about 5 to 50 feet (1.5 to 15 m) in thickness and dips southeastward at a low angle where it is not affected by minor, low-relief folding. Overburden on the Wall coal bed (pl. 11) ranges from zero at the outcrops to about 650 feet (198 m) in thickness. There are no known publicly available chemical analyses of the Wall coal in or close to the Spring Creek Ranch quadrangle. However, it is assumed that the Wall coal is similar to other closely associated coals in the quadrangle and is subbituminous C in rank.

Local coal bed

A local coal bed of limited areal extent, 5 feet (1.5 m) thick, occurs 18 feet (5.5 m) above the Wall coal bed in sec. 19, T. 6 S., R. 39 E. (Matson and Blumer, pl. 5A). Economic coal resources have not been assigned to this local coal bed.

Canyon coal bed

The Canyon coal bed was first described by Baker (1929, p. 36) from exposures in the northern extension of the Sheridan coal field, although a type locality was not given. In the Spring Creek Ranch quadrangle, the Canyon coal bed occurs about 185 to 210 feet (56 to 64 m) above the Wall coal bed. A clinker bed formed by the burning of this coal crops out on the lower slopes of the hills. Because the coal is generally burned, there is only one measurement of its thickness in the quadrangle. The isopach and structure contour map of the Canyon coal bed (pl. 7) is based to a considerable extent on measurements in adjacent quadrangles. This map shows that the Canyon coal bed ranges in thickness from less than 5 feet (1.5 m) to possibly as much as 30 feet (9 m) in thickness and dips eastward or southeastward at a gentle angle where it is not affected by minor, low-relief folding. Overburden on the Canyon coal bed (pl. 8) ranges from about 50 to 400 feet (15 to 122 m) in thickness. There is no known, publicly available chemical analysis of the Canyon coal in the Spring Creek Ranch quadrangle. However, a chemical analysis of this coal in coal test hole SH-36, sec. 16, T. 6 S., R. 39 E., about 1.7 miles (2.7 km) east of this quadrangle in the Kirby quadrangle (Matson and Blumer, 1973, p. 34) shows ash 3.243 percent, sulfur 0.026 percent, and heating value 9,113 Btu per pound (21,197 kJ/kg) on an as-received basis. This heating value converts to about 9,418 Btu per pound (21,906 kJ/kg) on a moist, mineral-matter-free basis, indicating that the Canyon coal at this location is subbituminous C in rank. Because of the proximity of

this location to the Spring Creek Ranch quadrangle, it is assumed that the Canyon coal in this quadrangle is similar and is subbituminous C in rank.

Dietz 2 and 3 coal beds

The Dietz 1, 2, and 3 coal beds were first described by Taff (1909, p. 139-140) from exposures in the Sheridan coal field, Wyoming. The coal bed which Baker (1929, pl. 28) mapped as the Anderson coal bed in the Spring Creek Ranch quadrangle was remapped by Matson and Blumer (1973, pl. 5B) as the Dietz coal beds (upper or combined benches). Matson and Blumer (1973, pl. 5A) mapped a higher bed near the south border of the quadrangle as the Anderson coal bed. Faults, unsuspected by Baker, were revealed by coal test holes drilled to support the field mapping of Matson and Blumer. These authors (1973, p. 31) state, "Extensive field work and interpretations were required on the Kirby area because of the structural complexity. Drilling was begun during the 1969 field season, and additional holes were drilled during the 1970 field season. In midwinter 1972-73, more holes were drilled to verify some of the interpretations and to assist in final preparation of the maps." The compiled maps accompanying this report follow the interpretations of Matson and Blumer (1973, pls. 5A and 5B). We believe that the two combined Dietz benches mapped by Matson and Blumer are equivalent to the Dietz 2 and 3 of Taff, and that the overlying Anderson coal bed includes the Dietz 1 of Taff.

In the Spring Creek Ranch quadrangle, the Dietz 2 and 3 coal beds occur about 200 feet (61 m) above the Canyon coal bed. The Dietz coal has been extensively burned, and unburned coal is believed to occur only in the southern part of the quadrangle (pl. 1). The isopach and structure contour map of the Dietz 2 and 3 coal beds (pl. 4), based principally on measurements in adjacent quadrangles, shows that this coal ranges from about 35 to 40 feet (10.7 to 12.2 m) in thickness and dips southwest at a very gentle angle. Overburden on the Dietz 2

and 3 coal beds (pl. 5) ranges from about 60 to 250 feet (18 to 76 m) in thickness.

There is no known, publicly available chemical analysis of the Dietz 2 and 3 coal beds in the Spring Creek Ranch quadrangle. However, a chemical analysis of this coal from a depth of 89 to 99 feet (27 to 30 m) in coal test hole SH-35, sec. 14, T. 6 S., R. 39 E., about 3.25 miles (5.2 km) east of the Spring Creek Ranch quadrangle in the Kirby quadrangle (Matson and Blumer, 1973, p. 34) shows ash 6.684 percent, sulfur 0.000 percent, and heating value 8,383 Btu per pound (19,499 kJ/kg) on an as-received basis. This heating value converts to about 8,983 Btu per pound (20,894 kJ/kg) on a moist, mineral-matter-free basis, indicating that the coal at this location is subbituminous C in rank. Because of the proximity of this location to the Spring Creek Ranch quadrangle, it is assumed that the Dietz 2 and 3 coal in this quadrangle is similar and is also subbituminous C in rank.

Anderson (Dietz 1) clinker bed

The reddish-colored clinker bed which caps a small ridge near the southern border of the quadrangle has been formed by burning of the Anderson (Dietz 1) coal bed. There is no unburned Anderson (Dietz 1) coal in this quadrangle, and consequently economic coal resources have not been assigned to this coal bed.

COAL RESOURCES

Data from all publicly available drill holes and from surface mapping by others (see list of references) were used to construct outcrop, isopach, and structure contour maps of the coal beds in this quadrangle.

A coal resource classification system has been established by the U.S. Bureau of Mines and the U.S. Geological Survey in U.S. Geological Survey Bulletin 1450-B (1976). Coal resource is the estimated gross quantity of coal in the ground that is now economically extractable or that may become so. Resources are

classified as either Identified or Undiscovered. Identified Resources are specific bodies of coal whose location, rank, quality, and quantity are known from geologic evidence supported by specific measurements. Undiscovered Resources are bodies of coal which are surmised to exist on the basis of broad geologic knowledge and theory.

Identified Resources are further subdivided into three categories of reliability of occurrence, namely Measured, Indicated, and Inferred, according to their distance from a known point of coal-bed measurement. Measured coal is coal located within 0.25 mile (0.4 km) of a measurement point, Indicated coal extends 0.5 mile (0.8 km) beyond Measured coal to a distance of 0.75 mile (1.2 km) from the measurement point, and Inferred coal extends 2.25 miles (3.6 km) beyond Indicated coal to a distance of 3 miles (4.8 km) from the measurement point.

Undiscovered Resources are classified as either Hypothetical or Speculative. Hypothetical Resources are those undiscovered coal resources in beds that may reasonably be expected to exist in known coal fields under known geologic conditions. In general, Hypothetical Resources are located in broad areas of coal fields where the coal bed has not been observed and the evidence of coal's existence is from distant outcrops, drill holes, or wells that are more than 3 miles (4.8 km) away. Hypothetical Resources are located beyond the outer boundary of the Inferred part of Identified Resources in areas where the assumption of continuity of the coal bed is supported only by extrapolation of geologic evidence. Speculative Resources are undiscovered resources that may occur in favorable areas where no discoveries have been made. Speculative Resources have not been estimated in this report.

For purposes of this report, Hypothetical Resources of subbituminous coal are in coal beds which are 5 feet (1.5 m) or more thick, under less than 3,000 feet (914 m) of overburden, but occur 3 miles (4.8 km) or more from a coal-bed measurement.

Reserve Base coal is that economically minable part of Identified Resources from which Reserves are calculated. In this report, Reserve Base coal is the gross amount of Identified Resources that occurs in beds 5 feet (1.5 m) or more thick and under less than 3,000 feet (914 m) of overburden for subbituminous coal.

Reserve Base coal may be either surface-minable coal or underground-minable coal. In this report, surface-minable Reserve Base coal is subbituminous coal that is under less than 500 feet (152 m) of overburden (stripping limit). In this report, underground-minable Reserve Base coal is subbituminous coal that is under more than 500 feet (152 m), but less than 3,000 feet (914 m) of overburden.

Reserves are the recoverable part of Reserve Base coal. In this area, 85 percent of the surface-minable Reserve Base coal is considered to be recoverable (a recovery factor of 85 percent). Thus, these Reserves amount to 85 percent of the surface-minable Reserve Base coal. For economic reasons coal is not presently being mined by underground methods in the Northern Powder River Basin. Therefore, the underground-mining recovery factor is unknown and Reserves have not been calculated for the underground-minable Reserve Base coal.

Tonnages of coal resources were estimated using coal-bed thicknesses obtained from the coal isopach map for each coal bed (see list of illustrations). The coal resources, in short tons, for each isopached coal bed are the product of the acreage of coal (measured by planimeter), the average thickness in feet of the coal bed, and a conversion factor of 1,770 short tons of subbituminous coal per acre-foot (13,018 metric tons per hectare-meter). Tonnages of coal in Reserve Base, Reserves, and Hypothetical categories, rounded to the nearest one-hundredth of a million short tons for each coal bed, are shown on the Areal Distribution and Tonnage maps (see list of illustrations).

As shown by table 1, the total tonnage of federally owned, surface-minable Reserve Base coal in this quadrangle is estimated to be 230.72 million short tons (209.31 million t). The total tonnage of federally owned, surface-minable Hypothetical coal is estimated to be 0.74 million short tons (0.67 million t). As shown by table 2, the total federally owned, underground-minable Reserve Base coal is estimated to be 11.60 million short tons (10.52 million t). There is no federally owned, underground-minable Hypothetical coal. The total tonnage of surface- and underground-minable Reserve Base coal is 242.32 million short tons (219.83 million t), and the total of surface- and underground-minable Hypothetical coal is 0.74 million short tons (0.67 million t).

About 3 percent of the surface-minable Reserve Base tonnage is classed as Measured, 42 percent as Indicated, and 55 percent as Inferred. All of the underground-minable Reserve Base tonnage is Inferred.

The total tonnages per section for both Reserve Base and Hypothetical coal, including both surface- and underground-minable coal are shown in the northwest corner of the Federal coal lands in each section on plate 2. All numbers on plate 2 are rounded to the nearest one-hundredth of a million short tons.

COAL DEVELOPMENT POTENTIAL

There is a potential for surface-mining in the Northern Powder River Basin in areas where subbituminous coal beds 5 feet (1.5 m) or more thick are overlain by less than 500 feet (152 m) of overburden, or where lignite beds of the same thickness are overlain by 200 feet (61 m) or less of overburden. Areas having a potential for surface mining were assigned a high, moderate, or low development potential based on their mining-ratios (cubic yards of overburden per short ton of recoverable coal).

The formula used to calculate mining-ratio values for subbituminous coal is:

$$MR = \frac{t_o\ (cf)}{t_c\ (rf)}$$

where MR = mining ratio
t_o = thickness of overburden, in feet
t_c = thickness of coal, in feet
rf = recovery factor = 0.85 in this area
cf = conversion factor = 0.911 cu. yds./ short ton for subbituminous coal

The mining-ratio values are used to rate the degree of potential that areas within the stripping limit have for surface-mining development. Areas having mining-ratio values of 0 to 10, 10 to 15, and greater than 15 are considered to have high, moderate, and low development potential, respectively. This grouping of mining-ratio values was provided by the U.S. Geological Survey and is based on economic and technological criteria. Mining-ratio contours and the stripping-limit overburden isopach, which serve as boundaries for the development-potential areas, are shown on the overburden isopach and mining-ratio contour plates. Estimated tonnages of surface-minable Reserve Base and Hypothetical coal resources in each development-potential category (high, moderate, and low) are shown in table 1.

Estimated tonnages of underground-minable coal resources are shown in table 2. Because coal is not presently being mined by underground mining in the Northern Powder River Basin for economic reasons, for purposes of this report all of the underground-minable coal resources are considered to have low development potential.

Development potential for surface-mining methods

The Coal Development Potential (CDP) map included in this series of maps pertains only to surface mining. It depicts the highest coal development-potential category which occurs within each smallest legal subdivision of land (normally about 40 acres or 16.2 ha). For example, if such a 40-acre

(16.2-ha) tract of land contains areas of high, moderate, and low development potential, the entire tract is assigned to the high development-potential category for CDP mapping purposes. Alternatively, if such a 40-acre (16.2-ha) tract of land contains areas of moderate, low, and no development potential, the entire tract is assigned to the moderate development-potential category for CDP mapping purposes. For practical reasons, the development-potential categories of areas of coal smaller than 1 acre (0.4 ha) have been disregarded in assigning a development potential to the entire 40-acre (16.2-ha) tract.

In areas of moderate to high topographic relief, the area of moderate-development potential for surface mining of a coal bed (area having mining-ratio values of 10 to 15) is often restricted to a narrow band between the high and low development-potential areas. In fact, because of the 40-acre (16.2-ha) minimum size of coal development-potential tracts, the narrow band of moderate development-potential area often does not appear on the CDP map because it falls within the 40-acre (16.2-ha) tracts that also include areas of high development potential. The Coal Development Potential (CDP) map then shows areas of low development potential abutting against areas of high development potential.

The coal development potential that the Federal coal lands have for surface-mining methods is shown on the Coal Development Potential map (pl. 13). Most of the Federal coal lands have a high development potential for surface mining. Scattered tracts have a moderate or low development potential, and only one small tract has no development potential.

The Wall coal bed (pl. 11) has a high development potential over a considerable part of the Federal lands extending from the boundary of the coal to the 10 mining-ratio contour or to the arbitrarily assigned stripping limit at the 500-foot overburden isopach.

The Canyon coal bed (pl. 8) has limited areas of high development potential on the hill slopes extending from the boundary of the coal to the 10 mining-ratio contour. The Canyon bed also has narrow bands of moderate development potential between the 10 and 15 mining-ratio contours, and wider areas of low development potential extending above the 15 mining-ratio contour to the crests of the hills.

The Dietz 2 and 3 coal beds have a limited area of high development potential in the southeastern part of the quadrangle. This area extends from the boundary of the unburned coal to the crests of the hills.

About 87 percent of the Federal coal lands in the quadrangle have a high development potential for surface mining, 6 percent have a moderate development potential, and about 1 percent have a low development potential.

Development potential for underground mining and in-situ gasification

Subbituminous coal beds 5 feet (1.5 m) or more in thickness lying more than 500 feet (152 m) but less than 3,000 feet (914 m) below the surface are considered to have development potential for underground mining. Estimates of the tonnage of underground-minable coal are listed in table 2 by development-potential category for each coal bed. Coal is not currently being mined by underground methods in the Northern Powder River Basin because of poor economics. Therefore, the coal development potential for underground mining of these resources for purposes of this report is rated as low, and a Coal Development Potential map for underground mining was not made.

In-situ gasification of coal on a commercial scale has not been done in the United States. Therefore, the development potential for in-situ gasification of coal found below the surface-mining limit in this area is rated as low, and a Coal Development Potential map for in-situ gasification of coal was not made.

Table 1.--Surface-minable coal resource tonnage (in short tons) by development-potential category for Federal coal lands in the Spring Creek Ranch quadrangle, Big Horn County, Montana

[Development potentials are based on mining ratios (cubic yards of overburden/short ton of recoverable coal). To convert short tons to metric tons, multiply by 0.9072]

Coal bed	High development potential (0-10 mining ratio)	Moderate development potential (10-15 mining ratio)	Low development potential (>15 mining ratio)	Total
Reserve Base tonnage				
Dietz 2 and Dietz 3	15,970,000	0	0	15,970,000
Canyon	6,630,000	5,590,000	9,970,000	22,190,000
Wall	87,440,000	67,990,000	37,130,000	192,560,000
Total	110,040,000	73,580,000	47,100,000	230,720,000
Hypothetical Resource tonnage				
Canyon	740,000	0	0	740,000
Total	740,000	0	0	740,000
Grand Total	110,780,000	73,580,000	47,100,000	231,460,000

Table 2.--Underground-minable coal resource tonnage (in short tons) by development-potential category for Federal lands in the Spring Creek Ranch quadrangle, Big Horn County, Montana

[To convert short tons to metric tons, multiply by 0.9072]

Coal bed	High Development potential	Moderate development potential	Low development potential	Total
Reserve Base tonnage				
Wall	0	0	11,600,000	11,600,000
	0	0	11,600,000	11,600,000
Hypothetical Resource tonnage				
	0	0	0	0
Total	0	0	0	0
Grand Total	0	0	11,600,000	11,600,000

REFERENCES

Baker, A. A., 1929, The northward extension of the Sheridan coal field, Big Horn and Rosebud Counties, Montana: U.S. Geological Survey Bulletin 806-B, p. 15-67.

Hatch, J. R., and Swanson, V. E., 1977, Trace elements in Rocky Mountain coals, in Proceedings of the 1976 symposium, Geology of Rocky Mountain coal, 1977: Colorado Geological Survey, Resource Series 1, p. 143-163.

Mapel, W. J., Swanson, V. E., Connor, J. J., Osterwald, F. W., and others, 1977, Summary of the geology, mineral resources, environmental geochemistry, and engineering geologic characteristics of the northern Powder River coal region, Montana: U.S. Geological Survey Open-File Report 77-292.

Matson, R. E., and Blumer, J. W., 1973, Quality and reserves of strippable coal, selected deposits, southeastern Montana: Montana Bureau of Mines and Geology Bulletin 91, 135 p.

Taff, J. A., 1909, The Sheridan coal field, Wyoming: U.S. Geological Survey Bulletin 341, p. 123-150.

U.S. Bureau of Mines and U.S. Geological Survey, 1976, Coal resource classification system of the U.S. Bureau of Mines and U.S. Geological Survey: U.S. Geological Survey Bulletin 1450-B, 7 p.

U.S. Department of Agriculture, Interstate Commerce Commission, and U.S. Department of the Interior, 1974, Final environmental impact statement on proposed development of coal resources in the eastern Powder River coal basin of Wyoming: v. 3, p. 39-61.