Text to Accompany:

Open-File Report 79-1028

1979

COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE SOUTHWEST QUARTER OF THE BOARS TUSK 15-MINUTE QUADRANGLE, SWEETWATER COUNTY, WYOMING

[Report includes 24 plates]

Prepared for

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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Purpose

This text is to be used in conjunction with Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) Maps of the southwest quarter of the Boars Tusk 15-minute quadrangle, Sweetwater County, Wyoming. This report was compiled to support the land planning work of the Bureau of Land Management (BLM) to provide a systematic coal resource inventory of Federal coal lands in Known Recoverable Coal Resource Areas (KRCRA's) in the western United States. This investigation was undertaken by Dames & Moore, Denver, Colorado, at the request of the U.S. Geological Survey under contract number 14-08-0001-17104. The resource information gathered for this report is in response to the Federal Coal Leasing Amendments Act of 1976 (P.L. 94-377). Published and unpublished public information available through June, 1978, was used as the data base for this study. No new drilling or field mapping was performed, nor was any confidential data used.

Location

In this report, the term "quadrangle" refers only to the southwest quarter of the Boars Tusk 15-minute quadrangle which is located in the central part of Sweetwater County, approximately 11 miles (18 km) north of the city of Rock Springs. In general, the quadrangle is unpopulated.

Accessibility

An improved light-duty road follows Killpecker Creek north-south through the western third of the quadrangle connecting with U.S. Highway 187 to the west of the quadrangle boundary. Several unimproved dirt roads and trails provide access for the remainder of the quadrangle. Interstate Highway 80 passes east-west through southern Wyoming approximately 10 miles (16 km) south of the quadrangle boundary.

The main east-west line of the Union Pacific Railroad passes through the city of Rock Springs south of the quadrangle. This line provides railway service across southern Wyoming connecting Ogden, Utah, to the west with Omaha, Nebraska, to the east. A spur from the

main line at Rock Springs extends northward to Winton Junction approximately 2.5 miles (4 km) south of the quadrangle boundary. North of Winton Junction the rail line is owned by U.S. Steel Corporation. It crosses through the western half of the quadrangle and extends northward to the Atlantic City, Wyoming area.

Physiography

The southwest quarter of the Boars Tusk 15-minute quadrangle lies in the northwestern part of the Rock Springs uplift. The quadrangle is characterized by a relatively flat-lying valley along Killpecker Creek in the western half of the quadrangle with rugged northeast-trending ridges and buttes in the eastern half of the quadrangle. Altitudes range from approximately 6,440 feet (1,963 m) on Killpecker Creek in the southwestern corner of the quadrangle to 7,337 feet (2,236 m) along the southern border of the quadrangle.

Killpecker Creek and its tributaries drain southerly into Bitter Creek near the city of Rock Springs south of the quadrangle. All of the streams are intermittent and flow mainly in response to snowmelt it in the spring.

Climate and Vegetation

The climate of southwestern Wyoming is semiarid and is characterized by low precipitation, rapid evaporation, and large daily temperature changes. Summers are usually dry and mild, and winters are cold. Annual precipitation averages 9 inches (23 cm), with approximately two thirds falling during the spring and early summer months.

The average annual temperature is 42°F (6°C). The temperature during January averages 18°F (-8°C), with temperatures ranging from 8°F (-13°C) to 28°F (-2°C). During July temperatures range from 54°F (12°C) to 84°F (29°C), with an average of 69°F (21°C) (Wyoming Natural Resources Board, 1966; U.S. Bureau of Land Management, 1978).

Winds are usually from the west-southwest and southwest with an average velocity of 11 miles per hour (18 km per hr), according to the U.S. Bureau of Land Management (1978).

Principal types of vegetation in the area include sagebrush, saltbush, rabbitbrush, greasewood, mountain mahogany, juniper, and grasses (U.S. Bureau of Land Management, 1978).

Land Status

The southwest quarter of the Boars Tusk 15-minute quadrangle lies in the northwestern part of the Rock Springs Known Recoverable Coal Resource Area (KRCRA). Approximately 91 percent of the quadrangle lies within the KRCRA boundary, with the Federal government owning the coal rights for approximately 43 percent of this area. One preference right lease application (PRLA) area and one active coal lease are present within the KRCRA boundary, as shown on plate 2.

GENERAL GEOLOGY

Previous Work

Schultz (1909) described the geology and coal resources of the northern part of the Rock Springs coal field and the geology and structure of the Baxter Basin (1920). Hale described the stratigraphy and depositional history of the formations cropping out on the flanks of the Rock Springs uplift in 1950 and 1955. Weimer (1960), Smith (1961), Douglas and Blazzard (1961), and Keith (1965) discussed stratigraphy and depositional environment of the Upper Cretaceous formations of the uplift. Coal analyses and measured sections of coal in the Rock Springs coal field were reported by Glass in 1975. Roehler and others described the geology and coal resources of the coal field in 1977. Roehler prepared a geologic map of the Rock Springs uplift in 1977 and, in 1978, correlated coal beds in several formations using measured sections. Unpublished data from Rocky Mountain Energy Company (RMEC) also provided coal thickness information.

Stratigraphy

The formations exposed in the quadrangle range in age from Late Cretaceous to Paleocene and crop out in north-south-trending bands across the quadrangle. The Rock Springs and Almond Formations, both of Late Cretaceous age, and the Fort Union Formation of Paleocene age contain significant amounts of coal.

The Mesaverde Group of Late Cretaceous age conformably overlies and laterally intertongues with the Baxter Shale in this area. The Mesaverde Group is subdivided into four formations which are, in ascending order, the Blair, the Rock Springs, the Ericson Sandstone, and the Almond.

The Blair Formation crops out in the southeastern part of the quadrangle (Roehler, 1977) and is approximately 1,100 feet (335 m) where measured in the Kenneth Luff Amoco-Champlin No. 1-25 well located in sec. 25, T. 22 N., R. 104 W. The lower part of the formation is composed of a thick series of light brown, thin-bedded, very fine grained sandstone; light-brownish-gray arenaceous siltstone; and brownish-gray silty to sandy shale with a basal layer of massive to thick-bedded, light-brown to brown, very fine to fine-grained sandstone which grades downward into the Baxter Shale. The upper part of the formation consists of light-brown sandy shale and occasional thin brown sandstone which grade into the overlying Rock Springs Formation (Hale, 1950 and 1955; Keith, 1965; Smith; 1961). The Blair Formation contains no coal in this quadrangle.

The coal-bearing Rock Springs Formation, conformably overlying the Blair Formation, is approximately 1,600 feet (488 m) thick where measured in T. 21 N., R. 104 W. (Roehler, 1978). It crops out in a wide band across the eastern part of the quadrangle (Roehler, 1977) and consists of a sequence of brown, black and gray carbonaceous shale, siltstone, claystone, gray sandstone and coal (Roehler, 1978).

The Ericson Sandstone, approximately 490 feet (149 m) thick (Roehler, 1978), crops out in a narrow band near the center of the quadrangle (Roehler, 1977) where it unconformably overlies the Rock Springs Formation (Roehler and others, 1977). The Ericson Sandstone consists of light-gray, massive, cliff-forming, cross-bedded, fine- to coarse-grained sandstone and conglomerate containing chert pebbles (Hale, 1950 and 1955; Smith, 1961).

The Almond Formation, conformably overlying the Ericson Sandstone, crops out in a narrow northeasterly-trending band through the central

part of the quadrangle. It thins to the south of the quadrangle owing to the presence of an unconformable contact with the overlying Fort Union Formation. Roehler (1978) reports that the Almond Formation is 760 feet (232 m) thick in sec. 26, T. 22 N., R. 4 W. The Almond Formation consists of carbonaceous shale, siltstone, mudstone, and sandstone alternating with coal beds of variable thickness and quality. The upper part of the formation is predominantly a buff-colored to light-gray, thick-bedded to massive fossiliferous sandstone (Hale, 1950 and 1955).

The Fort Union Formation unconformably overlies the Almond Formation and crops out in the western half of the quadrangle. An unknown thickness is present because of the uncertain contact between the Fort Union and the overlying Wasatch Formation. Hale (1950) reported that approximately 1,500 feet (457 m) of alternating micaceous sandstone, variegated shale and coal crop out in sec. 22, T. 19 N., R. 105 W. The coal beds and the formation itself thicken rapidly to the west (Roehler and others, 1977).

An unknown thickness of the Wasatch Formation of Eocene age is exposed along the western edge of the quadrangle. The main body of the Wasatch Formation, conformably overlying the Fort Union Formation, is composed of gray sandy mudstone, carbonaceous shale, muddy sandstone and a few thin coals (Bradley, 1964; Roehler and others, 1977).

Recent deposits of alluvium cover the stream valleys of Killpecker Creek and its tributaries.

The Upper Cretaceous formations in the southwest quarter of the Boars Tusk 15-minute quadrangle indicate the transgressions and regressions of a broad, shallow, north-south trending seaway that extended across central North America. These sediments accumulated near the western edge of the Cretaceous sea and reflect the location of the shoreline (Weimer, 1960 and 1961).

The Blair Formation, composed of intertonguing nearshore sandstones and offshore marine shales, was deposited in a shallow-water marine

sequence as the Cretaceous sea regressed eastward (Douglass and Blazzard, 1961; Gosar and Hopkins, 1969).

Both marine and continental deposits occur in the Rock Springs Formation. Northwest of a strand line extending from approximately the southeastern corner of T. 16 N., R. 106 W., northeastward through T. 22 N., R. 100 W., the Rock Springs Formation consists mostly of sediments deposited in swamp, deltaic and fluvial environments. Southeast of the strand line the Rock Springs Formation consists mainly of shallow-water marine deposits (Burger, 1965; Douglass and Blazzard, 1961; Gosar and Hopkins, 1969).

The Ericson Sandstone was deposited in stream and floodplain environments with a source area to the northwest (Douglass and Blazzard, 1961; Gosar and Hopkins, 1969).

The Almond Formation reflects deposition in fresh-water coastal swamps, brackish-water lagoons and shallow-water marine environments (Hale, 1950).

After the final withdrawal of the Cretaceous sea, the Fort Union Formation was deposited mainly in paludal or swamp environments across the Rock Springs uplift (Roehler, 1961). The main body of the Wasatch Formation was deposited in fresh-water swamps in the topographic low of an intermontane basin (Bradley, 1964; Roehler and others, 1977).

Structure

The southwest quarter of the Boars Tusk 15-minute quadrangle is located on the northwestern flank of the Rock Springs uplift which separates the Great Divide and Green River structural basins. The Rock Springs uplift is a doubly plunging asymmetric anticline with the west limb having the steeper dips (5° to 30° to the west). Dips along the east limb are from 5° to 10° to the east. Approximately 11,000 feet (3,353 m) of sedimentary rocks of Late Cretaceous age are exposed in the core of the uplift (Gosar and Hopkins, 1969; Yourston, 1955).

The strike of the coal beds in this quadrangle is generally from north to northeast, with the beds dipping 8° to 15° west to northwest, becoming progressively steeper toward the south. The location of several faults of Tertiary age are shown on plate 1 (Schultz, 1909).

COAL GEOLOGY

Coal beds included within three separate formations crop out in this quadrangle. The Rock Springs Formation coal beds are the oldest and occur along the eastern edge of the quadrangle. The Almond and Fort Union coal beds crop out approximately 850 and 1,450 feet (259 and 442 m), stratigraphically, above the uppermost Rock Springs coal bed and trend north-south across the central and western portions, respectively, of the quadrangle.

Chemical analyses of coal.--Chemical analyses of representative samples of Rock Springs Formation coals are shown in table 1 (U.S. Bureau of Mines, 1931). All of the samples analyzed rank as high-volatile C bituminous. Analyses of Fort Union and Almond Formation coals were not available, but Roehler and others (1977) reported that the coal in these formations to be subbituminous. The Rock Springs coals are ranked on a moist, mineral-matter-free basis according to ASTM Standard Specification D 388-77 (American Society for Testing and Materials, 1977).

Coal Beds of the Rock Springs Formation

Seven coal beds of Reserve Base thickness (5 feet or 1.5 meters) or greater were mapped in the quadrangle. Several other coal beds were present in drill holes and measured sections, but these were not mapped because they were less than Reserve Base thickness. Dips taken along the outcrops (Schultz, 1909) range from 6° in the northern part of the quadrangle to as much as 15° in the south. Dip direction is to the east or southeast.

A number system adapted by the Union Pacific Railroad is most commonly used (Schultz, 1909) to name the coal beds in the Rock Springs Formation. The beds worked in the coal field are numbered in descending

order, 5, 3, 1, 7 1/2, 7, 8, 9, 10, 11, (15, 17), and 19. The same nomenclature is used across the field although recent stratigraphic investigations suggest that the coal beds were commonly miscorrelated (Roehler and others, 1977).

Rock Springs No. 17 Coal Bed

In this quadrangle, the Rock Springs No. 17 coal bed is, stratigraphically, the lowest isopached coal bed in the formation. Locally, the coal bed reaches a maximum cumulative coal thickness of 10 feet (3.0 m) with 4 feet (1.2 m) of partings located in sec. 15, T. 21 N., R. 104 W. (plate 4). Generally, the coal bed is less than 5 feet (1.5 m) thick in this quadrangle and to the south. In the adjacent southeast quarter of the Boars Tusk 15-minute quadrangle to the east, the Rock Springs No. 17 coal bed is 10 feet (3.0 m) thick in the northwestern part of the quadrangle but thins to the southeast.

Rock Springs No. 15 Coal Zone

Because of the trashy characteristics of the coal, several thin coal beds have been grouped together as a zone in the isopach map of the Rock Springs No. 15 coal zone (plate 6). The coal zone reaches a maximum thickness of 49 feet (14.9 m) where measured in sec. 15, T. 21 N., R. 104 W., including a total of 17 feet (5.2 m) of coal in three beds and 32 feet (9.8 m) of rock partings. Individual coal beds contained within the zone range from 2 to 7 feet (0.6 to 2.1 m) in thickness. Because the coal beds in this zone appear to split, thicken and thin rapidly over very short distances, as indicated by measurements in drill holes in sec. 22, T. 21 N., R. 104 W., only Reserve Base tonnages have been calculated for the zone beyond the stripping limit.

In the Reliance quadrangle to the south, the Rock Springs No. 15 coal zone is generally less than Reserve Base thickness, but the coal bed locally thickens to 14 feet (4.3 m) without partings. To the east in the southeast quarter of the Boars Tusk 15-minute quadrangle, it is indicated in coal test holes that the Rock Springs No. 15 is one of the more persistant Rock Springs coal beds, ranging from 3 to 13 feet (0.9 to 4.0 m) thick in a single bed.

Rock Springs No. 9 Coal Bed

The Rock Springs No. 9 coal bed is generally less than 5 feet (1.5 m) thick in the quadrangle (plate 8). However, in the northern and southern parts of the quadrangle, it thickens to 9.0 and 12.5 feet (2.7 and 3.8 m), respectively. In the northern part of the adjacent Reliance quadrangle to the south, the Rock Springs No. 9 coal bed is 12 feet (3.7 m) thick but thins gradually to the south. To the east, the coal bed averages approximately 5 feet (1.5 m) in thickness in the southeast quarter of the Boars Tusk 15-minute quadrangle.

Rock Springs No. 8 Coal Bed

The Rock Springs No. 8 coal bed attains a maximum thickness of 13 feet (4.0 m) where measured in sec. 35, T. 22 N., R. 104 W., in the northern part of the quadrangle (plate 11). Elsewhere in the quadrangle, measurable coal thicknesses range from 4 to 8 feet (1.2 to 2.4 m). Measured thicknesses in the northern part of the Reliance quadrangle approach 10 feet (3.0 m), but the coal bed thins considerably to the south. In the southeast quarter of the Boars Tusk 15-minute quadrangle, the Rock Springs No. 8 coal bed attains a maximum thickness of 8 feet (2.4 m).

Rock Springs No. 7 Coal Bed

Measured coal thicknesses of the Rock Springs No. 7 coal bed range from 4 to 11 feet (1.2 to 3.4 m), as shown on plate 14. Rock partings up to 6 feet (1.8 m) thick are present but not included in the total coal bed thickness. The Rock Springs No. 7 coal bed is split in some areas in the Reliance quadrangle, and ranges up to 12 feet (3.7 m) thick in a single bed in sec. 18, T. 20 N., R. 104 W. In the southeast quarter of the Boars Tusk 15-minute quadrangle, the Rock Springs No. 7 coal bed generally exceeds Reserve Base thickness, thickening to 12.8 feet (3.9 m) in a single bed in the southeastern part of the quadrangle.

Rock Springs No. 7 1/2 Coal Bed

Although the Rock Springs No. 7 1/2 coal bed is generally one of the thinner Rock Springs coal beds in this area, it thickens locally to 8

feet (2.4 m), excluding a rock parting of 2 feet (0.6 m), in sec. 11, T. 21 N., R. 104 W. (plate 17). In the Reliance quadrangle, the coal bed is commonly split but attains a maximum coal thickness of 13 feet (4.0 m) in a single coal bed located in sec. 7, T. 20 N., R. 104 W. The average thickness of the Rock Springs No. 7 1/2 coal bed in the southeast quarter of the Boars Tusk 15-minute quadrangle is approximately 6 feet (1.8 m) in a single bed.

Rock Springs No. 1 Coal Bed

The Rock Springs No. 1 (plate 20), generally one of the thicker, more persistant Rock Springs coal beds, attains a maximum thickness of 13.5 feet (4.1 m) in sec. 15, T. 21 N., R. 104 W. It thickens erratically to the south, and, in the Reliance quadrangle, has been reported to be 18 feet (5.5 m) thick in T. 20 N., R. 105 W. In the southeast quarter of the Boars Tusk 15-minute quadrangle, the Rock Springs No. 1 coal bed ranges in thickness from 3 to 15 feet (0.9 to 4.6 m).

This coal bed is commonly split into as many as 5 distinct coal beds in many of the areas where it has been isopached. In some cases, thinner, less desirable coal beds have not been included in the total isopach thickness so as not to overestimate subsurface resources.

Rock Springs No. 3 Coal Bed

The isopach map of the Rock Springs No. 3 coal bed is shown on plate 17. Coal thickness in excess of 5 feet (1.5 m) were only encountered in two drill holes, both located in sec. 27, T. 21 N., R. 104 W., where the Rock Springs No. 3 coal bed attains a maximum thickness of 6.6 feet (2.0 m). This coal bed has been located in other quadrangles in the area, but it is usually thin and trashy.

Coal Beds of the Almond Formation

Coal beds in the Almond Formation tend to be thin, lenticular and of limited areal extent. Only one coal bed, the Almond [1] lying approximately 1,700 feet (518 m) stratigraphically above the Rock Springs No. 1 coal bed, has been mapped (plate 20) in the north-central part of this

quadrangle. This coal bed is not formally named and has been given a bracketed number for identification purposes in this quadrangle only.

The Almond [1] coal bed has been isopached in sec. 27, T. 22 N., R. 104 W., where it reaches a maximum thickness of 6 feet (1.8 m). Because of the lack of subsurface data, the lagoonal nature of the coal beds, and the unconformable contact between the Almond and Fort Union Formations, this coal bed could not be correlated with Almond coal beds in surrounding quadrangles.

Minable coal beds are present in the Almond Formation in some areas on the eastern and northwestern flanks of the Rock Springs uplift, especially in T. 14. N., R. 103 W.; T. 18 N., R. 101 W.; T. 16 N., R. 102 W.; and T. 18-19 N., R. 100-101 W. (Roehler and others, 1977).

Coal Beds of the Fort Union Formation

Three Fort Union Formation coal beds, located in the lower 650 feet (198 m) of the formation, exceed Reserve Base thickness and have been designated, in ascending order, the A, B and C coal beds for identification purposes. Roehler (1977) has named the middle coal bed, called the B coal bed in this report, the White Mountain coal bed.

A Coal Bed

Using scattered data from coal test holes, the approximate trace of the A coal bed has been projected on plates 1, 14, 15, and 16. This coal bed lies approximately 85 feet (26 m) above the unconformable contact between the Fort Union and Almond Formations. It attains a thickness of only 7 feet (2.1 m) in this quadrangle, but thickens rapidly to the west, where oil and gas wells have encountered thick Fort Union coal beds in the subsurface. To the south in the Reliance quadrangle, no measurable thicknesses were encountered for this coal bed. In the northwest quarter of the Boars Tusk 15-minute quadrangle, the A bed thickens to 9 feet (2.7 m).

B Coal Bed

The B or White Mountain coal bed has been mapped for several miles along the western flank of the Rock Springs uplift and is located approximately 400 feet (122 m) above the base of the Fort Union Formation. It thickens to 9 feet (2.7 m) in sec. 17, T. 21 N., R. 104 W. (plate 17), in this quadrangle, and maintains this thickness where mapped in the Reliance quadrangle. Like the underlying A coal bed, the B coal bed has been encountered deep within the subsurface in oil and gas wells to the west where it may be 20 feet (6.1 m) or more thick. Correlations of the B bed in the shallow coal test holes in this quadrangle and in the oil and gas wells to the west are only tentative due to the rapid thickening of the Fort Union Formation to the west and the scarcity of data.

C Coal Bed

The C coal bed is located approximately 625 feet (191 m) above the base of the Fort Union Formation. Subsurface data has been used to project the outcrop trace on plate 20 where the coal bed attains a maximum thickness of 10 feet (3.0 m). This coal bed was not encountered in quadrangles to the south or north, although it is believed to thicken down-dip to the west, as do the other Fort Union coal beds.

Isolated Data Points

In instances where isolated measurements of coal beds of Reserve Base thickness or greater are encountered, the standard criteria for construction of isopach, structure contour, mining ratio, and overburden isopach maps are not available. The lack of data concerning these coal beds limits the extent to which they can be reasonably projected in any direction and usually precludes correlations with other, better known coal beds. Also, where the inferred limit of influence from the isolated data point is entirely within non-Federal land areas or lands already leased for coal mining, isolated data point maps are not constructed for the coal bed, as is the case in this quadrangle.

COAL RESOURCES

Information from oil and gas wells and coal test holes from RMEC, as well as measured sections from Schultz (1909), were used to construct

outcrop, isopach, and structure contour maps of the coal beds in the southwest quarter of the Boars Tusk 15-minute quadrangle. At the request of RMEC, coal-rock data for some of their drill holes have not been shown on sheet 2 of plate 1 or on the derivative maps. However, data from these drill holes have been used to construct the derivative maps. These data may be obtained by contacting RMEC. The source of each indexed data point shown on plate 1 is listed in table 4.

Coal resources were calculated using data obtained from the coal isopach maps (plates 4, 6, 8, 11, 14, 17, and 20). The coal bed acreage (measured by planimeter) multiplied by the average isopached thickness of the coal bed, and by a conversion factor of 1,770 short tons of coal per acre-foot (13,018 metric tons per hectare-meter) for subbituminous coal, or 1,800 short tons of coal per acre-foot (13,238 metric tons per hectare-meter) for bituminous coal, yields the coal resources in short tons for each isopached coal bed. Coal beds thicker than 5 feet (1.5 m) that lie less than 3,000 feet (914 m) below the ground surface are included. These criteria differ somewhat from those used in calculating Reserve Base and Reserve tonnages as stated in U.S. Geological Survey Bulletin 1450-B which calls for a minimum thickness of 28 inches (70 cm) for bituminous coal and a maximum depth of 1,000 feet (305 m) for both bituminous and subbituminous coal.

Reserve Base and Reserve tonnages for the isopached beds are shown on plates 10, 13, 16, 19, and 22, and are rounded to the nearest 10,000 short tons (9,072 metric tons). Coal Reserve Base tonnages per Federal section are shown on plate 2 and total approximately 53.67 million short tons (48.69 million metric tons) for the entire quadrangle. Reserve Base tonnages in the various development potential categories for surface and subsurface mining methods are shown in tables 2 and 3.

Dames & Moore has not made any determination of economic recoverability for any of the coal beds described in this report.

COAL DEVELOPMENT POTENTIAL

Coal development potential areas are drawn so as to coincide with the boundaries of the smallest legal land subdivisions shown on plate 2. In sections or parts of sections where no land subdivisions have been surveyed by the BLM, approximate 40-acre (16-ha) parcels have been used to show the limits of the high, moderate, or low development potentials. A constraint imposed by the BLM specifies that the highest development potential affecting any part of a 40-acre (16-ha) lot, tract, or parcel be applied to that entire lot, tract, or parcel. For example, if 5 acres (2 ha) within a parcel meet criteria for a high development potential, 25 acres (10 ha) a moderate development potential, and 10 acres (4 ha) a low development potential, then the entire 40 acres (16 ha) are assigned a high development potential.

Development Potential for Surface Mining Methods

Areas where the coal beds of Reserve Base thickness are overlain by 200 feet (61 m) or less of overburden are considered to have potential for surface mining and were assigned a high, moderate, or low development potential based on the mining ratio (cubic yards of overburden per ton of recoverable coal). The formula used to calculate mining ratios for surface mining of coal is as follows:

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

where MR = mining ratio

t_o = thickness of overburden in feet

t_c = thickness of coal in feet

rf = recovery factor (85 percent for this quadrangle)

cf = conversion factor to yield MR value in terms of cubic yards of overburden per short tons of recoverable coal:
0.911 for subbituminous coal
0.896 for bituminous coal

Note: To convert mining ratio to cubic meters of overburden per metric ton of recoverable coal, multiply MR by 0.8428.

Areas of high, moderate, and low development potential for surface mining methods are defined as areas underlain by coal beds having respective mining ratio values of 0 to 10, 10 to 15, and greater than 15. These mining ratio values for each development potential category are based on economic and technological criteria and were provided by the U.S. Geological Survey.

Areas where the coal data is absent or extremely limited between the 200-foot (61-m) overburden line and the outcrop are assigned unknown development potentials for surface mining methods. This applies to those areas where no known coal beds 5 feet (1.5 m) or more thick occur. Limited knowledge pertaining to the areal distribution, thickness, depth, and attitude of the coal beds prevents accurate evaluation of the development potential in the high, moderate, or low categories.

The coal development potential for surface mining methods is shown on plate 23. Of the Federal land areas having a known development potential for surface mining methods, 67 percent are rated high, 14 percent are rated moderate, and 19 percent are rated low. The remaining Federal lands within the KRCRA boundary are classified as having unknown development potential for surface mining methods.

Development Potential for Subsurface and In-Situ Mining Methods

Areas considered to have a development potential for conventional subsurface mining methods include those areas where the coal beds of Reserve Base thickness are between 200 and 3,000 feet (61 and 914 m) below the ground surface and have dips of 15° or less. Coal beds lying between 200 and 3,000 feet (61 and 914 m) below the ground surface, dipping greater than 15°, are considered to have a development potential for in-situ mining methods.

Areas of high, moderate, and low development potential for subsurface mining methods are defined as areas underlain by coal beds at depths ranging from 200 to 1,000 feet (61 to 305 m), 1,000 to 2,000 feet (305 to 610 m), and 2,000 to 3,000 feet (610 to 914 m), respectively.

Areas where the coal data is absent or extremely limited between 200 and 3,000 feet (61 and 914 m) below the ground surface are assigned unknown development potentials. Even though these areas may contain coal thicker than 5 feet (1.5 m), limited knowledge pertaining to the areal distribution, thickness, depth, and attitude of the coal beds prevents accurate evaluation of the development potential in the high, moderate, or low categories.

The coal development potential for subsurface mining methods is shown on plate 24. All of the Federal land areas classified as having known development potential for conventional subsurface mining methods are assigned a high development potential. The remaining Federal land is classified as having unknown development potential for conventional subsurface mining methods.

Part of sec. 2, T. 21 N., R. 104 W., contains coal (Rock Springs No. 1) dipping in excess of 15°. This area has been classified as having a low development potential for in-situ mining methods because of the low tonnages (70,000 short tons or 63,500 metric tons) available for mining. The remaining Federal lands within the KRCRA are classified as having unknown development potential for in-situ mining.

Table 1.--Chemical analyses of coals in the southwest quarter of the Boars Tusk 15-minute quadrangle, Sweetwater County, Wyoming.

Location	COAL BED NAME	Form of Analysis	Proximate				Ultimate					Heating Value	
			Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Calories	Btu/Lb
Sec. 26. T. 19 N., R. 105 W., (U.P. Old No. 5 Mine) (U.S. Bureau of Mines, 1931)	Rock Springs, No. 5	A	10.9	30.8	42.7	15.6	1.0	-	-	-	-	-	9,990
		C	0.0	34.6	47.9	17.5	1.1	-	-	-	-	-	10,540
NW¼, NW¼, sec. 2, T. 18 N., R. 105 W., (Blairtown Mine) (U.S. Bureau of Mines, 1931)	Rock Springs, No. 3	A	11.5	36.8	50.1	1.6	0.8	-	-	-	-	-	12,220
		C	0.0	41.6	55.6	1.8	0.9	-	-	-	-	-	13,810
Sec. 35, T. 19 N., R. 105 W., (Union Pacific No. 1 Mine) (U.S. Bureau of Mines, 1931)	Rock Springs, No. 1	A	8.5	35.6	50.4	5.5	0.8	-	-	-	-	-	11,830
		C	0.0	38.9	55.1	6.0	0.9	-	-	-	-	-	12,940
Sec. 26, T. 19 N., R. 105 W., (Sweetwater No. 2 Mine) (U.S. Bureau of Mines, 1931)	Rock Springs, No. 7	A	9.8	32.6	48.6	9.0	0.9	-	-	-	-	-	11,300
		C	0.0	36.2	53.8	10.0	1.0	-	-	-	-	-	12,530

Form of Analysis: A, as received
B, air dried
C, moisture free

Note: To convert Btu/pound to kilojoules/kilogram, multiply by 2.326

Table 2.--Coal Reserve Base data for surface mining methods for Federal coal lands (in short tons) in the southwest quarter of the Boars Tusk 15-minute quadrangle, Sweetwater County, Wyoming.

Coal Bed or Zone	High Development Potential	Moderate Development Potential	Low Development Potential	Unknown Development Potential	Total
C	1,120,000	960,000	1,780,000	--	3,860,000
B	1,220,000	600,000	1,980,000	--	3,800,000
A	560,000	620,000	1,700,000	--	2,880,000
RS- 1	330,000	290,000	420,000	--	1,040,000
RS- 7	10,000	--	40,000	--	50,000
RS- 8	80,000	40,000	220,000	--	340,000
RS- 9	660,000	310,000	540,000	--	1,510,000
RS-15	310,000	10,000	--	--	320,000
RS-17	220,000	150,000	240,000	--	610,000
Totals	4,510,000	2,980,000	6,920,000	--	14,410,000

NOTE: To convert short tons to metric tons, multiply by 0.9072.

Table 3.--Coal Reserve Base data for subsurface mining methods for Federal coal lands (in short tons) in the southwest quarter of the Boars Tusk 15-minute quadrangle, Sweetwater County, Wyoming.

Coal Bed or Zone	High Development Potential	Moderate Development Potential	Low Development Potential	Unknown Development Potential	Total
C	10,940,000	--	--	--	10,940,000
B	11,770,000	--	--	--	11,770,000
A	9,710,000	--	--	--	9,710,000
A1 {1}	1,170,000	--	--	--	1,170,000
RS- 1	3,270,000	--	--	*70,000	3,340,000
RS- 7½	10,000	--	--	--	10,000
RS- 7	330,000	90,000	--	--	420,000
RS- 8	480,000	--	--	--	480,000
RS- 9	130,000	--	--	--	130,000
RS-15	750,000	--	--	--	750,000
RS-17	540,000	--	--	--	540,000
Totals	39,100,000	90,000	--	70,000	39,260,000

*Coal beds dipping in excess of 15° have been assigned an unknown development potential for conventional subsurface mining methods.

NOTE: To convert short tons to metric tons, multiply by 0.9072.

Table 4. -- Sources of data used on plate 1

Plate 1 Index Number	Source	Data Base
1	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 1-AS
2		Drill hole No. 1-3-1
3		Drill hole No. 1-2-1
4		Drill hole No. 10-AD
5		Drill hole No. 9-D line A
6		Drill hole No. 8-D line A
7		Drill hole No. 7-D line A
8		Drill hole No. 6-D line A
9		Drill hole No. 5-D line A
10		Drill hole No. 4-AD
11		Drill hole No. 3-AD
12		Drill hole No. 2-AD
13		Drill hole No. 1-AD
14		Drill hole No. 7-AD
15		Drill hole No. 6-AD
16		Drill hole No. 5-AD
17		Drill hole No. 4-AD

Table 4. -- Continued

Plate 1 Index Number	Source	Data Base
18	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 3-AD
19		Drill hole No. 2-AD
20		Drill hole No. 1-AD
21		Drill hole No. 2-AS
22		Drill hole No. 3-AS
23		Drill hole No. 1-AS
24		Drill hole No. 2-AS
25		Drill hole No. 8-AD
26		Drill hole No. 7-AD
27		Drill hole No. 6-AD
28		Drill hole No. 5-AD
29		Drill hole No. 4-AD
30		Drill hole No. 3-AD
31		Drill hole No. 2-Ad
32		Drill hole No. 1-AD
33		Drill hole No. 1-AS
34		Drill hole No. 1-AS
35		Drill hole No. 2-AS
36		Drill hole No. 1-AS
37		Drill hole No. 2-AS

Table 4. -- Continued

Plate 1 Index Number	Source	Data Base
38	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 3-AS
39	↓	Drill hole No. 4-AS
40		Drill hole No. 2-AS
41		Drill hole No. 1-AS
42		Drill hole No. 1-AS
43		Drill hole No. 1-AS
44		Drill hole No. 2-AS
45	El Paso Natural Gas Co.	Oil/gas well No. WDH-32-2
46	Dorchester Exploration, Inc.	Oil/gas well No. 1 U.P.R.R.
47	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 2-AS
48	↓	Drill hole No. 1-AS
49		Drill hole No. 4-AS
50		Drill hole No. 3-AS
51		Drill hole No. 1-AS
52		Drill hole No. 2-AS
53		Drill hole No. 1-AS
54		Drill hole No. 1-AS

Table 4. -- Continued

Plate 1 Index Number	Source	Data Base
55	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 1-AS
56		Drill hole No. 3-AS
57		Drill hole No. 2-AS
58		Drill hole No. 1-AS
59		Drill hole No. 3-AS
60		Drill hole No. 2-AS
61	Kenneth Luff, Inc.	Oil/gas well No. 1-25 Amoco-Champlin
62	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 2-AS
63		Drill hole No. 3-AS
64		Drill hole No. 2-AS
65		Drill hole No. 6-AD
66		Drill hole No. 5-AD
67		Drill hole No. 4-AD
68		Drill hole No. 3-AD
69		Drill hole No. 2-AD
70		Drill hole No. 1-AD
71		Drill hole No. 8-AD
72		Drill hole No. 7-AD
73		Drill hole No. 6-AD

Table 4. -- Continued

Plate 1 Index Number	Source	Data Base
74	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 5-AD
75		Drill hole No. 4-AD
76		Drill hole No. 3-AD
77		Drill hole No. 2-AD
78		Drill hole No. 1-AD
79		Drill hole No. 1-AS
80		Drill hole No. 2-AS

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