UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

TEXT TO ACCOMPANY:

COAL RESOURCE OCCURRENCE

AND

COAL DEVELOPMENT POTENTIAL

MAPS

OF THE

SOUTHEAST QUARTER OF FIFTY-FIVE RANCH 15' QUADRANGLE,

CONVERSE COUNTY, WYOMING

BY

INTRASEARCH INC.

DENVER, COLORADO

OPEN FILE REPORT 79-464
1979

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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 tons
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 Southeast Quarter of Fifty-Five Ranch 15' Quadrangle, Converse County, Wyoming. This CRO and CDP map series (U. S. Geological Survey Open-File Report 79-464) includes 24 plates. The project is compiled by IntraSearch Inc., 5351 South Roslyn Street, Englewood, Colorado, under KRCRA Eastern Powder River Basin, Wyoming Contract Number 14-08-0001-17180. This contract is part of a program to provide an inventory of unleased federal coal in Known Recoverable Coal Resource Areas (KRCRAs) in the western United States.

The Southeast Quarter of Fifty-Five Ranch 15' Quadrangle is located in Converse County, in northeastern Wyoming. It encompasses all or parts of Townships 35 and 36 North, Ranges 74 and 75 West, and covers the area: 43°00' to 43°07'30" north latitude; 105°45' to 105°52'30" west longitude.

Main access to the quadrangle is provided by a maintained gravel road from Glenrock, Wyoming, 16 miles (26 km) to the south. The gravel road extends northward through the central sections of Township 75 West. Minor roads and trails branch from the gravel road providing additional access to the remote areas. A Pacific Power and Light Company railroad spur is located at the Dave Johnston Mine in Township 35 North, Range 75 West and connects with the Burlington Northern main line near Glenrock, Wyoming.

Sage Creek Divide, located in the center of Township 36 North, trends east-west. Philips Creek and the South Fork of the Dry Fork of the Cheyenne River flow northward from the divide. Sand Creek and Sage Creek flow southward from the divide. Topographic elevations within the

study area attain heights of 6053 feet (1845 m) above mean sealevel, 300 to 500 feet (91 to 152 m) above the valley floors of the intermittent streams. Minimum elevations of less than 5440 feet (1648 m) occur in the valley of Sage Creek in the east-central portion of the study area.

The 10 to 12 inches (25 to 30 cm) of annual precipitation falling in this semi-arid 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 Douglas, Wyoming, average wintertime minimums and summertime maximums range from +5° to +°15F (-15° to -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 Converse County Courthouse in Douglas, 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 non-federal 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 the delineation of lignite, subbituminous coal, bituminous coal, and anthracite at the surface, and in the subsurface. In addition, the program identifies total tons of coal in place, as well as recoverable tons. These coal tonnages are then categorized into units of measured, indicated, and inferred reserves and resources, and hypothetical resources. Finally, recommendations are made 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 3000 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.

Surface and subsurface geological and engineering extrapolations drawn from the current data base suggest the occurrence of approximately 467 million tons (424 million metric tons) of unleased federal coal resources in the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle.

The suite of maps that accompany this report sets forth and portrays the coal resource and reserve occurrence in considerable detail. For the most part, this report supplements the cartographically displayed information with minimum verbal duplication of the CRO-CDP map data.

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 3000 feet (914 m) of the Fort Union Formation, including 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 Tongue River Member is composed of very fine-grained sandstones, siltstones, claystones, shales, carbonaceous shales, and numerous coal beds. The Lebo Member of the Fort Union Formation consists of light- to dark-gray very fine-grained to conglomeratic sandstone with interbedded siltstone, claystone, carbonaceous shale and thin coal beds. Thin bedded calcareous ironstone concretions interbedded with massive white sandstone and slightly bentonitic shale occur throughout the unit (Denson and Horn, 1975). The Lebo Member is mapped at the surface northeast of Recluse, Wyoming. Here, the Lebo Member is east of the principal coal outcrops and associated clinkers (McKay, 1974), and it 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 are trying to develop criteria for subsurface recognition of the Lebo-Tullock and Tongue River-Lebo contacts through the use of subsurface data from geophysical logs, no definitive guidelines are known to have been published. Hence, for subsurface mapping purposes, the Fort Union Formation is not divided into its members for this study.

During the Paleocene epoch, the Powder River Basin tropical to subtropical depositional environment included broad, inland flood basins with extensive swamps, marshes, freshwater lakes, and a sluggish, but active, northeastward-discharging drainage system. These features were superimposed on an emerging sea floor, near base level. Much of the vast area 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 character, 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 it 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 two degrees 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 delicate 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 draining this lowland 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, the contact is positioned near the top of the Roland coal bed as mapped by Olive (1957) in northwestern Campbell County, Wyoming. It is considered to descend disconformably 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 was made to differentiate the Wasatch and Fort Union Formations on geophysical logs or in the subsurface mapping program for this 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 Southeast Quarter of Fifty-Five Ranch 15' Quadrangle is located in an area where surface rocks are classified within the Fort Union and Wasatch Formations. 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.

The Smith coal bed was named by Taff (1909). Regional correlations by IntraSearch throughout the Powder River Basin suggest that the Smith coal bed of Taff may be equivalent to the Badger coal bed of Baker (1929) in this area. Baker (1929) assigned names to the Anderson and Canyon coal beds. Regional correlations indicate that in this quadrangle the Anderson coal bed of Baker is possibly equivalent to the School coal bed, which was informally named by previous workers. The Wildcat coal bed was informally named by IntraSearch, Inc. (1978).

Local. The Southeast Quarter of Fifty-Five Ranch 15' Quadrangle lies on the southwest flank of the Powder River Basin, where the strata dip gently eastward. The Wasatch Formation caps the higher elevations

over approximately 75 percent of the quadrangle, and is composed 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. The Fort Union Formation crops out over the remaining area and is composed of very fine-grained sandstones, siltstones, claystones, shales, carbonaceous shales, and numberous coal beds.

Gentle east to northeastward dip of less than one degree characterizes the structural configurations drawn on top of most of the coal beds.

III. Data Sources

Areal geology of the coal outcrops is derived from Smith and others (1972), and from Sharp and Gibbons (1964). The outcrop configuration is adjusted to the current topographic map of the area. The position of the contact between the Wasatch and Fort Union Formations in this area is based on Duell (1969), and is located at the top of the Smith (Badger) coal bed. Both the Smith (Badger) and Anderson (School) coal beds are considered to be in the Fort Union Formation according to Smith and others (1972). This interpretation differs from that of Denson and Horn (1975).

Information from the U. S. Environmental Protection Agency (1976) is used to supplement information from the topographic map regarding railroads.

Geophysical logs from oil and gas test bores and producing wells comprise the source of subsurface control. 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 suite of geophysical logs includes 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 and interpreted, and coal intervals are annotated. Maximum accuracy of coal bed indentification is accomplished where gamma, density, and resistivity curves are available. Coal bed tops and bottoms are picked on the logs at the midpoint between the minimum and maximum curve deflections. The correlation of coal beds within and between quadrangles is achieved utilizing a fence diagram to associate local correlations with regional coal occurrences.

In some parts of the Powder River Basin, additional subsurface control is available from U. S. Geological Survey open-file reports that include geophysical and lithologic logs of shallow holes drilled specifically for coal exploration. Numerous subsurface data points are shown in Smith and others (1972, Figure 7), and where these data are utilized, the rock-coal intervals are shown on the Coal Data Map (Plate 1). Inasmuch as these drill holes have no identifier headings, they are not set forth on the Coal Data Sheet (Plate 3). The geophysical logs of these drill holes were not available to IntraSearch to ascertain the accuracy of horizontal location, topographic elevation, and downhole data interpretation.

The reliability of correlations, set forth by IntraSearch in this report, varies depending on: the density and quality of lithologic and geophysical logs; the detail, thoroughness, and accuracy of published and unpublished surface geological maps; and interpretative proficiency. There is no intent on the part of IntraSearch to refute nomenclature established in the literature or used locally by workers in the area. IntraSearch's nomenclature focuses upon the suggestion of regional coal bed names applicable throughout the eastern Powder River

Basin. It is expected, and entirely reasonable, that some differences of opinion regarding correlations, as suggested by IntraSearch, exist. Additional drilling for coal, oil, gas, water, and uranium, coupled with expanded mapping of coal bed outcrops and associated clinkers will broaden the data base for coal bed correlations and allow continued improvement in the understanding of coal bed occurrences in the eastern Powder River Basin.

The topographic map of the Fifty-Five Ranch 15' Quadrangle is published by the U. S. Geological Survey, compilation date 1959. Land network and mineral ownership data are compiled from land plats available from the U. S. Bureau of Land Management in Cheyenne, Wyoming. This information is current to October 13, 1977.

IV. Coal Bed Occurrence

Wasatch and Fort Union Formation coal beds that are present in all or part of the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle include, in descending stratigraphic order, the Smith (Badger), the Anderson (School), three unnamed local coal beds, the Canyon, and the Wildcat coal beds. A suite of maps consisting of coal isopach, structure, overburden isopach, areal distribution of identified resources, identified resources, and where applicable, hypothetical resources, is prepared for each of these coal beds, except for the local coal beds. Insufficient areal extent precludes detailed mapping of the local coal beds. Mining ratio contours are presented on the isopach maps of the Smith, Anderson, and Canyon coal beds.

No physical and chemical analyses are known to have been published regarding the coal beds in the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle. However, the proximate analysis performed on an "as received" basis for Converse County coal beds are as follows:

COAL BED NAME			ASH %	FIXED CARBON %	MOISTURE %	VOLATILES %	SULFUR %	BTU/LB
Smith (Badger)	(*)		8.48	28.47	29.02	34.03	0.41	7606
Anderson (School)	(*)		9.68	29.48	26.41	34.43	0.52	7830
Canyon	(U)	Hole 757	6.024	32.831	26.907	34.237	0.336	8366

(*) - Glass, G. B., 1975b, p. 156 and 165.
(U) - U. S. Geological Survey and Montana Bureau of Mines and Geology - 1976.

The Coal Data Sheet, Plate 3, shows the down hole identification of coal beds within the quadrangle as interpreted from geophysical logs from oil and gas test bores and producing sites. A datum coal bed is utilized to position columnar sections on Plate 3. This portrayal is schematic by design; hence, no structural or coal thickness implications are suggested by the dashed correlation lines projected through no record (NR) intervals. Inasmuch as the Anderson (School) coal bed underlies 75 percent of the quadrangle, it is designated as datum for the correlation diagram. The Anderson (School) coal bed shows the thickest single coal bed occurrences throughout the quadrangle. The Wildcat coal bed is relatively thin throughout most of the area.

The Smith (Badger) coal bed is eroded from approximately 55 percent of the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle, and it is pinched out in an additional 12 percent of the quadrangle. The Smith coal bed crops out in the western portion of the quadrangle. The Smith coal bed varies in thickness from 0 to 20 feet (0 to 6 m). Minimum thicknesses occur to the east and northeast, and maximum thicknesses occur near the outcrop (Plate 4). The Smith coal bed is not present in parts of the northeastern quadrant. Generally, the Smith coal bed dips less than two degrees to the northeast (Plate 5), and it lies from 0 to 400 feet (0 to 122 m) beneath the surface (Plate 6).

The Anderson (School) coal bed, which lies approximately 110 to 180 feet (34 to 55 m) beneath the Smith coal bed, crops out along the western edge of the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle. Present over approximately 80 percent of the study area, the Anderson coal bed ranges in thickness from less than 10 feet (3 m) in the southeastern quadrant to more than 40 feet (12 m) near the southwestern edge of the outcrop (Plate 9). Structure contours drawn on top of the Anderson coal bed indicate a gentle dip to the east-northeast of less than two degrees. The Anderson coal bed occurs from 0 to less than 600 feet (0 to less than 183 m) below the surface.

The Canyon coal bed lies 50 to 150 feet (15 to 46 m) below the Anderson coal bed. Insufficient data precludes mapping of the Canyon coal bed throughout the southern 65 percent of the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle. Pinched out along the eastern edge of the study area, the Canyon coal bed attains a maximum thickness of more than 25 feet (8 m) in the central sections of Township 36 North, Range 75 West (Plate 14). the Canyon coal bed dips less than one degree to the east-northeast. The Canyon coal bed occurs from less than 100 feet (30 m) to less than 600 feet (183 m) beneath the surface (Plate 16).

The Wildcat coal bed lies 1080 to 1310 feet (329 to 399 m) beneath the Canyon coal bed, and varies in thickness from 0 feet (0 m) to 15 feet (5 m). Due to the absence of drill hole data, the Wildcat coal bed is not mapped in the southern 65 percent of the quadrangle. An insufficient data line delineates the area of no control. Two shallow, east-plunging synclinal features separated by a minor anticline characterize the structure drawn on top of the Wildcat coal bed (Plate 20). The Wildcat coal bed occurs at depths ranging from less than 1250 feet (381 m) to more than 1750 feet (533 m) below the surface (Plate 21).

V. Geological and Engineering Mapping Parameters

The correct horizontal location and elevation of drill holes utilized in subsurface mapping are critical to map accuracy. IntraSearch Inc., plots the horizontal location of the drill hole as described on the geophysical log heading. Occasionally this location is superimposed on or near to a drillsite shown on the topographic map, and the topographic map, horizontal location is utilized. If the ground elevation on the geophysical log does not agree with the topographic elevation of the drillsite, the geophysical log ground elevation is adjusted to conformance. If there is no indication of a drillsite on the topographic map, the "quarter, quarter, quarter" heading location is shifted within a small area until the ground elevation on the heading agrees with the topographic map elevation. If no elevation agreement can be reached, the well heading or data sheet is rechecked for footage measurements and ground elevation accuracy. Inquiries to the companies who provided the oil and gas geophysical logs frequently reveal that corrections have been made in the original survey. If all horizontal location data sources have been checked and the information accepted as the best available data, the drillsite elevation on the geophysical log is modified to agree with the topographic map elevation. IntraSearch Inc., considers this agreement mandatory for the proper construction of most subsurface maps, but in particular, the overburden isopach, the mining ratio, and Coal Development Potential maps.

Subsurface mapping is based on geologic data within, and adjacent, to the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle area. Data from geophysical logs are used to correlate coal beds and control contour lines for the coal thickness, structure, and overburden

maps. Isopach lines are also drawn to honor selected surface measured sections where there is sparse subsurface control. Where isopach contours do not honor surface measured sections, the surface thicknesses are thought to be attenuated by oxidation and/or erosion; hence, they are not reflective of total coal thickness. Isopach lines extend to the coal bed outcrops, the projections of coal bed outcrops, and the contact between porcellanite (clinker) and unoxidized coal in place. Attenuation of total coal bed thickness is known to take place near these lines of definition; however, the overestimation of coal bed tonnages that results from this projection of total coal thickness is insignificant to the Coal Development Potential maps. Structure contour maps are constructed on the tops of the main coal beds. Where subsurface data are scarce, supplemental structural control points are selected from the topographic map along coal outcrops.

In preparing overburden isopach maps, no attempt is made to identify coal beds that occur in the overburden above a particular coal bed under study. Mining ratio maps for this quadrangle are constructed utilizing a 95 percent recovery factor. Contours of these maps identify the ratio of cubic yards of overburden to tons of recoverable coal. Where ratio control points are sparse, interpolated points are computed at the intersections of coal bed and overburden isopach contours using coal structure, coal isopach, and topographic control. On the Areal Distribution of Identified Resources Map (ADIR), coal bed reserves are not calculated where the coal is less than 5 feet (1.5 m) thick, where the coal occurs at a depth greater than 500 feet (152 m), where non-federal coal exists, or where federal coal leases, preference-right lease applications, and coal prospecting permits exist.

Coal tonnage calculations involve the planimetering of areas of measured, indicated, inferred reserves and resources, and hypothetical resources to determine their areal extent in acres. An Insufficient Data Line is drawn to delineate areas where surface and subsurface data are too sparse for CRO map construction. Various categories of resources are calculated in the unmapped areas by utilizing coal bed thicknesses mapped in the geologically controlled area adjacent to the insufficient data line. Acres are multiplied by the average coal bed thickness and 1750, or 1770--the number of tons of lignite A or subbituminous C coal per acre-foot, respectively (12,874 or 13,018 metric tons per hectare-meter, respectively), to determine total tons in place. Recoverable tonnage is calculated at 95 percent of the total tons in place. Where tonnages are computed for the CRO-CDP map series, resources and reserves are expressed in millions of tons. Frequently the planimetering of coal resources on a sectionized basis involves complexly curvilinear lines (coal bed outcrop and 500-foot stripping limit designations) in relationship with linear section boundaries and circular resource category boundaries. Where these relationships occur, generalizations of complexly curvilinear lines are discretely utilized, and resources and/or reserves are calculated within an estimated 2 to 3 percent, plus or minus, accuracy.

VI. Coal Development Potential

Strippable Coal Development Potential. Areas where coal beds are 5 feet (1.5 m) or more in thickness and are overlain by 500 feet (152 m) or less of overburden are considered to have potential for surface mining and are 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 subbituminous coal is as follows:

$$MR = \frac{to\ (0.911)^*}{tc\ (rf)}$$

where MR = mining ratio
to = thickness of overburden
tc = thickness of coal
rf = recovery factor
0.911*= conversion factor (cu. yds./ton)

*A conversion factor of 0.922 is used for lignite.

A surface mining development potential map (Plate 24) was prepared utilizing the following mining ratio criteria for coal beds 5 to 40 feet (1.5 to 12 m) thick:

1. Low development potential = 15:1 and greater ratio.
2. Moderate development potential = 10:1 to 15:1 ratio.
3. High development potential = 0 to 10:1 ratio.

The following mining ratio criteria are utilized for coal beds greater than 40 feet (12 m) thick:

1. Low development potential = 7:1 and greater ratio.
2. Moderate development potential = 5:1 to 7:1 ratio.
3. High development potential = 0 to 5:1 ratio.

The surface mining potential is high for approximately 15 percent of the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle. The principal areas of high surface mining potential are located along the Sage Creek drainage, where the overburden above the Smith, Anderson, and Canyon coal beds is minimal; near the outcrops of the Smith and Anderson coal beds; where these coals attain their maximum thicknesses; and in the northwestern corner, where the Canyon coal bed attains its maximum thickness. Approximately 15 percent of the quadrangle is considered to have moderate potential for surface mining. The areas of moderate surface mining potential occur adjacent to the areas of high surface mining potential along the slopes of the Sage Creek drainage near the outcrops of

the Smith and Anderson coal beds. Approximately 10 percent of the study area has low development potential for surface mining. Low surface mining development potentials occur in areas such as Sage Creek Divide where thick overburden contributes to high mining ratios. The surface mining potential of approximately 20 percent of the quadrangle is unknown due to the paucity of data. The remaining 50 percent of the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle is non-federal coal or leased federal coal.

Underground Mining Coal Development Potential. Subsurface coal mining potential throughout the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle is considered low. Inasmuch as recovery factors have not been established for the underground development of coal beds in this quadrangle, reserves are not calculated for coal beds that occur more than 500 feet (152 m) beneath the surface. Table 2 sets forth the estimated coal resources in tons per coal bed.

In-Situ Gasification Coal Development Potential. The evaluation of subsurface coal deposits for in-situ gasification potential relates to the occurrence of coal beds more than 5 feet (1.5 m) thick buried from 500 to 3000 feet (152 to 914 m) beneath the surface. This categorization is as follows:

1. Low development potential relates to: 1) a total coal section less than 100 feet (30 m) thick that lies 1000 feet (305 m) to 3000 feet (914 m) beneath the surface, or 2) a coal bed or coal zone 5 feet (1.5 m) or more in thickness which lies 500 feet (152 m) to 1000 feet (305 m) beneath the surface.
2. Moderate development potential is assigned to a total coal section from 100 to 200 feet (30 to 61 m) thick and buried from 1000 to 3000 feet (305 to 914 m) beneath the surface.

3. High development potential involves 200 feet (61 m) or more of total coal thickness buried from 1000 to 3000 feet (305 to 914 m).

The coal development potential for in-situ gasification within the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle is low, hence no CDP map is generated for this map series. The coal resource tonnage for in-situ gasification with low development potential totals approximately 32 million tons (29 million metric tons) (Table 3). None of the coal beds in the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle qualify for a moderate or high development potential rating.

Table 1.--Strippable Coal Reserve Base and Hypothetical Resource Data (in short tons) for Federal Coal Lands in the Southeast Quarter of Fifty Five Ranch 15' Quadrangle, Converse County, Wyoming.

Development potentials are based on mining ratios (cubic yards of overburden/ton of recoverable coal).

Coal Bed	High Development Potential (0-10:1 Mining Ratio)	Moderate Development Potential (10:1-15:1 Mining Ratio)	Low Development Potential (>15:1 Mining Ratio)	Total
RESERVE BASE TONNAGE				
Smith (Badger)	18,210,000	25,510,000	13,130,000	56,850,000
Anderson (School)	101,890,000	78,940,000	105,730,000	286,560,000
Canyon	320,000	22,280,000	45,330,000	67,930,000
TOTAL	120,420,000	126,730,000	164,190,000	411,340,000
HYPOTHETICAL RESOURCE TONNAGE				
Smith (Badger)	-----	-----	960,000	960,000
Anderson (School)	-----	-----	60,000	60,000
Canyon	-----	-----	1,420,000	1,420,000
TOTAL	-----	-----	2,440,000	2,440,000
GRAND TOTAL	120,420,000	126,730,000	166,630,000	413,780,000

Table 2.--Coal Resource Base and Hypothetical Resource Data (in short tons) for Underground Mining Methods for Federal Coal Lands in the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle, Converse County, Wyoming.

Coal Bed Name	High Development Potential	Moderate Development Potential	Low Development Potential	Total
RESOURCE BASE TONNAGE				
Anderson (School)	-----	-----	3,250,000	3,250,000
Canyon	-----	-----	7,310,000	7,310,000
Wildcat	-----	-----	21,340,000	21,340,000
TOTAL	-----	-----	31,900,000	31,900,000
HYPOTHETICAL RESOURCES TONNAGE				
Canyon	-----	-----	20,000	20,000
TOTAL	-----	-----	20,000	20,000
GRAND TOTAL	-----	-----	31,920,000	31,920,000

Table 3.--Coal Resource Base and Hypothetical Resource Data (in short tons) for In-Situ Gasification for Federal Coal Lands in the Southeast Quarter of Fifty-Five Ranch 15' Quadrangle, Converse County, Wyoming.

Coal Bed Name	High Development Potential	Moderate Development Potential	Low Development Potential	Total
RESOURCE BASE TONNAGE				
	-----	-----	31,900,000	31,900,000
HYPOTHETICAL RESOURCE TONNAGE				
	-----	-----	20,000	20,000
GRAND TOTAL	-----	-----	31,920,000	31,920,000

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