UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

TEXT TO ACCOMPANY:

COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE WHITETAIL CREEK QUADRANGLE, CAMPBELL COUNTY, WYOMING

BY

INTRASEARCH INC.

DENVER, COLORADO

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This report is preliminary, and has not been edited or reviewed for conformity with U.S. Geological Survey standards or stratigraphic nomenclature.

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CONVERSION TABLE

To Convert	Multiply By	To Obtain
inches	2.54	centimeters (cm)
feet	0.3048	meters (m)
miles	1.609	kilometers (km)
acres	0.40469	hectares (ha)
tons (short)	0.9072	metric tons (t)
cubic yards/ton	0.8428	cubic meters per metric ton
acre feet	0.12335	hectare-meters
Btu/lb	2.326	kilojoules/kilogram (kJ/kg)
Btu/lb	0.55556	kilocalories/kilogram (kcal/kg)
Fahrenheit	5/9 (F-32)	Celsius

I. Introduction

This report and accompanying maps set forth the Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) of coal beds within the Whitetail Creek Quadrangle, Campbell County, Wyoming. This CRO and CDP map series includes 3 plates (U.S. Geological Survey Open-File Report 79-056). The project is compiled by IntraSearch Inc., 1600 Ogden Street, Denver, Colorado, under KRCRA Northeastern Powder River Basin, Wyoming Contract Number 14-08-0001-17180. This contract is a part of a program to provide an inventory of federal coal in Known Recoverable Coal Resource Areas (KRCRA's) in the western United States.

The Whitetail Creek Quadrangle is located in Campbell County, in northeastern Wyoming. It encompasses all or parts of Townships 46, 47, and 48 North, Ranges 69 and 70 West, and covers the area: 44°00' to 44°07'30" north latitude; 105°07'30" to 105°15' west longitude.

A maintained gravel road, Bishop Road, that is located beside the Belle Fourche River in the northern part of the quadrangle, provides the principal access to the quadrangle. A system of minor roads and trails that branch from Bishop Road establish access to much of the quadrangle. Bishop Road connects with U.S. Highway 14-16 one mile (1.6 km) east of Rozet, Wyoming, approximately 10 miles (16 km) north of the quadrangle. The closest railroad is the Burlington Northern trackage at Rozet, Wyoming.

The Belle Fourche River that flows northeastward through the northern part of the area provides the major drainage for the quadrangle. The principal tributaries are Yellow Hammer and White Creeks, which flow northward into the Belle Fourche River and drain the southern part of the quadrangle. The topography of the area is rugged with 600 feet (183 m) of relief. Maximum elevations of more than 4,900 feet (1,494 m) are mapped in the southern part of the quadrangle and minimum elevations of less than 4,300 feet (1,311 m) occur along the Belle Fourche River in the northeastern quadrant where it exits the quadrangle. The somber grays, yellows, and browns of outcropping shales and siltstones contrast strikingly with the brilliant reds, oranges, and purples of "clinker", and deep greens of the juniper and pine tree growth.

The 13 to 14 inches (33 to 36 cm) of annual precipitation that fall in this semiarid region accrue principally in the springtime. Summer and fall precipitation usually originates from thunderstorms, and infrequent snowfalls of 6 inches (15 cm) or less generally characterize winter precipitation. Although temperatures ranging from less than -25°F (-32°C) to more than 100°F (38°C) have been recorded near Gillette, Wyoming, average wintertime minimums and summertime maximums approach +5° to +15°F (-15° and -9°C) and 75° to 90°F (24° to 32°C), respectively.

Surface ownership is divided among fee, state, and federal categories with the state and federal surface generally leased to ranchers for grazing purposes. Details of surface ownership are available at the

Campbell County Courthouse in Gillette, Wyoming. Details of mineral ownership on federal lands are available from the U.S. Bureau of Land Management in Cheyenne, Wyoming. Federal coal ownership is shown on Plate 2 of the Coal Resource Occurrence maps. The nonfederal coal ownership comprises both fee and state coal resources.

The Coal Resource Occurrence and Coal Development Potential program pertains to unleased federal coal and focuses upon: (1) the delineation of lignite, subbituminous, bituminous, and anthracite coal at the surface and in the subsurface on federal land; (2) the identification of total tons in place as well as recoverable tons; (3) categorization of these tonnages into measured, indicated, and inferred reserves and resources, and hypothetical resources; and (4) recommendations regarding the potential for surface mining, underground, mining, and in-situ gasification of the coal beds. This report evaluates the coal resources of all unleased federal coal beds in the quadrangle which are 5 feet (1.5 m) or greater in thickness and occur at depths down to 3,000 feet (914 m). No resources or reserves are computed for leased federal coal, state coal, fee coal, or lands encompassed by coal prospecting permits and preference right lease applications.

II. Geology

Regional. The thick, economic coal deposits of the Powder River Basin in northeastern Wyoming occur mostly in the Tongue River Member of the Fort Union Formation, and in the lower part of the Wasatch Formation. Approximately 3,000 feet (914 m) of the Fort Union Formation,

that includes the Tongue River, Lebo, and Tullock Members of Paleocene age, are unconformably overlain by approximately 700 feet (213 m) of the Wasatch Formation of Eocene age. These Tertiary formations lie in a structural basin flanked on the east by the Black Hills uplift, on the south by the Hartville and Casper Mountain uplifts, and on the west by the Casper Arch and the Big Horn Mountain uplift. The structural configuration of the Powder River Basin originated in Late Cretaceous time, with episodic uplift thereafter. The Cretaceous Cordillera was the dominant positive land form throughout the Rocky Mountain area at the close of Mesozoic time.

Outcrops of the Wasatch Formation and the Tongue River Member of the Fort Union Formation cover most of the areas of major coal resource occurrence in the Powder River Basin. The Lebo Member of the Fort Union Formation is mapped at the surface northeast of Recluse, Wyoming, east of the principal coal outcrops and associated clinkers (McKay, 1974), and presumably projects into the subsurface beneath much of the basin. One of the principal characteristics for separating the Lebo and Tullock Members (collectively referred to as the Ludlow Member east of Miles City, Montana) from the overlying Tongue River Member is the color differential between the lighter-colored upper portion and the somewhat darker lower portion (Brown, 1958). Although geologists working with subsurface data, principally geophysical logs, in the

basin are trying to develop criteria for subsurface recognition of the Lebo-Tullock and Tongue River-Lebo contacts, no definitive guidelines are known to have been published. Hence, for subsurface mapping purposes, the Fort Union Formation is not divided into its member subdivisions for this study.

During the Paleocene epoch, the Powder River Basin tropic to subtropic depositional environment included broad, inland flood basins with extensive swamps, marshes, freshwater lakes, and a sluggish but active northeastward discharging drainage system, superimposed on a near base level, emerging sea floor. Much of the vast areas where organic debris collected was within a reducing depositional environment. Localized uplifts began to disturb the near sea level terrain of northeastern Wyoming, following retreat of the Cretaceous seas. However, the extremely fine-grained characteristics of the Tongue River Member clastics suggest that areas of recurring uplift peripheral to the Powder River Basin were subdued during major coal deposit formation.

The uplift of areas surrounding the Powder River Basin created a structural basin of asymmetric characteristic, with the steep west flank located on the eastern edge of the Big Horn Mountains. The axis of the Powder River Basin is difficult to specifically define, but is thought to be located in the western part of the basin, and to display a north-south configuration some 15 to 20 miles (24 to 32 km) east of Sheridan, Wyoming. Thus, the sedimentary section described in this

report lies on the east flank of the Powder River Basin, with gentle dips of 2^{o} or less disrupted by surface structure thought to relate to tectonic adjustment and differential compaction.

Some coal beds in the Powder River Basin exceed 200 feet (61 m) in thickness. Deposition of these thick, in-situ coal beds requires a discrete balance between subsidence of the earth's crust and in-filling by tremendous volumes of organic debris. These conditions in concert with a favorable ground water table, non-oxidizing clear water, and a climate amenable to the luxuriant growth of vegetation produce a stabilized swamp critical to the deposition of coal beds.

Deposition of the unusually thick coal beds of the Powder River Basin may be partially attributable to short distance water transportation of organic detritus into areas of crustal subsidence. Variations in coal bed thickness throughout the basin relate to changes in the depositional environment. Drill-hole data that indicate either the complete absence or extreme attenuation of a thick coal bed probably relate to location of the drill holes within the ancient stream channel system servicing this low land area in Early Cenozoic time. Where thick coal beds thin rapidly from the depocenter of a favorable depositional environment, it is not unusual to encounter a synclinal structure over the maximum coal thickness due to the differential compaction between organic debris in the coal depocenter and fine-grained clastics in the adjacent areas.

The Wasatch Formation of Eocene age crops out over most of the central part of the Powder River Basin and exhibits a disconformable contact with the underlying Fort Union Formation. The contact has been placed at various horizons by different workers; however, for the purpose of this report, in northwestern Campbell County, Wyoming, the contact is positioned near the top of the Roland coal bed as mapped by Olive (1957) and is considered to disconformably descend in the stratigraphic column to the top of the Wyodak-Anderson coal bed (Roland coal bed of Taff, 1909) along the eastern boundary of the coal measures. No attempt is made to differentiate the Wasatch and Fort Union Formations on geophysical logs or in the subsurface mapping program that is a part of this CRO/CDP project.

Although Wasatch and Fort Union lithologies are too similar to allow differentiation in some areas, most of the thicker coal beds occur in the Fort Union section on the east flank of the Powder River Basin. Furthermore, orogenic movements peripheral to the basin apparently increased in magnitude during Wasatch time causing the deposition of friable, coarse-grained to gritty arkosic sandstones, fine to very fine-grained sandstones, siltstones, mudstones, claystones, brown-to-black carbonaceous shales and coal beds. These sediments are noticeably to imperceptibly coarser than the underlying Fort Union clastics.

The Whitetail Creek Quadrangle is located in an area where surface rocks are classified into the Tongue River Member of the Fort Union Formation. Although the Tongue River Member is reportedly 1,200 to 1,300

feet (366 to 396 m) thick (Olive, 1957), only 500 to 600 feet (152 to 183 m) are exposed in this area. Olive (1957) correlated coal beds in the Spotted Horse coal field with coal beds in the Sheridan coal field (Baker, 1929) and Gillette coal field (Dobbin and Barnett, 1927), Wyoming, and with coal beds in the Ashland coal field (Bass, 1932) in southeastern Montana. This report utilizes, where possible, the coal bed nomenclature used in previous reports. Baker assigned names to the Anderson, Canyon, and Wall coal beds. The Cook coal bed was named by Bass (1932).

IntraSearch's correlation of thick coal beds from the Spotted Horse coal field to Gillette points out that the Wyodak coal bed, named the D coal bed by Dobbin and Barnett (1927), is equivalent to the Anderson, Canyon, and all or part of the Cook coal beds to the north and west of the Whitetail Creek Quadrangle. Due to problematic correlations outside of the Gillette area, the name Wyodak has been informally used by many previous authors to represent the coal beds in the area surrounding the Wyodak coal mine. The Wildcat, Moyer, and Oedekoven coal beds were informally named by IntraSearch (1978b, 1979, and 1978a).

III. Data Sources

Publications regarding the areal geology of coal outcrops and associated clinker at a scale appropriate for the CRO/CDP mapping program are unknown at the time of this publication.

The major source of subsurface control is the geophysical logs from oil and gas test bores and producing wells. Some geophysical logs are

not applicable to this study, for the logs relate only to the deep potentially productive oil and gas zones. More than 80 percent of the logs include resistivity, conductivity, and self-potential curves. Occasionally the logs include gamma, density, and sonic curves. These logs are available from several commercial sources.

All geophysical logs available in the quadrangle are scanned to select those with data applicable to Coal Resource Occurrence mapping. Paper copies of the logs are obtained, interpreted, and coal intervals identified where they exist.

The topographic map of the Whitetail Creek Quadrangle is published by the U.S. Geological Survey, compilation date, 1971. Land ownership data is compiled from land plats obtained from the U.S. Bureau of Land Management in Cheyenne, Wyoming. This information is current to October 13, 1977.

IV. Coal Bed Occurrence

The Whitetail Creek Quadrangle is located east of the principal coal deposits of the Powder River Basin. No coal bed outcrops are known in this area.

The Coal Data Sheet, Plate 3, shows by columnar sections the interpretations of geophysical well logs. The few coal beds that are identified in the subsurface are thin and have limited lateral extent. As a result, coal bed resource estimates are not made for this quadrangle.

These minor coal beds do not correlate with named coal beds mapped in quadrangles to the west. All of the geophysical well logs in this quadrangle involve resistivity, conductivity, and spontaneous potential curves. Inasmuch as no gamma or density curves are available, the assurance level of coal bed identification is diminished and no geophysical data are recorded where surface pipe is in the drill hole. These no-record intervals range from 92 to 642 feet (28 to 196 m) in drill holes in the Whitetail Creek Quadrangle.

The Wildcat, Moyer, and Oedekoven coal beds are identified in the subsurface on the Saddle Horse Butte Quadrangle, west of this area. Projection of the coal beds eastward with a gentle dip of 1^{o} or 2^{o} to the west suggests that, if present, they may be at a shallow depth within the no-record zone on the geophysical logs.

V. Coal Development Potential

The current data base indicates that there are no significant coal resources in the Whitetail Creek Quadrangle of importance to surface and underground mining or in-situ coal gasification. Since there is no coal development potential, no coal development potential maps are compiled for this quadrangle.

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