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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 Reno Junction Quadrangle, Campbell County, Wyoming. This CRO and CDP map series includes 29 plates (U. S. Geological Survey Open-File Report 79-068). 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 unleased federal coal in Known Recoverable Coal Resource Areas (KRCRA) in the western United States.

The Reno Junction Quadrangle is located in Campbell County, in northeastern Wyoming. It encompasses parts of Townships 44 and 45 North, Ranges 71 and 72 West, and covers the area: 43°45' to 43°52'30" north latitude; 105°22'30" to 105°30' west longitude.

The main access to Reno Junction Quadrangle is provided by U. S. Highway 59 which angles north to south through the western half of the study area. U. S. Highway 387 extends southwest from U. S. Highway 59 in the southwest corner of the quadrangle. Other maintained gravel roads, minor roads, and trails that branch from the highways provide additional access to more remote areas. The closest railroad is the Burlington Northern trackage which trends north to south 1 to 2 miles (1.6 to 3.2 km) east of the quadrangle boundary.

Major drainage is provided by Hay Creek which flows northward throughout the western half of the Reno Junction Quadrangle and eventually drains into the Belle Fourche River. The North Prong of the Little Thunder Creek flows southeastward into the Cheyenne River. The maximum elevation of 5080 feet (1548 m) above sea level is located on top of Rocky Hill in the southeastern portion of the quadrangle. Minimum elevations of 4700 feet (1433 m) above sea level occur in the valley floor of Hay Creek on the northern quadrangle boundary. 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 thirteen to fourteen inches (33 to 36 cm) of annual precipitation that falls in this semi-arid region accrues principally in the springtime. Summer and fall precipitation usually originates from thunderstorms, and infrequent snowfalls of six 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. Detail 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 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: 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 3000 feet (914 m). No resources or reserves are computed for leased federal coal, state coal, or fee coal.

Surface and subsurface geological and engineering extrapolations drawn from the current data base suggest the occurrence of approximately 6.7 billion tons (6.1 billion metric tons) of total unleased federal coal resource in the Reno Junction Quadrangle.

The suite of maps that accompany this report set forth and portray 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, 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 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 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 hole 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 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 Reno Junction Quadrangle is located in an area where surface rocks are classified into the Wasatch Formation. Although the Wasatch Formation is reportedly 700 to 800 feet (213 to 244 m) thick (Olive, 1957), only 300 to 400 feet (91 to 122 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. The Felix coal bed was named by Stone and Lupton (1910), and the Smith coal bed was named by Taff (1909). Baker (1929) assigned names to the Anderson, Canyon, and Wall coal beds. The Cook coal bed was named by Bass (1932), and the Pawnee coal bed was named by Warren (1959).

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 Gillette, Wyoming. IntraSearch's correlation of this suite of coal beds with the Wyodak coal bed south and southwest of Gillette suggests that the Andersen and Canyon coal beds equate with the upper ten to twenty-five percent of the thick Wyodak coal bed, and the Cook and Wall or Upper Wall coal beds are equivalent to the major part of the Wyodak coal bed. 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).

Local. The Reno Junction Quadrangle lies on the eastern flank of the Powder River Basin, where the strata dip gently westward. The Wasatch Formation crops out over the entire quadrangle, and is comprised of friable, corase-grained to gritty arkosic sandstones, fine-to very fine-grained sandstones, siltstones, mudstones, claystones, brown-to-black carbonaceous shales, and coal beds. The Tongue River Member of the Fort Union Formation lies 300 to 500 feet (91 to 152 m) beneath the surface and is composed of very fine-grained sandstones, siltstones, claystones, shales, carbonaceous shales, and numerous coal beds.

III. Data Sources

Areal geology of the coal outcrops and associated clinker is derived from the Preliminary Coal Resource Occurrence Map of the Reno Junction Quadrangle, Campbell County, Wyoming, Goolsby (1976).

The major source of subsurface control, particularly on deep coal beds, 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 eighty 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 annotated. Maximum accuracy of coal bed identification 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. A sparse scattering of subsurface data points are shown on unpublished CRO-CDP maps compiled by the U. S. Geological Survey, and where these data are utilized, the rock-coal intervals are shown on the Coal Data Map (Plate 1). Inasmuch as these drillholes 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 down-hole data interpretation.

The reliability of correlations, set forth by IntraSearch in this report, vary 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 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 Reno Junction 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

Wasatch and Fort Union Formation coal beds that are present in all or part of the Reno Junction Quadrangle include, in descending stratigraphic order, the Felix, Smith, Upper Wyodak, Middle and Lower Wyodak, Pawnee, Wildcat, Moyer, and Oedekoven coal beds. A complete suite of maps (structure, isopach, mining ratio, overburden/interburden, identified resources, and areal distribution of identified resources) is prepared for the Felix, Smith, and Upper Wyodak coal beds, and the Middle and Lower Wyodak, and Pawnee-Wildcat-Moyer-Oedekoven coal zones.

No physical and chemical analyses are known to have been published regarding the coal beds in the Reno Junction Quadrangle. However, the general "as received" basis proximate analyses for central and southern Campbell County coal beds are as follows:

COAL BED NAME		ASH%	FIXED CARBON%	MOISTURE%	VOLATILES%	SULPHUR%	BTU/LB
Felix (U)	Hole 7316	7.760	31.233	30.098	30.909	0.524	7743
Smith (U)	Hole 7312C	6.167	33.340	20.610	30.883	1.068	8215
Upper Wyodak (U)	Hole 7544	4.501	32.688	24.337	38.450	0.201	8953
Middle & Lower Wyodak (U)	Hole 757	6.024	32.831	26.907	34.237	0.336	8366
Pawnee (U)	Hole 7424	7.880	31.029	31.910	29.183	0.386	7344

(U) - U. S. Geological Survey and Montana Bureau of Mines & Geology, 1974, 1975, 1976.

The Coal Data Sheet, Plate 3, shows the downhole identification of the coal beds within the quadrangle as interpreted from U. S. Geological Survey and Montana Bureau of Mines and Geology drill holes, and 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) areas. Inasmuch as the Middle and Lower Wyodak coal zone underlies the entire quadrangle, it is designated as datum for the correlation diagram. The Middle and Lower Wyodak coal zone shows the thickest coal bed occurrence throughout the quadrangle. The Upper-Lower Felix, Smith, Upper Wyodak, Pawnee, Wildcat, Moyer, and Oedekoven coal beds are relatively thin throughout most of the area. The Pawnee, Wildcat, Moyer, and Oedekoven coal beds occur more than 500 feet (152 m) beneath the surface throughout the entire Reno Junction Quadrangle.

The Upper and Lower Felix coal beds, eroded from approximately 85 percent of the area, are present only in portions of the western half of the quadrangle. These coal beds are separated by a non-coal interval from 1 to 2 feet (0.3 to 0.6 m) or more in thickness. Aggregate thicknesses vary from 20 to 31 feet (6 to 9 m). Maximum thicknesses are located along the western edge of the quadrangle with an eastward-thinning trend. Structural contours on top of the Felix coal bed portray a westward dip of less than two degrees. The Felix coal bed lies less than 160 feet (49 m) beneath the surface throughout the study area.

The Smith coal bed occurs approximately 350 to 400 feet (107 to 122 m) beneath the Felix coal bed and averages 11 feet (3 m) thick. Thicknesses range from 5 feet (1.5 m) in the northeast corner to 15 feet

(5 m) in the west-central and southwestern portions of the quadrangle. West of this quadrangle the Smith coal bed thickens to 17 feet (5 m). Structural contours on top of the Smith coal bed define a westward dip of one to two degrees and minor east-west trending folds (Plate 10). The Smith coal bed lies less than 500 feet (152 m) beneath the surface throughout 98 percent of the study area.

The Upper Wyodak coal bed lies 79 to 168 feet (24 to 51 m) beneath the Smith coal bed, and averages approximately 9 feet (2.7 m) thick. A maximum thickness of 14 feet (4 m) is located in the northwest corner of the quadrangle (Plate 14). The Upper Wyodak coal bed is absent from the eastern third of the study area. Structural contours on top of the Upper Wyodak coal bed indicate a slight westward dip with no prominent structural features superimposed thereon. The Upper Wyodak coal bed is overlain by less than 500 feet (152 m) of overburden throughout approximately ninety percent of the Reno Junction Quadrangle.

From 192 to 358 feet (59 to 109 m) of clastic sediment separates the Middle and Lower Wyodak coal zone from the overlying Upper Wyodak coal bed. The Middle and Lower Wyodak coal beds are divided by a non-coal interval from 18 to 75 feet (5 to 23 m) thick in the northern portion of the quadrangle. In this area, thicknesses for the Middle Wyodak coal bed average 54 feet (16 m), and vary from 40 to 60 feet (12 to 18 m). The Lower Wyodak coal bed ranges from 10 to 50 feet (3 to 15 m) thick, and averages 28 feet (9 m) in thickness. South of the line that divides the Middle and Lower Wyodak coal beds, the Wyodak coal zone averages 104 feet (32 m) thick and varies from 60 to 130 feet

(18 to 40 m) in thickness. The westward-dipping Middle and Lower Wyodak coal zone lies more than 500 feet (152 m) beneath the surface throughout approximately eighty percent of the Reno Junction Quadrangle (Plate 21).

The Pawnee-Wildcat-Moyer-Oedekoven coal zone lies 209 to 575 feet (64 to 175 m) beneath the Middle and Lower Wyodak coal zone, and averages 12 feet (4 m) thick. Aggregate thicknesses for the coal zone vary from 5 feet (1.5 m) in the eastern portion to 25 feet (8 m) in the northwest corner of the quadrangle. The Pawnee coal bed is present in four drill holes in the western portion of the study area. The Wildcat coal bed lies 353 feet (108 m) below the Pawnee coal bed, and is present only in the southeast portion of the quadrangle. The Moyer coal bed occurs 88 feet (27 m) beneath the Wildcat coal bed and is present throughout ninety percent of the study area. From 104 to 197 feet (32 to 60 m) of interburden separate the Oedekoven coal bed from the overlying Moyer coal bed. The total non-coal intervals in this coal zone attain a maximum thickness of 537 feet (164 m) in Section 1, T. 44 N., R. 72 W. The Pawnee-Wildcat-Moyer-Oedekoven coal zone dips westward and lies more than 500 feet (152 m) beneath the surface throughout the entire quadrangle. Structural contours are drawn on the top of the Pawnee coal bed, and where the Pawnee coal bed is absent, they are drawn on the top of the Wildcat coal bed. Where both coal beds are absent, structural contours are drawn on the top of the Moyer coal bed.

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 plots the horizontal location of the drill hole as described on the geophysical log heading. Occasionally this location is superimposed 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 correctness. 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 considers this agreement mandatory for the proper construction of most subsurface maps, but in particular, the overburden isopach, the ratio, and Coal Development Potential maps.

Subsurface mapping is based on geologic data within and adjacent to the Reno Junction Quadrangle area. Data from geophysical legs are used to correlate coal beds and control contour lines for the coal thickness, structure, and overburden maps. Isopech lines are also drawn to honor selected 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 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 is 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 to a particular coal bed under study. Mining ratio maps for this quadrangle are constructed utilizing a ninety-five 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 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 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 linit designations) in relationship with linear section boundaries and circular resource category boundaries. Where these relationships occur, generalizations of complex curvilinear lines are discretely utilized, and resources and/or reserves are calculated within an estimated two to three 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 is as follows:

$$MR = \frac{t_o\,(0.911)}{t_c\,(rf)}^{*}$$

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

*Use (0.922) for lignite

A surface mining potential map is 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 is 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.

Approximately ten percent of the Reno Junction Quadrangle is classified as high development potential for surface mining. The high potential areas in the western half of the quadrangle are the result of the Felix coal bed occurring at or near the surface. Low mining ratios for the Smith coal bed and the Middle and Lower Wyodak coal zone produce high potential areas in the eastern portion of the quadrangle. Approximately fifteen percent of the Reno Junction Quadrangle is designated moderate development potential for surface mining. These moderate areas relate to increasing overburden thicknesses and higher mining ratios for the Smith coal bed and the Middle and Lower Wyodak coal zone. Low development potential areas cover approximately seventy-five percent of the quadrangle, and result from high overburden to coal ratios for the coal beds beneath the Felix coal bed. Table 1 sets forth the estimated strippable reserve base tonnages per coal bed for the quadrangle.

Underground Mining Coal Development Potential. Subsurface coal mining potential throughout the Reno Junction 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 buried 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 500 feet (152 m) to 3000 feet (914 m) beneath the surface, or 2) coal beds 5 feet (1.5 m) or more in thickness that lie 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 on the Reno Junction 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 5.0 billion tons (4.5 billion metric tons) (Table 3). None of the coal beds in the Reno Junction Quadrangle qualify for a moderate or high development potential rating.

Table 1.--Strippable Coal Reserve Base Data (in short tons) for Federal Coal Lands in the Reno Junction Quadrangle, Campbell 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
Felix	132,780,000	--	--	132,780,000
Smith	37,330,000	51,410,000	450,540,000	539,280,000
Upper Wyodak	1,810,000	310,000	155,140,000	157,260,000
Pawnee-Wildcat-Moyer-Oedekoven	--	--	--	--
	(0-5:1 Mining Ratio)	(5:1-7:1 Mining Ratio)	(>7:1 Mining Ratio)	Total
Middle and Lower Wyodak	312,090,000	321,290,000	120,440,000	753,820,000
TOTAL	484,010,000	373,010,000	726,120,000	1,583,140,000

Table 2.--Coal Resource Base Data (in short tons) for Underground Mining Methods for Federal Coal Lands in the Reno Junction Quadrangle, Campbell County, Wyoming.

Coal Bed Name	High Development Potential	Moderate Development Potential	Low Development Potential	Total
Felix	--	--	--	--
Smith	--	--	6,610,000	6,610,000
Upper Wyodak	--	--	28,780,000	28,780,000
Middle and Lower Wyodak	--	--	4,366,870,000	4,366,870,000
Pawnee-Wildcat-Moyer-Oedekoven	--	--	617,220,000	617,220,000
TOTAL	--	--	5,019,480,000	5,019,480,000

Table 3.--Coal Resource Base Data (in short tons) for In-Situ Gasification for Federal Coal Lands in the Reno Junction Quadrangle, Campbell County, Wyoming.

Coal Bed Name	High Development Potential	Moderate Development Potential	Low Development Potential	Total
Felix	--	--	--	--
Smith	--	--	6,610,000	6,610,000
Upper Wyodak	--	--	28,780,000	28,780,000
Middle and Lower Wyodak	--	--	4,366,870,000	4,366,870,000
Pawnee-Wildcat-Moyer-Oedekoven	--	--	617,220,000	617,220,000
TOTAL	--	--	5,019,480,000	5,019,480,000

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