

Text to Accompany:

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COAL RESOURCE OCCURRENCE MAPS AND  
COAL DEVELOPMENT POTENTIAL OF THE  
SOUTHEAST QUARTER OF THE  
FIREHOLE BASIN QUADRANGLE,  
SWEETWATER COUNTY, WYOMING  
[Report includes 3 plates]

Prepared for

UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

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

CONTENTS

	<u>Page</u>
Introduction.....	1
Purpose.....	1
Location.....	1
Accessibility.....	1
Physiography.....	2
Climate and vegetation.....	2
Land status.....	3
General geology.....	3
Previous work.....	3
Stratigraphy.....	3
Structure.....	6
Coal geology.....	6
Coal beds of the Fort Union Formation.....	6
Coal beds of the Wasatch Formation.....	7
Coal development potential.....	7
References.....	12

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ILLUSTRATIONS

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	<u>Page</u>
Plates 1-3. Coal resource occurrence maps:	
1. Coal data map	
2. Boundary data map	
3. Coal data sheet	
Figure 1. Isopach and structure contour map of the D coal bed.....	8
2. Overburden isopach and mining ratio map of the D coal bed.....	9

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TABLES

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Table 1. Sources of data used on plate 1.....	11
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## INTRODUCTION

### Purpose

This text is to be used in conjunction with Coal Resource Occurrence (CRO) Maps of the southeast quarter of the Firehole Basin 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 Published and unpublished public information available through June, 1978, was used as the data base for this study.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 southeast quarter of the Firehole Basin 15-minute quadrangle which is located in southwestern Sweetwater County, approximately 15 airline miles (24 km) southwest of the city of Rock Springs and 12 airline miles (19 km) southeast of the town of Green River, Wyoming. With the exception of the Sage Creek Ranch located in the southwestern part of the quadrangle, the quadrangle is unpopulated.

### Accessibility

Wyoming Highway 373, a paved medium-duty road, crosses the northeastern part of the quadrangle, connecting Interstate Highway 80 west of Rock Springs with the Wyoming-Utah border. Interstate Highway 80 lies approximately 12 miles (19 km) to the north of the quadrangle boundary. A light-duty road follows Sage Creek east-west across the southern third of the quadrangle, providing access to the Flaming Gorge Reservoir approximately 9 miles (14 km) west of the quadrangle. A second light-

duty road crosses the northwestern corner of the quadrangle, dropping into Firehole Canyon. Several other unimproved dirt roads and trails serve the remainder of the quadrangle.

The main east-west line of the Union Pacific Railroad passes approximately 12 miles (19 km) north of the quadrangle. This line provides railway service across southern Wyoming, connecting Ogden, Utah to the west with Omaha, Nebraska to the east.

#### Physiography

The southeastern quarter of the Firehole Basin 15-minute quadrangle lies on the southwestern flank of the Rock Springs uplift. The landscape is characterized by flat-topped mesas and deeply incised canyons. Altitudes in the quadrangle range from 7,765 feet (2,367 m) on Sheep Mountain along the southern edge of the quadrangle, to approximately 6,400 feet (1,951 m) on Sage Creek along the southwestern edge of the quadrangle.

Firehole Canyon drains the Firehole Basin located in the northern half of the quadrangle, while Sage Creek and its tributaries drain the southern half of the quadrangle. Both of these drainages flow into the Green River west of the quadrangle boundary. All of the streams in the quadrangle are intermittent and flow mainly 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 (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) (U.S. Bureau of Land Management, 1978, and Wyoming Natural Resources Board, 1966).

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).

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

#### Land Status

The southeast quarter of the Firehole Basin 15-minute quadrangle lies in the southwestern part of the Rock Springs Known Recoverable Coal Resource Area (KRCRA). Approximately 30 percent of the quadrangle's total area lies within the KRCRA boundary. The Federal government owns the coal rights for less than half of this area as shown on plate 2. No outstanding Federal coal leases, permits or licenses occur within the quadrangle.

#### GENERAL GEOLOGY

##### Previous Work

Culbertson's unpublished maps (no date) of the Firehole Basin 15-minute quadrangle are the only semi-detailed coal-outcrop maps available for this quadrangle. Bradley (1964), Culbertson (1965) and Roehler (1965) have described Tertiary strata in the quadrangle, especially in the Sage Creek area, where good rock exposures are present.

##### Stratigraphy

The formations cropping out in the southeast quarter of the Firehole Basin 15-minute quadrangle range in age from Paleocene to Oligocene. Only the Fort Union and Wasatch Formations are known to contain coal in this quadrangle.

The Fort Union Formation of Paleocene age crops out in the north-eastern corner of the quadrangle (Roehler, 1977, and Culbertson, no date). The rocks of this formation are characteristic of sediments deposited in reducing paludal environments, consisting of approximately 600 to 900 feet (183 to 274 m) of interbedded gray shales, carbonaceous shales, coals and white to rust-brown-weathering sandstones (Roehler, 1961).

The main body of the Wasatch Formation of Eocene age conformably overlies the Fort Union Formation and crops out over the eastern half of the quadrangle (Roehler, 1977). It is approximately 1,200 to 1,500 feet (366 m to 457 m) thick (Roehler, 1978), and consists of "red sandstones and thin interbedded red shales" known as the Fire Hole Sandstone facies (Roehler, 1965). Two coal beds are present in the upper part of the formation just beneath the Luman Tongue of the Green River Formation (Roehler, 1977). The coarse clastic nature of the red-bed fluviatile sequence suggests a local sediment source and deposition in a well-drained oxidizing environment (Roehler, 1965).

Approximately 15 feet (4.6 m) of thin low-grade oil shale and ostracode coquina limestone, forming the Luman Tongue of the Green River Formation of Eocene age, conformably overlies the main body of the Wasatch Formation (Culbertson, 1965). It crops out in a narrow north-south trending band through the west-central part of the quadrangle (Roehler, 1977). On Sage Creek in the eastern part of T. 15 N., R. 106 W., the Luman Tongue consists of a zone of drab tan-gray-colored shales and siltstones deposited in a paludal environment. Further to the north, the Luman Tongue is characterized by coal beds and oil shale suggesting that the tongue undergoes rapid facies changes in the northern part of the Firehole Basin 15-minute quadrangle (Roehler, 1965).

The Niland Tongue of the Wasatch Formation crops out in the west-central part of the quadrangle (Roehler, 1977), where it conformably overlies the Luman Tongue of the Green River Formation. It consists of approximately 455 feet (139 m) of red-bed fluvial claystone, siltstone,

mudstone and sandstone (Culbertson, 1965). Roehler (1965) indicates that the Niland Tongue abruptly changes to the south in sec. 7, T. 14 S., R. 105 W., from sediments representing a recurrent-lacustrine environment of deposition to that of a red-bed fluvial environment.

The Tipton Tongue (Tipton Shale Member) of the Green River Formation conformably overlies the Niland Tongue of the Wasatch Formation and crops out in a narrow north-south trending band through the west-central part of the quadrangle (Roehler, 1977). It consists of approximately 150 feet (46 m) of buff-colored papery low-grade oil shale, marlstone, and sandstone (Bradley, 1964). The Tipton Tongue was deposited in Tipton Lake, the largest of the Eocene fresh-water lakes in southwestern Wyoming (Roehler, 1965).

The Wilkins Peak Member of the Green River Formation conformably overlies the Tipton Tongue and is approximately 1,000 feet (305 m) thick (Bradley, 1964), cropping out along the northwestern edge of the quadrangle (Roehler, 1977). This member is composed of gray to green mudstone, and abundant thin beds of gray dolomitic siltstone, marlstone, dolomite and limestone, and buff-colored calcareous sandstone. The member was deposited during the influx of Wilkins Peak Lake during Eocene time (Roehler, 1965).

The Laney Shale Member of the Green River Formation conformably overlies the Wilkins Peak Member and crops out on the southwestern edge of the quadrangle (Roehler, 1977). It is composed of a basal unit of buff-colored shale, light-gray marlstone and a 50-foot- (15-m-) thick bed of tuff (Bradley, 1964). The remainder of the member consists of an unknown thickness of interbedded gray to tan siltstones, shales, fine-grained sandstones, and thin limestones deposited in a recurrent-lacustrine environment (Roehler, 1965).

The Bishop Conglomerate unconformably overlies the Wasatch and Green River Formations in the northeastern, southwestern and central parts of the quadrangle (Roehler, 1977). The Bishop Conglomerate is

Oligocene in age and consists of cobbles and pebbles of quartz, hornblende gneiss, granite, and chert derived from the ancestral Uinta Mountain to the south (Bradley, 1964, and Roehler, 1973, 1977).

#### Structure

The southeast quarter of the Firehole Basin 15-minute quadrangle is located along the western flank of the Rock Springs uplift. Throughout most of the quadrangle, the formations generally strike north or northwest and dip 2° to 5° to the west. No faults have been mapped within the quadrangle.

#### COAL GEOLOGY

Both the Fort Union Formation and the main body of the Wasatch Formation are known to contain coal. Culbertson (no date) mapped four Fort Union coal beds in the northeastern corner of the quadrangle and Roehler (1977) indicates two Wasatch Formation coal beds on his map of the Rock Springs uplift (plate 1).

Chemical analyses of coal.--Roehler and others (1977) state that coal in the main body of the Wasatch Formation is ranked from subbituminous A to lignite and consistently has 4 to 9 percent sulfur. Data on coal quality of the Fort Union Formation coal beds in this quadrangle are not available.

#### Coal Beds of the Fort Union Formation

Four Fort Union Formation coal beds in two distinct zones have been mapped by Culbertson (no date) in this quadrangle. The upper zone consists of two coal beds separated by approximately 16 feet (4.9 m) of rock. Rocky Mountain Energy Company (RMEC) has named the upper coal bed G and the lower coal bed F. Both coal beds are less than Reserve Base thickness (5 feet or 1.5 meters) in this quadrangle and where they can be followed to the north in the northeast quarter of the Firehole Basin 15-minute quadrangle.

The lower coal zone is located approximately 250 to 300 feet (76 to 91 m) below the upper zone and consists of two coal beds, the E and D, separated by 20 to 30 feet (6 to 9 m) of rock. The E coal bed is stratigraphically higher. The D coal bed locally attains a thickness of 8.5 feet (2.6 m), excluding 0.7 feet (0.2 m) of partings. Both the D and E coal beds can be traced northward into the northeast quarter of the Firehole Basin 15-minute quadrangle. The D coal bed is 5 to 7 feet (1.5 to 2.1 m) thick in that quadrangle; the E coal bed thins to the north and eventually pinches out in T. 17 N., R. 105 W. In the southwest quarter of the Firehole Basin 15-minute quadrangle, dips along the D and E coal beds average 5° to the southwest (Culbertson, no date).

Information from coal test holes drilled by RMEC, as well as surface mapping by Schultz (1910) and Culbertson (no date) were used to construct an isopach and structure map (figure 1), and an overburden isopach and mining ratio map (figure 2) of the D coal bed.

#### Coal Beds of the Wasatch Formation

The Big Firehole and Middle Firehole coal beds, located within the upper part of the main body of the Wasatch Formation, are shown on plate 1. They crop out just below the Luman Tongue of the Green River Formation, and, for the most part, lie outside of the KRCRA boundary. Although information concerning the thickness of these coal beds is not available, the coal beds can be traced to the north and south (beyond the quadrangle boundary) for several miles (Roehler, 1977).

#### COAL DEVELOPMENT POTENTIAL

Areas where coal beds of Reserve Base thickness (5 feet or 1.5 meters) or greater are overlain by 3,000 feet (914 m) or less of overburden are considered to have development potential for either surface or subsurface mining methods. In the southwest quarter of the Firehole Basin 15-minute quadrangle, coal beds of Reserve Base thickness are not known to be present on or beneath Federal lands. Therefore, all Federal

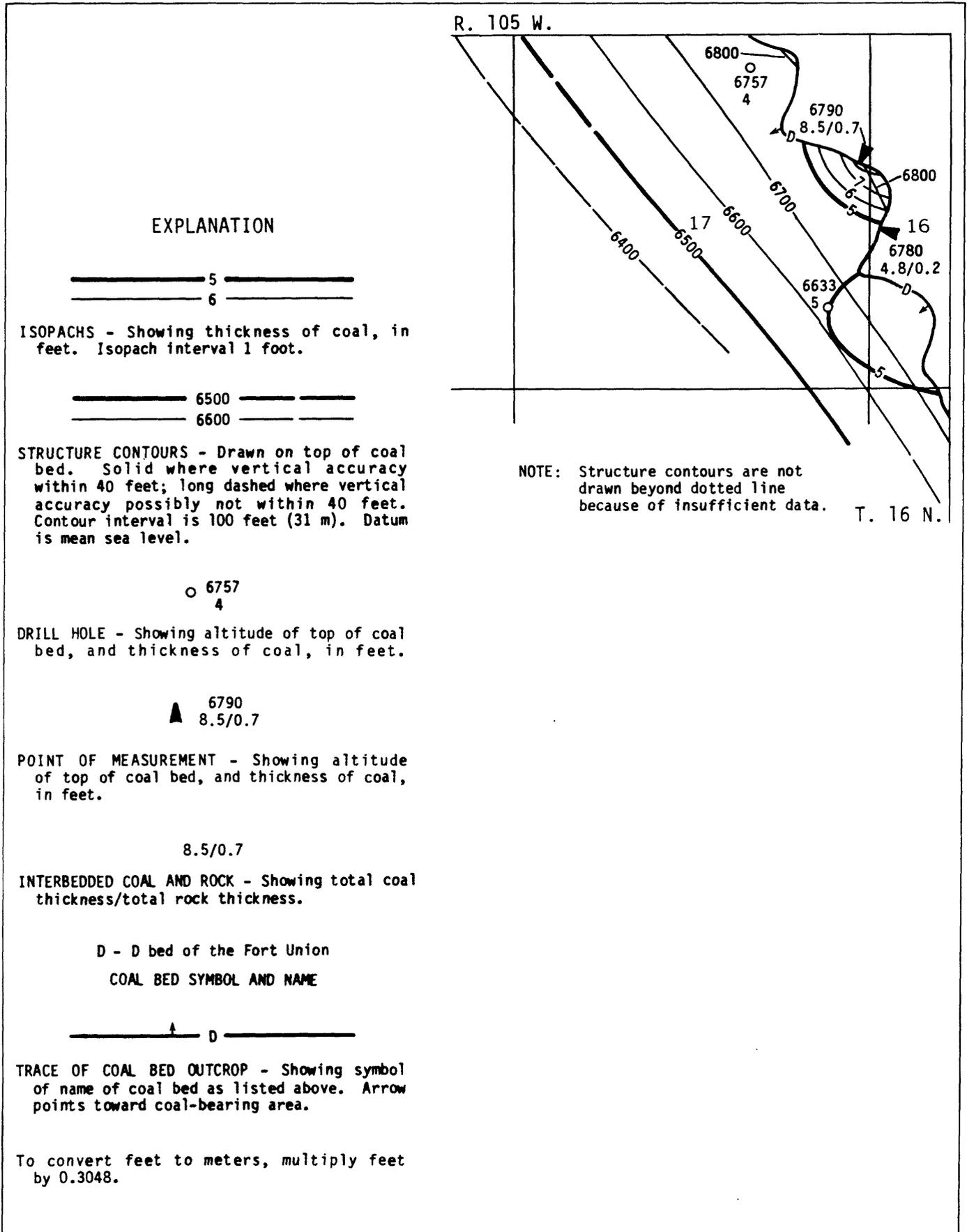


Figure 1. — Isopach and structure contour map of the D coal bed

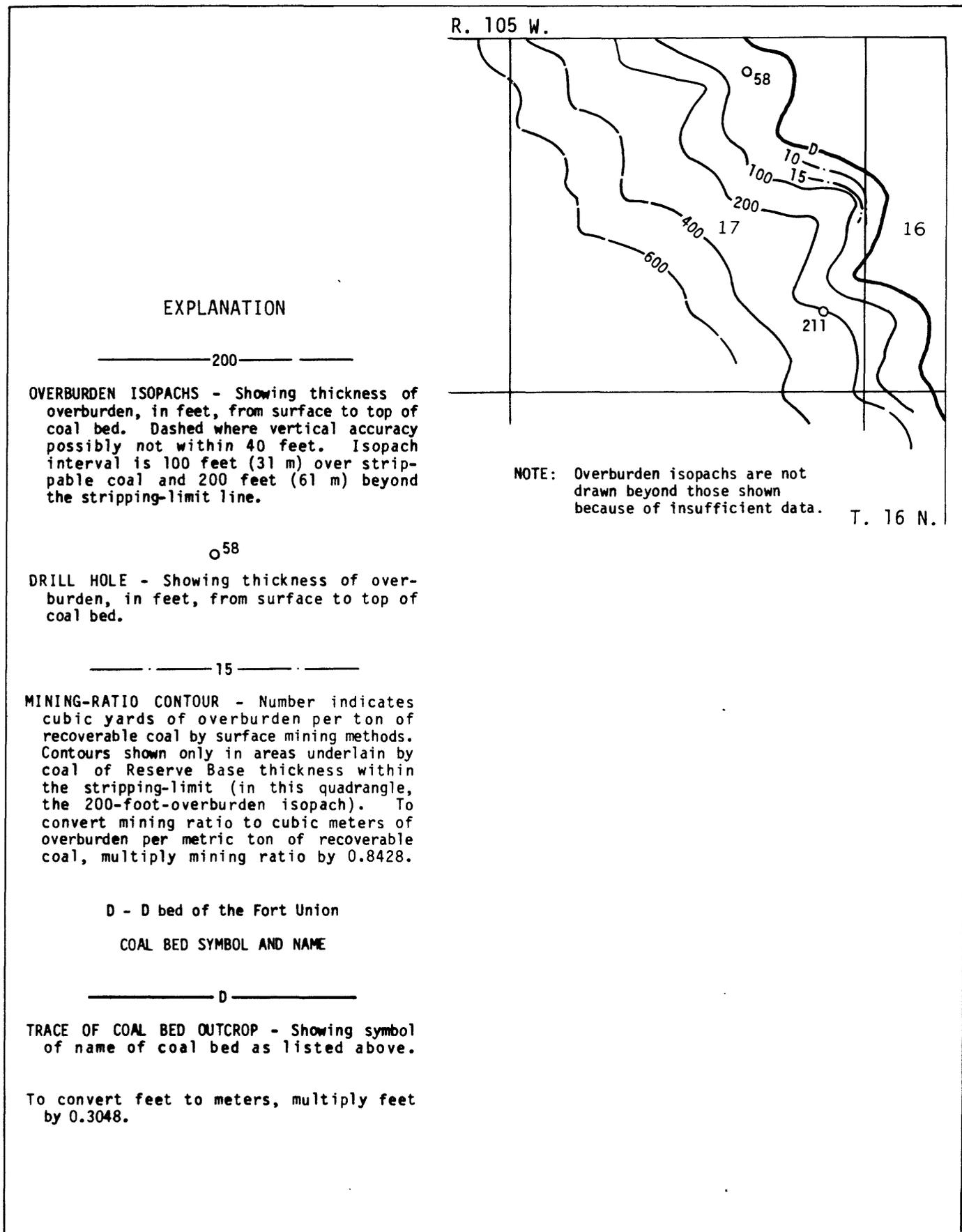


Figure 2. — Overburden isopach and mining ratio map of the D coal bed

land within the KRCRA boundary in this quadrangle have been classified as having unknown development potential for surface and subsurface mining methods.

The source of each indexed data point shown on plate 1 is listed in table 1.

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

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<u>Plate 1</u> <u>Index</u> <u>Number</u>	<u>Source</u>	<u>Data Base</u>
1	Schultz, 1910, U.S. Geological Survey Bulletin 381-B p. 238	Measured Section
2	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 1AS
3	↓	Drill hole No. 4AS
4	Culbertson, (no date), U.S. Geological Survey, unpublished map	Measured Section No. C 62-467
5	Schultz, 1910, U.S. Geological Survey Bulletin 381-B, p. 238	Measured Section
6	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 2AS
7	↓	Drill hole No. 3AS
8	Schultz, 1910, U.S. Geological Survey Bulletin 381-B, p. 238	Measured Section
9	Culbertson, (no date), U.S. Geological Survey, unpublished map	Measured Section
10	Rocky Mountain Energy Co., (no date), unpublished data	Drill hole No. 4AD

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REFERENCES

- Bradley, W. H., 1964, Geology of the Green River Formation and associated Eocene rocks in southwestern Wyoming and adjacent parts of Colorado and Utah: U.S. Geological Survey Professional Paper 496-A, A 55-56.
- Culbertson, W. C., 1965, Tongues of the Green River and Wasatch Formations in the southeastern part of the Green River Basin, Wyoming: U.S. Geological Survey Professional Paper 525-D, p. D139-D143.
- \_\_\_\_\_ (no date), Geologic map of parts of the Firehole Basin 15-minute quadrangle, Sweetwater County, Wyoming: U.S. Geological Survey, unpublished map, scale 1:62,500.
- Rocky Mountain Energy Company, (no date), Unpublished drill-hole data from the Union Pacific coal inventory of 1970.
- Roehler, H. W., 1961, The Late Cretaceous-Tertiary boundary in the Rock Springs uplift, Sweetwater County, Wyoming, in Symposium on the Late Cretaceous rocks of Wyoming and adjacent areas, Wyoming Geological Association Guidebook, 16th Annual Field Conference, 1961: p. 96-100.
- \_\_\_\_\_ 1965, Early Tertiary depositional environments in the Rock Springs uplift area, in Rock Springs uplift, Wyoming, Wyoming Geological Association Guidebook, 19th Annual Field Conference, 1965: p. 140-150.
- \_\_\_\_\_ 1973, Geologic map of the Titsworth Gap quadrangle, Sweetwater County, Wyoming: U.S. Geological Survey Geologic Quadrangle Map GQ-1083, scale 1:24,000.
- \_\_\_\_\_ 1977, Geologic map of the Rock Springs uplift and adjacent areas, Sweetwater County, Wyoming: U.S. Geological Survey Open-File Report 77-242, scale 1:126,720.
- \_\_\_\_\_ 1978, Correlations of coal beds in the Fort Union, Almond, and Rock Springs Formations in measured sections on the west flank of the Rock Springs uplift, Sweetwater County, Wyoming: U.S. Geol. Survey Open-File Report 78-395.
- Roehler, H. W., Swanson, V. E., and Sanchez, J. D., 1977, Summary report of the geology, mineral resources, engineering geology and environmental geochemistry of the Sweetwater-Kemmerer area, Wyoming, part A, geology and mineral resources: U.S. Geological Survey Open-File Report 77-360, 80 p.
- Schultz, A. R., 1910, The southern part of the Rock Springs coal field, Sweetwater, Wyoming, in Coal fields in Wyoming: U.S. Geologic Survey Bulletin 381-B, p. 214-281.

References--Continued

U.S. Bureau of Land Management, 1978, Draft environmental statement, proposed development of coal resources in southwestern Wyoming: U.S. Department of the Interior, v. 1 to 3.

Wyoming Natural Resources Board, 1966, Wyoming weather facts: Cheyenne, p. 34-35.