Text to accompany:

Open-File Report 78-063

1978

COAL RESOURCE OCCURRENCE MAPS OF THE COAL BANK BASIN QUADRANGLE, CARBON COUNTY, WYOMING

(Report includes 3 plates)

Prepared by:

TEXAS INSTRUMENTS INCORPORATED
DALLAS, TEXAS

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

CONTENTS

ILLUSTRATIONS

[Plates are in pocket]

APPENDICES

INTRODUCTION

Purpose

This text is to be used along with the accompanying Coal Resource Occurrence (CRO) maps of the Coal Bank Basin quadrangle, Carbon County, Wyoming (3 plates; U.S. Geol. Survey Open-File Report 78-063),prepared by Texas Instruments Incorporated under contract to the U.S. Geological Survey. This report was prepared to support the land planning work of the U.S. Bureau of Land Management's Energy Minerals Activities Recommendation System (EMARS) program, and to contribute to a systematic coal resource inventory of Federal coal lands in Known Recoverable Coal Resource Areas (KRCRA's) in the western United States. The Coal Resource Occurrence maps for this quadrangle cover an area south of the KRCRA of the Hanna coal field. The lack of correlatable coal of Reserve Base thickness in this quadrangle, as indicated on the CRO maps, precluded the construction of Coal Development Potential (CDP) maps which normally accompany this type of report.

Acknowledgment

Texas Instruments Incorporated acknowledges the cooperation of the Rocky Mountain Energy Company, a wholly owned subsidiary of the Union Pacific Railroad Company, in supplying copies of survey sheets, driller reports, electric logs, and coal analyses from the Union Pacific coal inventory program.

The Hanna and Carbon coal basins were studied as part of the Union Pacific coal inventory program and test drilling was conducted in 1970-1971. More than 650 Union Pacific coal drill holes have been evaluated as part of this contract study of 21 quadrangles in Carbon County, Wyoming, and the results and 230 coal analyses have been incorporated into these reports.

Location

The Coal Bank Basin 7½-minute quadrangle is in the southeastern part of Carbon County, Wyoming. The center of the quadrangle is approximately 9 miles (14 km) southeast of Walcott and 14 miles (23 km) southwest of Hanna, Wyoming (Figure 1).

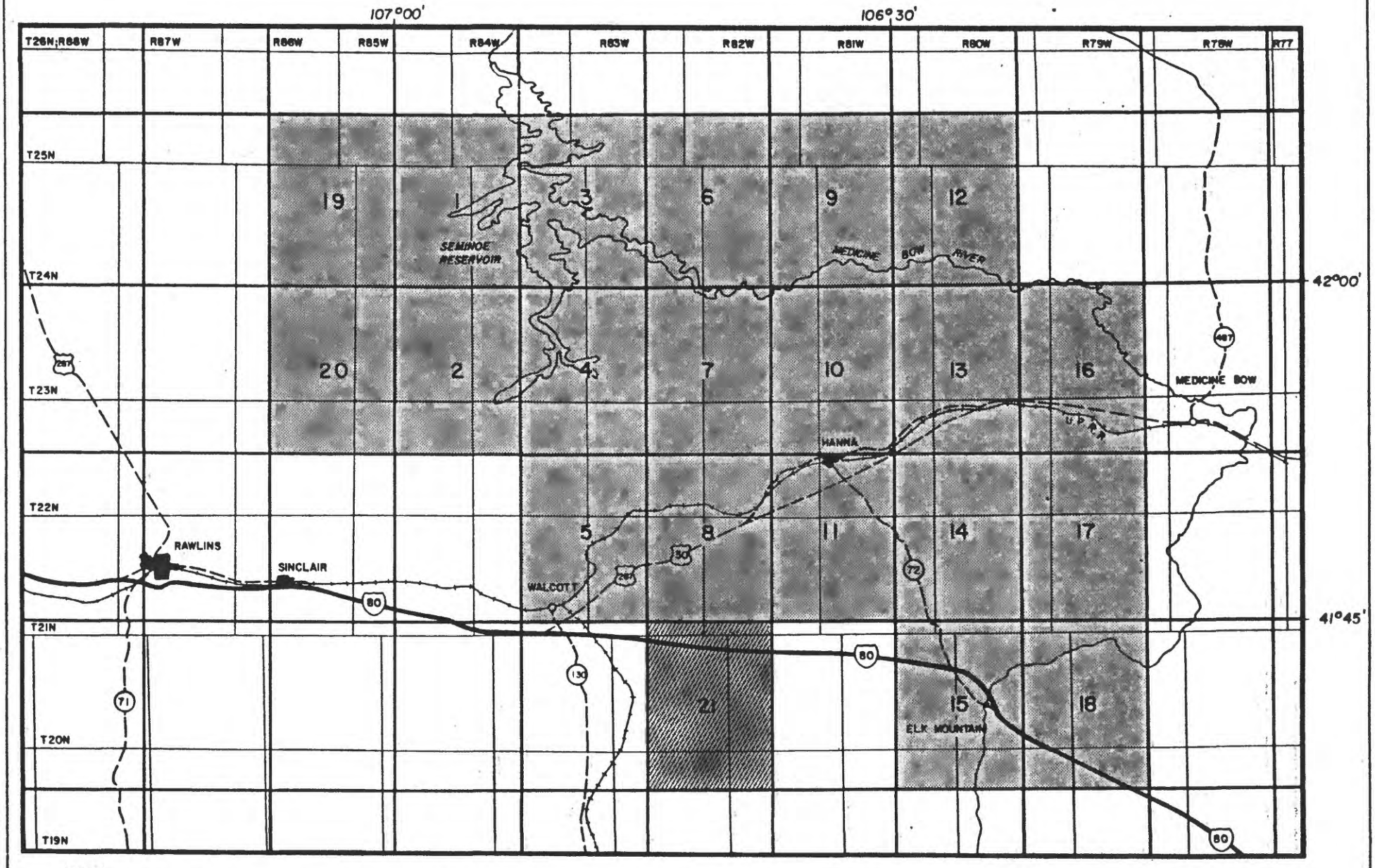

Figure 1. — Map of Hanna and Carbon Basins Study Area

Accessibility

U.S. Interstate Highway 80 crosses the quadrangle, near its northern border, in an approximate east-west direction. Several light-duty roads are south of the highway. The principle light-duty road is Rattlesnake Pass Road which crosses the central part of the quadrangle in an east-west direction connecting with State Highway 130 to the west and State Highway 72 to the east. In the northeast corner of sec. 29, T. 20 N., R. 83 W. a light-duty road extends due south along the section lines from Rattlesnake Pass Road to the southwest corner of the quadrangle. In the quadrangle corner, this road branches; one branch extends west beyond this quadrangle to connect with State Highway 130, and the other branch extends southwest to the town of Saratoga. The one remaining light-duty road in the quadrangle is a private road which, in sec. 4, T. 20 N., R. 83 W., leaves the section line road and runs approximately two miles to the southeast, to the Melody Ranch. A number of unimproved dirt roads provide access from the light-duty roads to a large portion of the remainder of the quadrangle.

The main east-west track of the Union Pacific Railroad lies approximately 10 miles (16 km) to the north of the center of Coal Bank Basin quadrangle.

Physiography

The quadrangle is located on the southern rim of the Hanna structural basin. The most prominent topographic features in the quadrangle are:

- Coal Bank Basin, an area of dissected upland plains, located in the north-central part of the quadrangle. Elevations range from about 6,800 to 7,100 feet (2,073 to 2,164 m).
- An arcuate ridge encompassing the Coal Bank Basin. Local relief varies from 200 to 500 feet (61 to 152 m). In the northeast part of the quadrangle this feature is named Dana (or Pass Creek) Ridge which, in this quadrangle, is the southeastern end of a major topographic feature, more than 11 miles (18 km) long, that extends northwest beyond this quadrangle to near the railroad camp of Edson in the Walcott quadrangle. Names of topographic features are taken from the 1:24,000 topographic map (1955 edition). If different names were used on the geologic map of Dobbin, Bowen, and Hoots (1929) the earlier names are shown in parentheses throughout this report.

- Sheephead Mountain in the southeastern part of the quadrangle, with a local relief above Rattlesnake Creek of nearly 1,800 feet (549 m).

- Overland Flats, an area of undulating upland plains, located in the west-central and southwestern parts of the quadrangle. Water supplies are more plentiful in this area, the valley of Pass Creek, and ranches are numerous compared with the remainder of the of the quadrangle.

Elevations within the quadrangle range from less than 6,670 feet (2,033 m) on Pass Creek at the northwest border of the quadrangle, to 8,679 feet (2,645 m) at the summit of Sheephead Mountain.

Four streams drain the major part of the quadrangle: from south to north Hat Creek, Rattlesnake Creek and Coal Bank Draw, flow westerly to Pass Creek; Pass Creek flows north across the Overland Flats near the western border and leaves the quadrangle in the northwest to join the North Platte River, 10 miles (16 km) west of the center of this quadrangle. Numerous intermittent tributary streams drain the upland slopes and ridges.

Climate

Climate data for the Coal Bank Basin quadrangle were obtained by evaluating and averaging the data recorded at two nearby weather stations. The Elk Mountain station is located 14 miles (23 km) east of the center of the quadrangle at an elevation of 7,270 feet (2,216 m); precipitation records are available for 65 years to 1970 and temperature records are available for 22 years to 1970. The Seminoe Dam station is located 34 miles (55 km) northwest of the center of the quadrangle at an elevation of 6,838 feet (2,084 m); precipitation and temperature records are available for 33 years to 1970.

The climate is semiarid with a mean annual temperature of 42°F (6°C) and extremes ranging from 98° to -42°F (37° to -41°C). July is the warmest month with a mean monthly temperature of 66°F (19°C) and January is the coldest month with 22°F (-6°C). For seven months of the year, April to October, the mean monthly temperature exceeds 32°F (0°C). Average annual precipitation is 14 inches (36 cm) with 53 percent of this total falling in the five months of March to July. Part of the precipitation in March, April, and May is in the form of snow. Average annual snowfall is 102

inches (259 cm) with 63 percent falling in the four months of January to April. Snow rarely falls in July and August but an inch or more of snow may fall in any other month. March is the month of maximum snowfall (18 inches, or 46 cm).

High winds are common throughout most of the year. The prevailing wind direction, as recorded at four weather stations around the perimeter of the Hanna and Carbon Basins, is westerly for all twelve months of the year. The growing season is restricted to less than 100 days between late May and early September, which are the average times of the last killing spring frost and the first killing fall frost, respectively.

Land Status

The Coal Bank Basin quadrangle is more than 4 miles (6 km) south of the KRCRA of the Hanna coal field. The Federal Government owns 25 percent of the coal rights in the quadrangle; the remaining 75 percent is nonfederally owned. There are no known active mining leases, permits or licenses in the quadrangle, and no known active mining operations. Plate 2 of the CRO maps illustrates the ownership status of land in the quadrangle.

Two unnamed abandoned underground coal mines are located in secs. 1 and 12, T. 20 N., R. 83 W. (Plate 1). According to Glass (1972) these mines operated prior to 1955 and mined Cretaceous coal beds, but no production tonnage data are available. Most probably, the mines worked Mesaverde coal beds for local use.

GENERAL GEOLOGY

Previous Work

Veatch (1907) prepared a geologic reconnaissance map of east-central Carbon County which included the Coal Bank Basin quadrangle. Dobbin, Bowen, and Hoots (1929) mapped the area immediately to the north of the quadrangle. Beckwith (1941) mapped the eastern portion of the quadrangle and described the rock units exposed in the quadrangle. Weitz and Love (1952) compiled a geologic map of Carbon County which incorporates available data, published and unpublished, to that date.

Stratigraphy

Rocks exposed in the Coal Bank Basin quadrangle range in age from Precambrian to Quaternary. Coal occurrences mapped in the quadrangle are short outcrops of two coal beds in the Medicine Bow Formation on the northern quadrangle boundary. Coal is known to occur in the Mesaverde Formation but no surface exposures have been mapped in this quadrangle.

The oldest rocks exposed in the quadrangle are Precambrian in age. In the extreme southeastern corner of the quadrangle, Precambrian pink granites are exposed on Bear Butte. Just to the north of Bear Butte, on the southern slopes of Sheephead Mountain, Precambrian schists, granite gneisses, and granites are exposed. From Sheephead Mountain northward along the eastern edge of the quadrangle, progressively younger sediments crop out as part of the north-plunging Sheephead Mountain anticline. The succession consists of

- 490 feet (149 m) of Carboniferous rocks; these include the Madison Limestone, the Fountain Formation, and the Tensleep Sandstone.
- 850 feet (259 m) of Chugwater Formation of Permian-Triassic age.
- 150 feet (46 m) of Jelm Formation of Triassic age.
- 580 feet (177 m) of Upper Jurassic rocks; these include the Sundance and Morrison Formations.
- 405 feet (123 m) of Lower Cretaceous marine sediments, including the Cloverly Formation, Thermopolis Shale, and Mowry Shale.
- 4,170 feet (1,271 m) of Upper Cretaceous marine sediments, including the Frontier Formation, Carlile Shale, Niobrara Formation, and Steele Shale.

The succession is mainly marine; a continental environment is assigned only to parts of the Fountain and Chugwater Formations, to the Jelm and Morrison Formations, and to part of the Cloverly Formation. Beckwith (1941) places the base of the Upper Cretaceous at the top of the Cloverly Formation but faunal evidence requires that the overlying Thermopolis Shale and Mowry Shale be assigned an Early Cretaceous age (Oster, 1953, p. 44).

The Steele Shale defines the northern limit of the Sheephead Mountain anticline as it plunges north beneath the onlapping Tertiary sediments in

the northeastern corner of the quadrangle. Conformably overlying the Steele Shale is the Upper Cretaceous Mesaverde Formation. Recent studies in south-central Wyoming by Gill, Merewether, and Cobban (1970) have resulted in elevating the Mesaverde to group status and measuring and defining four separate formations within the group. Surface mapping delineating the formations of the Mesaverde Group has not been extended into the Coal Bank Basin quadrangle, however, and the group is here treated as a single unit. The Mesaverde Formation is exposed in a broad band across the central part of the quadrangle and in the northeast corner. Dobbin, Bowen, and Hoots (1929) report a thickness of 2,279 feet (695 m) for the Mesaverde Formation approximately 15 miles (24 km) northwest of the center of the Coal Bank Basin quadrangle. Beckwith (1941), when mapping the east part of the quadrangle, measured a thickness of 3,500 feet (1,067 m) for the Mesaverde, but states that 1,200 feet (366 m) of sandstones and sandy shales that he measured at the base of the unit were included in the Steele Shale by Dobbin, Bowen, and Hoots (1929). Beckwith (1941) describes the Mesaverde Formation in the Coal Bank Basin quadrangle as consisting of brown, gray and white sandstones alternating with light gray to carbonaceous shales. He also states that the lower part of the formation is marine and the upper part contains thin coal beds. He did not, however, map any coal beds in the Mesaverde Formation.

The Lewis Shale of Late Cretaceous age conformably overlies the Mesaverde Formation. It is exposed in a semicircular band in the northern part of the quadrangle, at the southern end of Walcott syncline. Beckwith (1941) assigns a thickness of 3,000 feet (914 m) to the Lewis Shale in the Coal Bank Basin quadrangle. He describes the unit as being predominantly dark gray shales with bands of light gray sandstones and sandy shales that contain hard brown "ironstone" concretions. The formation was deposited in a marine environment.

The Medicine Bow Formation of Late Cretaceous age conformably overlies the Lewis Shale. The unit is exposed in the north-central part of the Coal Bank Basin quadrangle in the core of the Walcott syncline. Beckwith (1941) accepts the thickness of 6,200 feet (1,890 m) for the Medicine Bow Formation as measured by Dobbin, Bowen, and Hoots (1929). Beckwith (1941) describes the formation as consisting of gray to brown sandstones, light gray to gray carbonaceous shales, and thin beds of coal. The depositional environment of

the formation is dominantly fresh-water with occasional brackish-water elements. Beckwith (1941) did not map any coal beds in the Medicine Bow Formation, but Dobbin, Bowen, and Hoots (1929) mapped two Medicine Bow coal beds in the quadrangle to the north, and projected their outcrops a few thousand feet into the north part of the Coal Bank Basin quadrangle.

McGrew (1951) described two continental Tertiary formations in the vicinity of Saratoga, 17 miles (27 km) to the southwest of the center of the Coal Bank Basin quadrangle. On their compilation map of Carbon County, Weitz and Love (1951) show the two units as extending into this quadrangle. The Browns Park Formation is of Miocene age; it is exposed in the northwest corner of the quadrangle and along the valley of Pass Creek, unconformably overlapping the Cretaceous formations on the south flank of the Walcott syncline. It comprises a basal conglomerate which grades up into gray to nearly white fine-grained sandstones, with thin lenses and beds of marl, clay, and green and gray volcanic ash. The basal conglomerate of the Browns Park varies in thickness from a few feet to 100 feet (30 m); the overlying sandstones are 750 feet (229 m) thick where exposed a few miles north of Saratoga. The North Park Formation is Pliocene in age; in this quadrangle it overlies the Browns Park Formation and extends easterly across the southern half of the quadrangle to lie unconformably on older rock units of the Sheephead Mountain anticline. It comprises a sequence of pinkish-buff fine-grained sands, bentonitic clays, stream gravels, marl, and volcanic ash. The thickness of the North Park Formation is variable. Beckwith (1941) gives a thickness of 0 to 400 feet (0-122 m) in the Elk Mountain district, and McGrew (1951) suggests a thickness of 1,600 feet (488 m) on the west flank of the Medicine Bow range. In the northeast corner of the Coal Bank Basin quadrangle, Tertiary sediments overlap the north flank of the Walcott syncline and the north end of the Sheephead Mountain anticline. In this area the Browns Park and North Park Formations of McGrew (1951) have not been differentiated in surface mapping and the unit is labeled Pliocene and Miocene undivided by Weitz and Love (1952).

Quaternary alluvium occurs as scattered deposits along the major drainage channels.

Structure

The dominant structure of the Coal Bank Basin quadrangle is the Sheephead Mountain anticline. This is a large structure which trends north-south along the east side of the quadrangle. The anticline is asymmetric with the axial plane dipping steeply to the west (Beckwith, 1941). Dips on the west flank range from 40° to 60° while dips on the east flank are steep, to vertical, to overturned. In the northeast part of the quadrangle, Beckwith (1941) noted a swing to the northwest of the axis of the anticline and he states that the structure is probably the same fold as the northwest-trending Dana (or Pass Creek) Ridge anticline that emerges, 4 miles (6 km) to the northwest, from beneath the overlapping Tertiary sediments. Near the summit of Sheephead Mountain four high-angle reverse faults cut the west flank of the Sheephead Mountain anticline. Displacement on the faults is small and probably the faults die out in the subsurface at moderate depth.

The only other structure exposed in the Coal Bank Basin quadrangle is the southeastern end of the Walcott syncline. The axial trace of the syncline is trending northwesterly as the structure plunges to the northwest from the west flank of the Sheephead Mountain anticline. The south flank of the syncline is progressively overlapped by Tertiary sediments and, in the northwest part of the quadrangle, the axial trace is also overlapped. The syncline is asymmetric with the axial plane dipping to the southwest; consequently, steep dips occur on the northeast flank and moderate dips occur on the southwest flank.

COAL GEOLOGY

Previous Work

The coal deposits of the Hanna and Carbon Basins have been studied by Veatch (1907), Dobbin, Bowen, and Hoots (1929), Berryhill and others (1950), and Glass (1972 and 1975).

Twenty-six coal analyses have been published since 1913 for coal beds of the Mesaverde Group and the Medicine Bow, Ferris, and Hanna Formations within the Hanna and Carbon Basins (Appendices 1 and 2). Samples collected and analyzed prior to 1913 have not been considered in this report (American Society for Testing and Materials, 1977, p. 218). An average analysis and

an apparent rank of coal beds in each of these four stratigraphic units have also been calculated for the 230 analyses from the Union Pacific coal inventory program (Appendices 1 and 2). A standard rank determination (ASTM, 1977, p. 216, sec. 6.2.2) cannot be made because: (a) some of the published analyses are from weathered coal samples, and (b) the procedure and quality of sampling for the Union Pacific coal evaluation program are not known.

Glass (1975) and U.S. Department of Interior (1975) published not only proximate coal analyses for 17 samples collected in the Hanna Basin, but also assays for 10 major and minor oxides, 12 major and minor elements, and up to 32 trace elements. Glass (1975, p. 1) stresses that his assay data are insufficient to characterize the chemical and physical properties of any individual coal beds but that this will be possible at a later date as the study continues. Assay results of the 17 Hanna Basin samples show that these coals contain no significantly greater amounts of trace elements of environmental concern than are found in the 42 samples collected in six other Wyoming coal fields.

General Features

In the Coal Bank Basin quadrangle, two Medicine Bow coal beds were mapped by Dobbin, Bowen, Hoots (1929); neither bed was identified in the subsurface (Plates 1 and 3). Coal is also reported in the Mesaverde Formation but none has been mapped in this quadrangle.

Medicine Bow Coal Beds

Two coal beds, DL1 and CBL1, in the Medicine Bow Formation were mapped in sec. 36, T. 21 N., R. 83 W. They strike west-northwest and dip 74° to the southwest. One surface measurement of 3.2 feet (1.0 m) was made on coal bed DL1; coal thicknesses for coal bed CBL1 average 1.5 feet (0.5 m).

COAL RESOURCES

Previous Work

Coal reserves of the Hanna and Carbon Basins have been estimated or calculated by Dobbin, Bowen, and Hoots (1929), Berryhill and others (1950), and Glass (1972).

Method of Calculating Resources

Data from Dobbin, Bowen, and Hoots (1929), oil and gas well logs, and coal drill holes (written communication, Rocky Mountain Energy Company, 1977) were used to construct the Coal Data Map (Plate 1) and the Coal Data Sheet (Plate 3) for the Coal Bank Basin quadrangle. U.S. Geological Survey reviewed these two plates and concluded that no individual coal bed or coal zone on unleased Federal land was thick enough and extensive enough to be selected for coal reserve evaluation. The additional Coal Resource Occurrence maps and the Coal Development Potential maps, which normally accompany this type of report, were not constructed. It is, therefore ,concluded that no coal resources and coal reserves exist beneath unleased Federal land in the Coal Bank Basin quadrangle.

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Appendix 1. — Average analyses of coal samples from the Hanna and Carbon Basins

Source of Data	Number of samples (1)	Total footage Ft	in	Average analyses — as received basis, Percent: Moisture	Ash	Volatile matter	Fixed carbon	Sulfur	Btu/lb	Calorific Value, Btu/lb Moist, mineral-matter-free basis (2)	Apparent rank of coal (3)
Published analyses	26	318	6	12.5	7.1	36.2	44.2	0.6	10,553	11,438	sub A or hvCb
Union Pacific coal inventory program	230	1,605	10	12.48	8.74	35.12	43.68	0.82	10,398	11,494	sub A or hvCb

Notes:

(1) Published data from USBM (1931, p. 40-45, sample nos. 2623, 2624, 22800, 22972, 93486, 93488, 93541, A14123, A14124); Glass (1975, p. 16-19, sample nos. 74-23 to 74-34, inclusive); Dept. of Interior (1975, p. 38, sample nos. D169597-99, D169607-08). Union Pacific coal inventory program data from company files, Rocky Mountain Energy Company (1977).

(2) Moist, mineral-matter-free Btu/lb calculated from average analyses, as received basis, using Parr formula (ASTM, 1977, p. 216, sec. 8.2).

(3) Sub A — subbituminous A; hvCb — high volatile C bituminous (ASTM, 1977, p. 215, sec 4.2, and p. 217).

[To convert feet and inches to meters, multiply feet by 0.3048 and inches by 0.0254. To convert Btu/lb to kilojoule/kilogram, multiply by 2.326].

Appendix 2. — Average analyses of coal grouped by coal-bearing formations in the Hanna and Carbon Basins

Source of data	Formation or Group	Number of samples (1)	Total footage Ft	Total footage in	Average analyses — as received basis: Percent: Moisture	Ash	Volatile matter	Fixed carbon	Sulfur	Btu/lb	Calorific Value, Btu/lb: Moist, mineral-matter-free basis (2)	Apparent rank of coal (3)
Published analyses	Mesaverde	1	4	0	14.1	7.8	36.5	41.6	1.1	10,290	11,251	sub A or hvCb
	Medicine Bow	2	10	1	12.8	3.8	33.3	50.2	0.8	11,050	11,534	hvCb
	Ferris	10	93	1	.13.0	8.3	34.3	44.3	0.4	9,970	10,956	sub A or hvCb
	Hanna	13	211	4	12.0	6.6	38.1	43.3	0.7	11,946	11,797	hvCb
Union Pacific coal inventory program	Mesaverde	13	70	5	9.45	8.41	35.42	46.72	0.77	11,112	12,237	hvCb
	Medicine Bow	16	93	4	13.09	4.03	35.46	47.42	0.80	10,927	11,446	sub A or hvCb
	Ferris	114	863	1	12.69	7.96	34.39	44.97	0.44	10,331	11,309	sub A or hvCb
	Hanna	87	579	0	12.51	10.67	35.96	40.85	1.33	10,280	11,640	hvCb

Notes:

(1) Published data from USBM (1931, p. 40-45, sample nos. 2623, 2624, 22800, 22972, 93486, 93488, 93541, A14123, A14124); Glass (1975, p. 16-19, sample nos. 74-23 to 74-34, inclusive); Dept. of Interior (1975, p. 38, sample nos. D169597-99, D169607-08). Union Pacific coal inventory program data from company files, Rocky Mountain Energy Company (1977).

(2) Moist, mineral-matter-free Btu/lb calculated from average analyses, as received basis, using Parr formula (ASTM, 1977, p. 216, sec. 8.2).

(3) Sub A — subbituminous A; hvCb — high volatile C bituminous (ASTM, 1977, p. 215, sec. 4.2, and p. 217).

[To convert feet and inches to meters, multiply feet by 0.3048 and inches by 0.0254. To convert Btu/lb to kilojoule/kilogram, multiply by 2.326].