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COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE COOK CREEK BUTTE QUADRANGLE ROSEBUD AND BIG HORN COUNTIES, MONTANA

[Report includes 13 plates]

By

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To convert	Multiply by	To obtain
feet	0.3048	meters (m)
miles	1.609	kilometers (km)
acres	0.40469	hectares (ha)
tons (short)	0.907	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 Cook Creek Butte quadrangle, Rosebud and Big Horn Counties, Montana, (13 plates; U.S. Geological Survey Open-File Report 79-646). 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 Cook Creek Butte 7 1/2-minute quadrangle is in southern Rosebud County and eastern Big Horn County, Montana, about 45 miles (72 km) southeast of Hardin, Montana, a town in Bighorn River valley. Hardin is on U.S. Highway 212, U.S. Interstate 90, and on the Chicago, Burlington, and Quincy Railroad.

Accessibility

The Cook Creek Butte quadrangle is accessible from Hardin, Montana, by going southward on U.S. Interstate 90 and then eastward on U.S. Highway 212 for a total of about 53 miles (85.2 km) to the Muddy Creek Road, thence southward on the Muddy Creek Road about 18 miles (30 km), thence eastward on an unimproved local road about 5 miles (8 km) to the western border of the quadrangle. The nearest mainline railroad is the Chicago, Burlington, and Quincy Railroad about 36 miles (57.9 km) west of the quadrangle at Crow Agency in the Little Bighorn River

valley. A branch of the railroad serves the Decker coal mine which is about 22 miles (35.4 km) south-southwest of the quadrangle in the Tongue River valley.

Physiography

The Cook Creek Butte quadrangle is within the Missouri Plateau Division of the Great Plains physiographic province. However, the upland surface has been trenched with deep valleys bordered in places by precipitous slopes. The southeastern part of the quadrangle is drained and dissected by eastward-flowing Cook Creek, a long tributary of the Tongue River which it joins 6 to 10 miles (9.6 to 16 km) southeast of the quadrangle. The northern part of the quadrangle is drained by tributaries of Rosebud Creek which is about 8 miles (12.9 km) northwest of the quadrangle. Rosebud Creek and the Tongue River both flow northeastward and northward to the Yellowstone River. The divide between these two major drainages extends from the west-central border to the northeastern corner of the quadrangle as a series of irregular mesas. Cook Creek Butte, elevation 4,505 feet (1,373 m), the highest point in the quadrangle, projects slightly above the level of the mesas. The lowest elevation, 3,450 feet (1,052 m), is on Cook Creek at the eastern border of the quadrangle. Topographic relief within the quadrangle is about 1,055 feet (321.6 m).

Climate

The climate of Rosebud and Big Horn Counties 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 Cook Creek Butte quadrangle. In the southeastern part of the quadrangle, the southern boundary of the Northern Cheyenne Indian Reservation is formed by Cook Creek, and in the southwestern corner of the quadrangle the Reservation boundary turns southward and follows the Rosebud-Bighorn County line. Only the area south and east of the Reservation contains Federal coal lands and has been mapped for coal. The Northern Powder River Basin Known Recoverable Coal Resource Area (KRCRA) covers this area and abuts against the Northern Cheyenne Indian Reservation. There were no outstanding Federal coal leases or prospecting permits recorded as of 1977.

GENERAL GEOLOGY

Previous work

Baker (1929) mapped that part of the Cook Creek Butte quadrangle south and east of the Northern Cheyenne Indian Reservation as a part of the northern expansion of the Sheridan coal field, Montana. Matson and Blumer (1973, pl. 6) mapped the Wall coal bed in this part of the quadrangle as part of the Canyon Creek coal deposit.

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 member of the Fort Union Formation (Paleocene), the Tongue River Member.

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, but about 1,600 feet (488 m) remains.

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 Cook Creek Butte quadrangle is in the northwestern part of the Powder River structural basin. The strata in general dip southward or southeastward at an angle of less than 1 degree. In places the regional structure is modified by low-relief folds, as shown by the structure contour maps on top of the coal beds (pls. 4, 7, 10). Some of the nonuniformity 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 Cook Creek Butte quadrangle are shown in outcrop on the Coal Data Map (pl. 1) and in section on the Coal Data Sheet (pl. 3). All the coal beds belong to the Tongue River Member of the Fort Union Formation.

The lowermost recognized coal bed is the Brewster-Arnold coal bed which is about 700 feet (213 m) above the base of the Tongue River Member. The Brewster-Arnold coal bed is overlain successively by a noncoal interval of about 240 feet (73 m), the Wall coal bed, a noncoal interval of about 250 feet (76 m), the Canyon coal bed, a mostly noncoal interval of about 260 feet (79 m) which contains three local coal beds, and then a thick clinker bed formed by the burning of the combined Anderson (Dietz 1), Dietz 2, and Dietz 3 coal beds.

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).

Brewster-Arnold coal bed

The Brewster-Arnold coal bed was named by Bass (1924) for outcrops at the Brewster-Arnold mine, sec. 23, T. 6 S., R. 43 E., about 11 miles (17.7 km) southeast of the Cook Creek Butte quadrangle in the Browns Mountain quadrangle. The Brewster-Arnold coal bed occurs about 700 feet (213 m) above the base of the Tongue River Member and about 235 feet (71.6 m) below the Wall coal bed. It does not crop out in the Cook Creek Butte quadrangle but has been projected into the subsurface of this quadrangle from the Clubfoot Creek and Birney quadrangles to the east and southeast where it does crop out. The isopach and structure contour map of the Brewster-Arnold coal bed (pl. 10) shows that the coal bed ranges from less than 5 to about 13 feet (less than 1.5 to about 4 m) in thickness and dips eastward at an angle of less than 1 degree. Overburden on the Brewster-Arnold coal bed (pl. 11) ranges from about 60 to 740 feet (18 to 226 m) in thickness.

There is no known, publicly available chemical analysis of the Brewster-Arnold coal bed in the Cook Creek Butte quadrangle. An analysis of this bed from a depth of 102 to 110 feet (31 to 33.5 m) in drill hole SH-7057, sec. 28, T. 5 S., R. 42 E., 3.5 miles (5.6 km) east-southeast of the Cook Creek Butte quadrangle in the Birney quadrangle, shows ash 12.525 percent, sulfur 0.553 percent, and heating value 7,979 Btu per pound (18,559 kJ/kg) on an as-received basis (Matson and Blumer, 1973, p. 40). This heating value converts to about 9,123 Btu per pound (21,220 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 Cook Creek Butte quadrangle, it is assumed that the Brewster-Arnold coal in this quadrangle is similar and is subbituminous C in rank.

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 8 miles (12.9 km) south-southeast of the Cook Creek Butte quadrangle in the Birney quadrangle. A clinker bed, formed by burning of the Wall coal bed, crops out in the southeastern part of the Cook Creek Butte quadrangle 200 to 240 feet (61 to 73 m) above the Brewster-Arnold coal bed. The thickness of the Wall coal bed has not been measured in this quadrangle because of the absence of outcrops and coal test holes. The isopach and structure contour map of the Wall coal bed (pl. 7) was constructed by projection of the thickness and structure into this quadrangle from adjacent quadrangles. On this basis the Wall coal bed is believed to range from about 10 to 35 feet (3.0 to 10.7 m) in thickness and to dip northeastward at an angle of less than 1 degree. Overburden on the Wall coal bed (pl. 8) ranges from about 50 to 500 feet (15 to 152 m) in thickness.

A chemical analysis of the Wall coal bed from a depth of 150 to 159 feet (45.7 to 48.5 m) in drill hole SH-110, sec. 33, T. 5 S., R. 41 E. about 1 mile

(1.6 km) south of the Cook Creek Butte quadrangle in the Birney SW quadrangle shows ash 5.790 percent, sulfur 0.380 percent, and heating value 8,970 Btu per pound (20,864 kJ/kg) on an as-received basis (Matson and Blumer, 1973, p. 39). This heating value converts to about 9,521 Btu per pound (22,146 kJ/kg) on a moist, mineral-matter-free basis, indicating that the Wall coal bed at this location is subbituminous B in rank. Because of the proximity of this location to the Cook Creek Butte quadrangle, it is assumed that the Wall coal in this quadrangle is similar and is subbituminous B in rank.

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 he did not give a type locality. In the Cook Creek quadrangle the Canyon bed crops out in a few places on the hill sides about 250 feet (76 m) above the Wall coal bed, but in most places the coal is burned near the surface. The isopach and structure contour map (pl. 4), based largely on projections from adjacent quadrangles, shows the Wall coal bed to range from 5 to 25 feet (1.5 to 7.6 m) in thickness and to dip southward at an angle of less than 1 degree. Overburden on the Canyon coal bed (pl. 5) ranges from zero at the outcrop to about 500 feet (152 m) in thickness.

There are no known, publicly available chemical analyses of the Canyon coal bed in the Cook Creek Butte quadrangle. An analysis from a depth of 55 to 60 feet (16.7 to 18.3 m) in drill hole SH-47, sec. 3, T. 6 S., R. 40 E., about 4.5 miles (7.2 km) southwest of the Cook Creek Butte quadrangle in the Taintor Desert quadrangle shows ash 6.747 percent, sulfur 0.651 percent, and heating value 8,006 Btu per pound (18,622 kJ/kg) on an as-received basis (Matson and Blumer, 1973, p. 40). This heating value converts to about 8,585 Btu per pound (19,922 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 Cook Creek Butte quadrangle it is assumed that the Canyon coal in this quadrangle is similar and is subbituminous C in rank.

Local coal beds

Three local coal beds occur between the Canyon coal bed and the overlying Anderson-Dietz clinker bed. Since these local beds are less than 5 feet (1.5 m) thick, coal resources have not been calculated for them.

Anderson-Dietz clinker bed

A clinker bed, in places as much as 100 feet (30.5 m) thick, caps the high hills in the southern part of the quadrangle. This clinker is about 260 feet (79.2 m) above the Canyon coal. It is believed to have formed from the burning of the combined Anderson (Dietz 1) and Dietz 2 and 3 coal beds. These coals apparently have been entirely burned in this quadrangle.

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 128.67 million short tons (116.70 million t). The total tonnage of federally owned, surface-minable Hypothetical coal is estimated to be 13.01 million short tons (11.80 million t). As shown by table 2, the total federally owned, underground-minable Reserve Base coal is estimated to be 0.32 million short tons (0.29 million t). The total

federally owned, underground-minable Hypothetical coal is estimated to be 17.18 million short tons (15.58 million t). The total tonnage of surface- and underground-minable Reserve Base coal is 128.99 million short tons (116.99 million t), and the total of surface- and underground-minable Hypothetical coal is 30.19 million short tons (27.38 million t).

All of the surface-minable Reserve Base tonnage is classed as Inferred, except for less than 1 percent of the tonnage, which is classed as Indicated. 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 for surface-mining methods of the Federal coal lands is shown on the Coal Development Potential map (pl. 13). The lands are somewhat evenly divided between high, medium, and low development potential.

The Canyon coal bed (pl. 5) has a fairly wide area of high development potential (mining-ratio values less than 10) on the lower hill slopes in the southwestern part of the quadrangle, but most of this wide area is on non-Federal coal lands. There are narrow to broad bands of moderate development potential (mining ratio values 10-15). A wide are of low development potential extends from the 15 mining-ratio contour to the crests of the hills.

The Wall coal bed (pl. 8) has fairly wide areas of high development potential along the valleys of Cook Creek and its southern tributaries, but most of these areas are non-Federal coal lands. This bed also has high development potential along valleys that extend northward into the southwestern part of the mapped area. These areas of high development potential are mostly on Federal coal land. There are narrow bands of moderate development potential for the Wall coal bed along the steeper slopes in the eastern part of the mapped area,

but there are broader areas of moderate development potential where the slopes are less steep in the western part of the mapped area. The areas of moderate development potential are more or less evenly divided among Federal and non-Federal coal lands. There are extensive areas of low development potential beneath the hills in the eastern part of the mapped area on both Federal and non-Federal coal lands. There is one fairly extensive area of low development potential in the western part of the mapped area, but it is almost entirely on non-Federal coal land. There are only a few small areas on both Fedral and non-Federal land where the overburden exceeds the 500-foot stripping limit and where there is, consequently, no development potential for surface mining.

The Brewster-Arnold coal bed (pl. 11) has a small area of high development potential (mining-ratio values 0-10), and a small area of moderate development potential (mining-ratio values 10-15), but these areas are on non-Federal coal lands. The Federal coal lands are within areas of low development potential extending from the 15 mining-ratio contour to the arbitrarily assigned stripping limit at the 500-foot overburden contour, or within areas of no development potential for surface mining where the overburden is greater than 500 feet (152 m) thick.

About 53 percent of the Federal coal lands in the quadrangle have a high development potential for surface mining, 28 percent have a moderate development potential, and 19 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 Cook Creek Butte quadrangle, Rosebud and Big Horn Counties, 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				
Canyon	8,800,000	7,860,000	18,300,000	34,960,000
Wall	20,900,000	43,150,000	29,660,000	93,710,000
Total	29,700,000	51,010,000	47,960,000	128,670,000
Hypothetical Resource tonnage				
Wall	470,000	4,500,000	1,480,000	6,450,000
Brewster-Arnold	0	0	6,560,000	6,560,000
Total	470,000	4,500,000	8,040,000	13,010,000
Grand Total	30,170,000	55,510,000	56,000,000	141,680,000

Table 2.--Underground-minable coal resource tonnage (in short tons) by development-potential category for Federal lands in the Cook Creek Butte quadrangle, Rosebud and Big Horn Counties , 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	320,000	320,000
Total	0	0	320,000	320,000
Hypothetical Resource tonnage				
Brewster-Arnold	0	0	17,180,000	17,180,000
Total	0	0	17,180,000	17,180,000
Grand Total	0	0	17,500,000	17,500,000

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