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# COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE ROCK SPRINGS QUADRANGLE, SWEETWATER COUNTY, WYOMING

[Report includes 24 plates]

Prepared for

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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# INTRODUCTION

## Purpose

This text is to be used in conjunction with Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) Maps of the Rock Springs 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 Published and unpublished public information was used as the data base for this study. No new drilling or field mapping was performed, nor was any confidential data used.

## Location

The Rock Springs quadrangle is located in west-central Sweetwater County, Wyoming, approximately 11 miles (18 km) east of Green River and 19 miles (31 km) southwest of Point of Rocks, Wyoming. The city of Rock Springs, located in the northwestern part of the quadrangle, and the town of Quealy, in the southwestern part of the quadrangle, are the only populated areas in the quadrangle.

## Accessibility

The main east-west line of the Union Pacific Railroad passes through Rock Springs, and provides railway service across southern Wyoming, connecting Ogden, Utah to the west, with Omaha, Nebraska to the east. Spur lines run north from Rock Springs to the towns of Reliance and Winton, and south to Quealy.

Interstate Highway 80 passes east-west across the northern third of the quadrangle through the city of Rock Springs. Wyoming Highway 187 extends northward from Rock Springs, cutting across the northwestern corner of the quadrangle. Wyoming Highway 430, connecting Rock Springs to Hiawatha, Colorado, crosses the central part of the quadrangle. Secondary dirt roads and trails branching from these major routes provide access through the remainder of the quadrangle.

## Physiography

The Rock Springs quadrangle is located on the western flank of the Rock Springs uplift. The landscape is characterized by a generally rugged terrain of buttes, escarpments, valleys, and badland topography. The Baxter Basin borders the eastern edge of the quadrangle. Altitudes in the quadrangle range from approximately 6,240 feet (1,902 m) along Bitter Creek on the northwestern edge of the quadrangle to 7,020 feet (2,140 m) in the east-cental part of the quadrangle.

Bitter Creek, a tributary of the Green River to the west of the quadrangle, flows westerly across the northern half of the quadrangle. Sweetwater Creek, a tributary of Bitter Creek, flows northwesterly and drains the southern half of the quadrangle. Killpecker Creek drains a small area in the northwestern corner of the quadrangle and joins Bitter Creek at Rock Springs. All streams flow intermittently in response to snowmelt 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. The annual precipitation averages 9 inches (22.9 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) (U.S. Bureau of Land Management, 1978, and Wyoming Natural Resources Board, 1966).

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

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

### Land Status

The Rock Springs quadrangle lies in the west-central part of the Rock Springs Known Recoverable Coal Resource Area. Approximately two thirds of the quadrangle lies within the KRCRA boundary; however the Federal government owns the coal rights for only one sixth of this land. One active coal lease is present within the KRCRA boundary, as shown on plate 2.

## GENERAL GEOLOGY

### Previous Work

Schultz described the geology and coal resources of the northern (1909) and the southern (1910) parts of the Rock Springs coal field, and the geology and structure of the Baxter Basin and surrounding area (1920). Sears (1926) also investigated the geology and structure of the Baxter Basin gas field located on the eastern edge of the Rock Springs quadrangle and in adjacent quadrangles. Swann (1930) described the coals present in the Rock Springs coal field. Dobbin (1940) mapped the Gunn-Quealy area and Lindeman (1947) mapped the northern part of the Rock Springs coal field. Hale described the stratigraphy and depositional history of the formations cropping out on the flanks of the Rock Springs uplift in 1950 and 1955. Yourston (1955) described the structure and stratigraphy of the coal-bearing formations in the Rock Springs coal field and published analyses for Rock Springs area coals. Weimer (1960), Smith (1961), Weichman (1961), Burger (1965), and Keith (1965) described the stratigraphy and discussed the depositional environment of Upper

Cretaceous-age formations in the Rock Springs area. The depositional history of the Upper Cretaceous-age formations exposed on the flanks of the Rock Springs uplift was also described by Weimer (1961) and Douglas and Blazzard (1961). Roehler (1961) described the Late Cretaceous-Tertiary unconformity present in the Rock Springs area. Gosar and Hopkins (1969) summarized the structure and stratigraphy of Upper Cretaceous- and Tertiary-age formations in the southwestern part of the Rock Springs uplift. Coal analyses and measured sections of coal in the Rocks Springs coal field were published by Glass in 1975. Roehler, Swanson, and Sanchez described the geology and coal resources of the Rock Springs coal field in 1977. Unpublished drill hole data from Rocky Mountain Energy Company (RMEC) also provided coal thickness information.

## Stratigraphy

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

The Baxter Shale of Upper Cretaceous age, cropping out on the eastern edge of the quadrangle, is composed of soft, slightly sandy, dark-gray gypsiferous shale with thin-bedded sandstone and limestone. The non-coal-bearing marine Baxter Shale, which may be up to 3,600 feet (1,097 m) thick, forms the floor of Baxter Basin (Hale, 1950, 1955, Keith, 1965, and Smith, 1961).

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

The Blair Formation crops out in the eastern part of the quadrangle where it is approximately 1,300 feet (396 m) thick. 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 grade 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, 1955, Keith, 1965, and Smith, 1961). The Blair Formation contains no coal.

The coal-bearing Rock Springs Formation, conformably overlying the Blair Formation, is approximately 1,450 feet (442 m) thick and crops out in a north-south trending band across the center of the Rock Springs quadrangle. The Rock Springs Formation consists of a sequence of thick coal beds; brown, black and gray carbonaceous shale; siltstone; claystone and sandstone in the north and northwestern parts of the Rock Springs uplift. These paludal sedimentary rocks intertongue to the southeast with massive white to light-gray, fine- to medium-grained littoral sandstone. These, in turn, intertongue with and grade laterally into gray marine shale and associated thin, very fine grained sandstone toward the southeastern part of the uplift area (Hale, 1950, 1955, Keith, 1965, Smith, 1961, and Weichman, 1961).

The Ericson Formation, approximately 400 feet (122 m) thick (Smith, 1961), crops out in a narrow band along the western part of the Rock Springs quadrangle where it unconformably overlies the Rock Springs Formation (Roehler and others, 1977). The upper and lower sections of the Ericson Formation consist of light-gray, massive, cliff-forming, cross-bedded, fine- to coarse-grained sandstone and conglomerate containing chert pebbles. These are separated by a middle section of shale, carbonaceous shale or occasional thin coals, and rusty-weathering sandstone. This middle section, often referred to as the "rusty zone," is approximately 65 feet (20 m) thick in T. 17 N., R. 105 W., and thins northward along the west flank of the Rock Springs uplift, so that near Winton, Wyoming it cannot be recognized with any certainty (Hale, 1950, 1955, and Smith, 1961).

The Almond Formation, conformably overlying the Ericson Formation, is exposed in a narrow band across the northwestern corner of the Rock Springs quadrangle. Because of the unconformable contact with the overlying Fort Union Formation of Paleocene age, the Almond Formation thins out from north to south in the Rock Springs quadrangle (Hale, 1950). However, Gosar and Hopkins (1969) report Almond Formation outcrops in the Kappes Canyon quadrangle to the south. The Almond Formation reaches a maximum thickness of over 640 feet (195 m) at the northern end of the Rock Springs uplift (Hale, 1950 and 1955). In the Mountain Fuel Supply Company Firehole Unit No. 1 well located in sec. 12, T. 16 N., R. 106 W., to the southwest of the Rock Springs quadrangle, the Almond Formation is only 170 feet (52 m) thick where truncated and overlapped by the Fort Union Formation sediments (Gosar and Hopkins, 1969). 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 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 northwestern corner of the quadrangle. Hale (1950) reports 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., resting on middle Almond Formation.

Recent deposits of alluvium cover the stream valleys of Bitter Creek, Sweetwater Creek and Killpecker Creek.

The formations of Cretaceous age in the Rock Springs 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).

Deposition of the Baxter Shale marked a westward or landward movement of the sea as shale, sandstone, and limestone were deposited in an offshore marine environment (Douglass and Blazzard, 1961, and Hale, 1950).

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, and 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, and Gosar and Hopkins, 1969).

The Ericson Formation was deposited in stream and floodplain environments with a source area to the northwest (Douglass and Blazzard, 1961, and 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. South of Rock Springs, thick sections of detrital material were deposited in fluvial environments surrounding a topographic high present in that area during Paleocene time (Roehler, 1961).

## Structure

The Rock Springs quadrangle is located on the western 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 Upper Cretaceous age are exposed in the core of the uplift (Gosar and Hopkins, 1969, and Yourston, 1955).

The strike of the coal beds in the Rock Springs quadrangle is generally from north to northeast, with the beds dipping 5° to 18° west to northwest. The area contains numerous faults including several normal faults in the western half of the quadrangle which strike nearly at right angles to the strike of the beds. Horizontal displacement of the Tertiary-age faults can be as great as 3 miles (4.8 m) with vertical movement of several hundred feet (Yourston, 1955).

## COAL GEOLOGY

In this quadrangle, drill hole and measured section data are only available for the Rock Springs Formation coal zone. The Almond Formation contains coal to the north in the Reliance quadrangle, but no coal beds were mapped in this quadrangle. One Almond Formation coal bed, identified in a drill hole in the Reliance quadrangle, influences part of a Federally owned section along the northern boundary of the Rock Springs quadrangle (see the Isolated Data Points section of this report). The Fort Union Formation is believed to contain one coal bed of significant thickness projected from drill hole data in the Reliance quadrangle.

The Rock Springs Formation coal zone is the stratigraphically lowest coal zone found in this quadrangle. The Fort Union Formation coal bed is approximately 2,000 feet (610 m) above the uppermost coal bed of the Rock Springs Formation coal zone.

Chemical analyses of coal.--Chemical analyses of samples from the Rock Springs Formation coal zone are shown in table 1. The samples analyzed all rank as high-volatile C bituminous. Analyses of the Fort Union Formation and Almond Formation coal zones were not available, but Roehler (1977) reported the coal in these formations to be subbituminous. The coals are ranked on a moist mineral-matter-free basis according to ASTM standard specification D 388-77 (ASTM, 1977).

## Rock Springs Formation Coal Zone

Five coal beds of Reserve Base thickness (5 feet or 1.5 meters minimum) were mapped in the quadrangle. A number of other Rock Springs coal zone coal beds were also present in drill holes and measured sections, but were not of Reserve Base thickness. The Rock Springs Formation coal zone crops out through the central and western parts of the quadrangle with the strike of the coal beds running, generally, north-south. Dips taken along the outcrops range from 9° to 18° to the west with overburden thickness increasing in the same direction (Schultz, 1910).

### Rock Springs No. 15 Coal Bed

The Rock Springs No. 15 coal bed is, stratigraphically, the lowest isopached coal bed in the Rock Springs Formation coal zone. The coal bed reaches a maximum cumulative coal thickness of 10 feet (3.0 m) with 16 feet (4.9 m) of rock partings in sec. 1, T. 18 N., R. 105 W. The average thickness, however, is only 4 feet (1.2 m) in this quadrangle. In the Reliance quadrangle to the north, the Rock Springs No. 15 coal bed averages 5 feet (1.5 m) thick. Toward the southern boundary of the Rock Springs quadrangle, the coal bed appears to pinch out. The dip of the coal bed, as calculated from plate 5, ranges from 5° to 7° to the west.

### Rock Springs No. 7 Coal Bed

The Rock Springs No. 7 coal bed is stratigraphically above and separated from the Rock Springs No. 15 coal bed by approximately 240 feet (73 m) of sandstone and carbonaceous shale. Where encountered in drill holes in secs. 2 and 15, T. 18 N., R. 105 W., the Rock Springs No. 7 coal bed is 7.4 feet (2.3 m) thick. The coal bed averages 6 feet (1.8 m) thick, thinning to the north and south within the quadrangle. In the Reliance quadrangle, to the north, the Rock Springs No. 7 coal bed thickens to an average of 6 feet (1.8 m). Calculated from plate 12, the dip of the coal bed is approximately 6° to the west.

Rock Springs No. 1 Coal Bed

The Rock Springs No. 1 coal bed is located approximately 250 feet (76 m) stratigraphically above the Rock Springs No. 7 coal bed. In sec. 25, T. 19 N., R. 105 W., an outcrop measurement of 11 feet (3.4 m) was recorded; however, the average coal bed thickness is approximately 7 feet (2.1 m) in this quadrangle. The average coal bed thickness is also 7 feet (2.1 m) to the north in the Reliance quadrangle, but to the south in the Kappes Canyon quadrangle, the Rock Springs No. 1 coal bed thins to less than Reserve Base thickness. The dip, calculated from plate 16, is approximately 7° to the west.

Rock Springs No. 3 Coal Bed

The Rock Springs No. 3 coal bed is separated from the Rock Springs No. 1 coal bed by approximately 150 feet (46 m) of carbonaceous shale and sandstone. The maximum recorded thickness for the Rock Springs No. 3 coal bed is 6.4 feet (2.0 m), located in sec. 15, T. 18 N., R. 105 W. The average thickness of the coal bed in this quadrangle is approximately 5 feet (1.5 m), thinning to 4 feet (1.2 m) toward the northern boundary of the quadrangle. In the Reliance quadrangle to the north, the average thickness is also 5 feet (1.5 m), and to the south in the Kappes Canyon quadrangle, the coal bed is believed to thin to less than Reserve Base thickness. The dip, calculated from plate 20, is 9° to the west.

Rock Springs No. 5 Coal Bed

The Rock Springs No. 5 coal bed is located stratigraphically above the Rock Springs No. 3 coal bed and is separated from it by approximately 250 feet (76 m) of carbonaceous shale and sandstone. The maximum recorded thickness, located in sec. 15, T. 18 N., R. 105 W., is 11.8 feet (3.6 m) and contains no rock partings. From this location, the bed thins to less than Reserve Base thickness in all directions in this quadrangle. In the Reliance quadrangle to the north, the correlative Upper Rock Springs No. 5 coal bed can be as much as 26 feet (7.9 m) thick, excluding the shale partings which range from 1 to 6 feet (0.3 to 1.8 m) in thickness. The average dip as calculated from plate 8 is 8° to the west.

## Fort Union Formation Coal Zone

At least one prominent coal bed, the Fort Union No. 1 coal bed, probably extends into this quadrangle from the adjacent Reliance quadrangle, although no data points from the Fort Union Formation Coal Zone were available in this quadrangle. The Fort Union No. 1 coal bed measures 11 feet (3.4 m) thick in sec. 15, T. 19 N., R. 105 W., on the southern boundary of the Reliance quadrangle. A 10-foot (3.0-m) isopach line extends into the Rock Springs quadrangle as a result of this measurement. The dip of the coal bed, as derived from plate 4, is approximately 8° to the west.

## Isolated Data Points

In instances where isolated measurements of coal beds thicker than 5 feet (1.5 m) 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 beds limits the extent to which they can be reasonably projected in any direction and usually precludes correlations with other, better known beds. For this reason, isolated data points are included on a separate sheet (in U.S. Geological Survey files) for non-isopached coal beds. The isolated data point found in this quadrangle and the influences from isolated data points in adjacent quadrangles are listed on the following page. Coal beds identified by bracketed numbers are not formally named, but are used for identification purposes in this quadrangle only.

| Source | Location | Coal Bed or Zone | Thickness |
|---|---|---|---|
| RMEC | sec. 24<br>T. 19 N., R. 105 W. | RS[2] | 6.0 ft (1.8 m) |
| | From Reliance Quadrangle | | |
| RMEC | sec. 15<br>T. 19 N., R. 105 W. | A1 | 5.5 ft (1.7 m) |
| | From Kanda Quadrangle | | |
| RMEC | sec. 3<br>T. 18 N., R. 105 W. | FU | 7.3 ft (2.2 m) |
| Dobbin, 1940 | sec. 16<br>T. 18 N., R. 105 W. | RS[1] | 6.1 ft (1.9 m) |

## COAL RESOURCES

Information from an oil and gas well, and coal test holes from Rocky Mountain Energy Company (RMEC), the U.S. Geological Survey (1951), and Dobbin (1940), as well as measured sections by Schultz (1910), the U.S. Geological Survey (no date) and Glass (1975), were used to construct outcrop, isopach, and structure contour maps of the coal beds in the Rock Springs quadrangle. The source of each indexed data point shown on plate 1, sheet 1, is listed in table 4. 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.

Coal resources were calculated using data obtained from the coal isopach maps (plates 4, 7, 11, 15, and 19). 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. Reserve Base and Reserve tonnages for the isopached beds are shown on plates 10, 14, 18, and 22, and are rounded to the nearest 10,000 short tons (9,072 metric tons). Coal beds of

Reserve Base thickness (5 feet or 1.5 meters) or greater that lie less than 3,000 feet (914 m) below the ground surface are included. These criteria differ somewhat from that 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 bituminous and subbituminous coal. Only Reserve Base tonnages (designated as inferred resources) are calculated for areas influenced by the isolated data points in this quadrangle.

Coal Reserve Base tonnages per Federal section are shown on plate 2 and total approximately 10.64 million short tons (9.65 million metric tons) for the entire quadrangle, including tonnages from the isolated data points. 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.

Unknown development potentials have been assigned to those areas where coal data is absent or extremely limited. 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. Areas influenced by isolated data points are considered to have unknown development potential. The areas influenced by the isolated data points in this quadrangle contain approximately 1,470,000 short tons (1,334,000 metric tons) of coal available for surface mining.

The coal development potential for surface mining methods (less than 200 feet or 61 meters of overburden) is shown on plate 23.

Of the Federal land areas having a known development potential for surface mining methods, 60 percent are rated high, 20 percent are rated moderate, and 20 percent are rated low. The remaining Federal lands within the KRCRA boundary are classified as having unknown development potential for surface mining methods, indicating that no known coal beds 5 feet (1.5 m) or more thick, excluding isolated data points, occur within 200 feet (61 m) of the ground surface but that coal-bearing units are present.

## 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 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.

Unknown development potentials have been assigned to those areas where coal data is absent or extremely limited. 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. Areas influenced by isolated data points are considered to have unknown development potential. The areas influenced by the isolated data points in this quadrangle contain approximately 220,000 short tons (200,000 metric tons) of coal available for conventional subsurface mining.

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.

None of the Federal lands within the KRCRA boundary in this quadrangle have been rated for in-situ mining because the coal beds dip less than 15 degrees.

Table 1. Chemical analyses of coals in the Rock Springs quadrangle, Sweetwater County, Wyoming.

| LOCATION | COAL BED NAME | Form of analysis | Proximate | | | | Ultimate | | | | | Heating value | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Moisture | Volatile matter | Fixed carbon | Ash | Sulfur | Hydrocarbon | Carbon | Nitrogen | Oxygen | Calories | Btu/lb |
| SE¼, SW¼, sec. 26, T. 19 N., R. 105 W., (Union Pacific Old No. 5 Mine - U.S. Bur. 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. Bur. 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 |
| NE¼, NE¼, sec. 35, T. 19 N., R. 105 W., (Union Pacific No. 1 Mine - U.S. Bur. 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 |
| NE¼, NW¼, sec. 25, T. 19 N., R. 105 W., (No. 8 Mine - U.S. Bur. Mines, 1931) | Rock Springs No. 7 | A | 14.5 | 33.3 | 47.1 | 5.2 | 1.0 | - | - | - | - | - | 10,960 |
| | | C | 0.0 | 38.9 | 55.0 | 6.1 | 1.2 | - | - | - | - | - | 12,800 |
| **Form of analysis:** A, as received<br>C, moisture free | | | | | | | | | | | | | |

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

**Table 2.** Strippable coal Reserve Base data for Federal coal lands (in short tons) in the Rock Springs quadrangle, Sweetwater County, Wyoming.

| Coal Bed | High Development Potential | Moderate Development Potential | Low Development Potential | Total |
|---|---|---|---|---|
| Fort Union No. 1 | 70,000 | 40,000 | 150,000 | 260,000 |
| Rock Springs No. 15 | 870,000 | 640,000 | 820,000 | 2,330,000 |
| Total | 940,000 | 680,000 | 970,000 | 2,590,000 |

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 Rock Springs quadrangle, Sweetwater County, Wyoming.

| Coal Bed | High Development Potential | Moderate Development Potential | Low Development Potential | Total |
|---|---|---|---|---|
| Fort Union No. 1 | 50,000 | - | - | 50,000 |
| Rock Springs No. 5 | 910,000 | - | - | 910,000 |
| Rock Springs No. 3 | 1,090,000 | 240,000 | - | 1,330,000 |
| Rock Springs No. 1 | 1,540,000 | 390,000 | - | 1,930,000 |
| Rock Springs No. 7 | 300,000 | 1,500,000 | - | 1,800,000 |
| Rock Springs No. 15 | 360,000 | - | - | 360,000 |
| Total | 4,250,000 | 2,130,000 | - | 6,380,000 |

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. 4AD |
| 2 | | Drill hole No. 3AD |
| 3 | | Drill hole No. 1AS |
| 4 | | Drill hole No. L.C. |
| 5 | | Drill hole No. 3 |
| 6 | | Drill hole No. 2 |
| 7 | | Drill hole No. 4 |
| 8 | | Drill hole No. 6 |
| 9 | | Drill hole No. 11 |
| 10 | | Drill hole No. 12 |
| 11 | | Drill hole No. 7 |
| 12 | | Drill hole No. 9 |
| 13 | | Drill hole No. 10 |
| 14 | | Drill hole No. 1 |
| 15 | | Drill hole No. 1AD |
| 16 | Dobbin, 1940, U.S. Geological Survey, unpublished map | Drill hole No. 5 |
| 17 | | Drill hole No. 7 |
| 18 | Rocky Mountain Energy Co., (no date), unpublished data | Drill hole No. 1AD |

Table 4. -- Continued

| Plate 1 Index Number | Source | Data Base |
|---|---|---|
| 19 | Dobbin, 1940, U.S. Geological Survey, unpublished map | Drill hole No. 8 |
| 20 | Rocky Mountain Energy Co., (no date), unpublished data | Drill hole No. 3AD |
| 21 | ↓ | Drill hole No. 1AS |
| 22 | ↓ | Drill hole No. 7-A |
| 23 | ↓ | Drill hole No. 12-A |
| 24 | ↓ | Drill hole No. 10-A |
| 25 | Dobbin, 1940, U.S. Geological Survey, unpublished map | Drill hole No. 4 |
| 26 | ↓ | Drill hole No. 3 |
| 27 | ↓ | Drill hole No. 2-A |
| 28 | Glass, 1975, Wyoming Geological Survey Report of Investigations No. 11 | Measured Section No. 74-22 |
| 29 | Rocky Mountain Energy Co., (no date), unpublished data | Drill hole No. 3AD |
| 30 | ↓ | Drill hole No. 2AD |
| 31 | ↓ | Drill hole No. 1AD |
| 32 | ↓ | Drill hole No. 3AD |
| 33 | ↓ | Drill hole No. 2AD |

Table 4. -- Continued

| Plate 1 Index Number | Source | Data Base |
|---|---|---|
| 34 | Rocky Mountain Energy Co., (no date), unpublished data | Drill hole No. 1AD |
| 35 | U.S. Geological Survey, 1951, Inactive Coal Lease No. Evanston-015155 | Drill hole No. 16-26 |
| 36 | ↓ | Drill hole No. 4-26 |
| 37 | ↓ | Drill hole No. 1 |
| 38 | ↓ | Drill hole No. 9-26 |
| 39 | ↓ | Drill hole No. 235 |
| 40 | ↓ | Drill hole No. 46 |
| 41 | ↓ | Drill hole No. 12-26 |
| 42 | Rocky Mountain Energy Co., (no date), unpublished data | Drill hole No. 1 line A |
| 43 | ↓ | Drill hole No. 2 line A |
| 44 | ↓ | Drill hole No. 6 line A |
| 45 | ↓ | Drill hole No. 5 line A |
| 46 | ↓ | Drill hole No. 4 line A |
| 47 | ↓ | Drill hole No. 3 line A |
| 48 | ↓ | Drill hole No. 1AS |

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Table 4. -- Continued

| Plate 1 Index Number | Source | Data Base |
|---|---|---|
| 49 | Rocky Mountain Energy Co., (no date), unpublished data | Drill hole No. 2AS |
| 50 | ↓ | Drill hole No. 4 line B |
| 51 | | Drill hole No. 3 line B |
| 52 | | Drill hole No. 2 line A |
| 53 | | Drill hole No. 1 line B |
| 54 | | Drill hole No. 6AS |
| 55 | | Drill hole No. 1AS |
| 56 | | Drill hole No. 3AS |
| 57 | | Drill hole No. 3AD |
| 58 | Davis Oil Co. | Oil/gas well No. 1 Quealy |
| 59 | Rocky Mountain Energy Co., (no date), unpublished data | Drill hole No. 1AS-2 |
| 60 | ↓ | Drill hole No. 6AD |
| 61 | | Drill hole No. 5AD |
| 62 | | Drill hole No. 4AD |
| 63 | | Drill hole No. 3AD |

Table 4. -- Continued

| Plate 1 Index Number | Source | Data Base |
|---|---|---|
| 64 | Rocky Mountain Energy Co., (no date), unpublished data | Drill hole No. 2AD |
| 65 | ↓ | Drill hole No. 1AD |
| 66 | ↓ | Drill hole No. 4AS |
| 67 | ↓ | Drill hole No. 3AS |
| 68 | ↓ | Drill hole No. 5AS |
| 69 | ↓ | Drill hole No. 2AS |
| 70 | ↓ | Drill hole No. 1AS |

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