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COAL RESOURCE OCCURRENCE MAPS AND COAL DEVELOPMENT POTENTIAL MAP OF THE SOUTHEAST QUARTER OF THE AZTEC 15-MINUTE QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO

[Report includes 26 plates]

by

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

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SOUTHEAST QUARTER OF THE AZTEC 15-MINUTE QUADRANGLE

INTRODUCTION

Purpose

This text is to be used in conjunction with the Coal Resource Occurrence (CRO) Maps and Coal Development Potential Map of the southeast quarter of the Aztec 15-minute quadrangle, San Juan County, New Mexico. These maps were compiled to provide a systematic coal resource inventory of Federal coal lands in Known Recoverable Coal Resource Areas (KRCRA's) of the western United States. The work was performed under contract with the Conservation Division of the U.S. Geological Survey (Contract No. 14-08-0001-17172).

The resource information gathered in this program is in response to the Federal Coal Leasing Amendments Act of 1976 and is a part of the U.S. Geological Survey's coal program. The information provides basic data on coal resources for land-use planning purposes by the Bureau of Land Management, state and local governments, and the public.

Location

The southeast quarter of the Aztec 15-minute quadrangle is in northeastern San Juan County, New Mexico. The area is approximately 22 miles (35 km) east-northeast of Farmington, New Mexico.

Accessibility

The southeast quarter of the Aztec 15-minute quadrangle is accessible from New Mexico State Routes 287 and 511, which extend across the area, and State Route 17, which is south of the area. From these routes, light-duty roads provide access to remote parts of the quadrangle. The Atchison, Topeka, and Santa Fe Railway operates a route which passes through Gallup, New Mexico, approximately 104 miles (167 km) to the southwest.

Physiography

This quadrangle is in the north-central portion of the Central Basin area (Kelley, 1950) of the structural depression known as the San Juan Basin. Elevations range from 5,571 ft (1,698 m) in the San Juan River Valley to 6,926 ft (2,111 m) in the northwest. The San Juan River flows westward across the southeast corner of the quadrangle. The remainder of the area is characterized by mesas and canyons which have been incised by numerous intermittent streams.

Climate

The climate of the San Juan Basin is arid to semi-arid. Annual precipitation is usually less than about 10 inches (25 cm) but varies across the basin due to elevational differences. Rainfall is rare in the early summer and winter; most precipitation is received in July and August as intense afternoon thundershowers. Annual temperatures range from below 0°F (-18°C) to over 100°F (38°C) in the basin. Snowfall may occur from November to April.

Land Status

Approximately 74 percent of the quadrangle is in the northeast portion of the San Juan Basin Known Recoverable Coal Resource area. The Federal Government owns the coal rights for approximately 89 percent of the KRCRA land within the quadrangle as shown on Plate 2 of the Coal Resource Occurrence Maps. No Federal coal leases occur in the quadrangle.

GENERAL GEOLOGY

Previous Work

Reeside (1924) has mapped the geology of the area on a scale of 1:250,000 as part of a study of the Upper Cretaceous and Tertiary formations of the San Juan Basin. A more recent publication by Fassett and Hinds (1971) includes subsurface interpretations of Fruitland Formation coal deposits throughout the San Juan Basin.

Geologic History

The San Juan Basin, an area of classic transgressive and regressive sedimentation, provided the ideal environment for formation of coals during

Late Cretaceous time. At that time a shallow epeiric sea, which trended northwest-southeast, was northeast of the basin. The sea transgressed southwesterly into the basin area and regressed northeasterly numerous times; consequently, sediments from varying environments were deposited across the basin. Noncarbonaceous terrestrial deposition predominated during Paleocene and Eocene time.

Depositional evidence of the final retreat of the Late Cretaceous sea is the nearshore regressive Pictured Cliffs Sandstone. Southwest (shoreward) of the beach deposits, swamps, which were dissected by streams, accumulated organic matter which later became coals of the Fruitland Formation. Deposition of organic material was influenced by the strandline as shown by both the continuity of the coal beds parallel to the northwest-southeast strandline and their discontinuity perpendicular to it to the northeast. The less continuous Fruitland coals appear to be noncorrelative, but are stratigraphically equivalent in terms of their relative position within the Fruitland Formation.

The brackish-water swamp environment of the Fruitland moved northeast of the quadrangle as the regression continued in that direction. Terrestrial freshwater sediments then covered the area as indicated by the lacustrine, channel, and floodplain deposits of the Kirtland Shale. This sequence of events is evidenced by both an upward decrease in occurrence and thickness of Fruitland coals and a gradational change to noncarbonaceous deposits of the Kirtland. Continuous deposition during Late Cretaceous time ended with the Kirtland. The sea then retreated beyond the limits of the quadrangle area, and modern basin structure began to develop. An erosional unconformity developed in a relatively short time as part of the Cretaceous Kirtland Shale was removed.

Terrestrial deposition resumed in the Paleocene as represented by the Ojo Alamo Sandstone and the overlying Nacimiento Formation. Alluvial plain and floodplain deposits of the Ojo Alamo were followed by the thick, lithologically varied deposits of the Nacimiento during continuous nonmarine deposition. The Nacimiento was later exposed to erosion.

The Eocene San Jose Formation was subsequently deposited over the Nacimiento erosional surface, reflecting various nonmarine environments which developed across the basin. Deposition and structural deformation of the basin then ceased, and the warped strata of the San Juan Basin have been exposed to the present time.

Stratigraphy

The formations studied in this quadrangle range from Late Cretaceous to Eocene in age. They are, in order from oldest to youngest: the Pictured Cliffs Sandstone, Fruitland Formation, Kirtland Shale, Ojo Alamo Sandstone, Nacimiento Formation, and San Jose Formation. A composite columnar section on CRO Plate 3 illustrates the stratigraphic relationships of these formations and is accompanied by lithologic descriptions of the individual formations.

The Pictured Cliffs Sandstone averages 130 ft (40 m) thick in the area. The formation consists of a white to cream, micaceous sandstone interbedded with gray, calcareous shale and siltstone near the base of the unit. Intertonguing with the overlying Fruitland Formation occurs throughout the entire basin, and, consequently, minor Fruitland coal beds commonly are present in the upper portion of the Pictured Cliffs. Because the unit is present throughout most of the San Juan Basin and easily recognized on geophysical logs, the top was picked as the datum for Fruitland coal correlations (CRO Plate 3).

The major coal-bearing unit in the quadrangle is the Fruitland Formation. Wide variations in reported thickness of the unit are common due to an indistinct upper contact with the Kirtland Shale, but the average is about 350 ft (107 m) in this quadrangle. Many authors have utilized various criteria to establish the upper contact, but, in general, for this study the uppermost coal was chosen (after Fassett and Hinds, 1971). The formation consists primarily of gray, carbonaceous shale with plant fossils, interbedded cream sandstone, and lenticular coal beds.

The Upper Cretaceous Kirtland Shale conformably overlies the Fruitland Formation and averages 760 ft (232 m) in thickness in this area. It consists predominantly of freshwater, gray to green shale with plant fossils, interbedded white to cream sandstone, and interbedded gray to green siltstone with sandy stringers. The formation has previously been divided into several members by various authors; however, for the purposes of this report it was not necessary to distinguish between the individual members.

The Paleocene Ojo Alamo Sandstone unconformably overlies the Kirtland Shale. It is a white to gray, locally conglomeratic sandstone with interbedded gray-green to brown shale with plant fossils, and averages 100 ft (30 m) in thickness.

Approximately 1,200 ft (366 m) of the Paleocene Nacimiento Formation overlie the Ojo Alamo Sandstone in this area. The Nacimiento is exposed in the southern part of the quadrangle where it consists of gray-green to brown, micaceous shale, interbedded gray-green to brown siltstone, and interbedded tan to gray, silty sandstone.

The San Jose Formation of Eocene age unconformably overlies the Nacimiento Formation and crops out over the northern part of the quadrangle area. It predominantly consists of tan to gray-green, arkosic, friable, slightly micaceous, locally conglomeratic sandstone, and interbedded gray-green to brown siltstone and shale.

Structure

The southeast quarter of the Aztec 15-minute quadrangle is in the Central Basin area (Kelley, 1950) of the San Juan Basin. The axis of the basin is about 5 miles (8 km) north of the quadrangle area and trends in an arcuate pattern across the northern portion of the Central Basin area (Baltz, 1967). Reeside (1924) has stated that the rocks in the area are "nearly horizontal."

COAL GEOLOGY

Six coal beds (Fruitland 1, Fruitland 2, Fruitland 3, Fruitland 4, Fruitland 5, Fruitland 6) and a coal zone (Fruitland) were identified in the subsurface of this quadrangle (CRO Plate 1). The Fruitland 1 (Fr 1) coal bed is defined by the authors as the lowermost coal of the Fruitland Formation; it is generally directly above the Pictured Cliffs Sandstone. The Fruitland 2 (Fr 2) coal bed is above the Fruitland 1 separated by a rock interval of 22 to 53 ft (6.7-16.2 m); the Fruitland 3 (Fr 3) coal bed is above the Fruitland 2 separated by a rock interval of 13 to 53 ft (4.0-16.2 m); the Fruitland 4 (Fr 4) coal bed is above the Fruitland 3 separated by a rock interval of 16 to 47 ft (4.9-14.3 m); the Fruitland 5 (Fr 5) coal bed is above the Fruitland 4 separated by a rock interval of 23 to 40 ft (7.0-12.2 m); the Fruitland 6 (Fr 6) coal bed is above the Fruitland 5 separated by a rock interval of 23 to 48 ft (7.0-14.6 m). Although the coal beds have been correlated and mapped as consistent horizons, they may actually be several different coal beds that are lithostratigraphically equivalent but not laterally continuous. Occasionally there are several local (L) coal beds between the correlative beds. The local coals are generally noncorrelative and discontinuous.

The remaining coals in the upper portion of the Fruitland Formation are designated as the Fruitland coal zone (Fr zone). These coals are generally noncorrelative, discontinuous, and less than reserve base thickness (5 ft [1.5 m], as specified by the U.S. Geological Survey); exceptions are an 8-ft (2.4-m) coal bed in drill hole 25 and a 5-ft (1.5-m) coal bed in drill holes 27 and 28. Due to these characteristics, derivative maps were not constructed.

Fruitland Formation coals in the central part of the San Juan Basin are considered high volatile A bituminous in rank. The rank has been determined on a moist, mineral-matter-free basis with calorific values averaging 14,833 Btu's per pound (34,502 kj/kg) (Amer. Soc. for Testing and Materials, 1977). The coal is hard, brittle, and black with a bright luster. The coal readily slakes with exposure to weather; however, it stocks fairly well when protected. The "as received" analyses indicate moisture content varying from 1.4 to 2.6 percent, ash content ranging from 9.8 to 24.7 percent, sulfur content of 0.5 to 2.2 percent, and heating values on the order of 12,358 Btu's per pound (28,745 kj/kg). Analyses of several Fruitland Formation coals are given in Table 1 (Bauer and Reeside, 1921; Dane, 1936; Fassett and Hinds, 1971).

TABLE 1

Analyses of coal samples from the Fruitland Formation

(Form of analysis: A, as received; B, moisture free; C, moisture and ash free)

U.S. Bureau Mines Lab No.	Well or Other Source	Location			Approx. Depth Interval of Sample (ft.)	Form of Analysis	Proximate, percent					Heating Value (Btu)	Remarks
		Section	T.N.	R.W.			Mois-ture	Volatile matter	Fixed Carbon	Ash	Sulfur		
H-13061	Aztec Oil & Gas Reid No. 23-D	SW¼ 17	28	9	1,985-1,990	A	1.4	36.1	42.1	20.4	0.8	11,670	
						B	---	36.6	42.7	20.7	0.8	11,830	
						C	---	46.2	53.8	----	1.0	14,920	
H-5472	Aztec Oil & Gas Caine No. 13	NW¼ 16	28	10	1,842-1,853	A	1.6	38.4	40.7	19.3	0.6	11,760	
						B	---	39.0	41.4	19.6	0.6	11,950	
						C	---	48.5	51.5	----	0.8	14,870	
H-12704	Redfern & Herd Redfern & Herd No. 5	SW¼ 10	28	11	1,490-1,500	A	2.1	39.8	43.4	14.7	0.6	12,190	
						B	---	40.7	44.3	15.0	0.6	12,460	
						C	---	47.9	52.1	----	0.7	14,670	
H-16310	Aztec Oil & Gas Cain No. 16-D	SW¼ 30	29	9	1,985-2,005	A	1.6	41.1	46.6	10.7	0.7	13,310	
						B	---	41.7	47.5	10.8	0.7	13,520	
						C	---	46.8	53.2	----	0.7	15,160	
H-27541	Aztec Oil & Gas Grenier "B" No. 3	SW¼ 5	29	10	2,065-2,080	A	2.3	39.1	42.1	16.5	1.9	12,020	
						B	---	40.0	43.1	16.9	2.0	12,300	
						C	---	48.1	51.9	----	2.4	14,800	
H-27540	Aztec Oil & Gas Grenier "B" No. 3	SW¼ 5	29	10	2,150-2,160	A	2.0	40.6	47.6	9.8	0.5	13,300	
						B	---	41.4	48.6	10.0	0.5	13,560	
						C	---	46.0	54.0	----	0.6	15,070	
H-3028	International Oil Fogelson No. 1-9	NW¼ 9	29	11	1,905-1,910	A	1.8	39.9	43.9	14.4	0.7	12,360	
						B	---	40.6	44.8	14.6	0.7	12,590	
						C	---	47.6	52.4	----	0.8	14,750	
H-13060	Tidewater N.M.-Fed. No. 12-E	SE¼ 12	29	11	2,065-2,070	A	2.1	38.7	47.9	11.3	0.6	12,830	
						B	---	39.5	48.9	11.6	0.6	13,100	
						C	---	44.7	55.3	----	0.7	14,820	

TABLE 1 (Continued)

Analyses of coal samples from the Fruitland Formation

(Form of analysis: A, as received; B, moisture free; C, moisture and ash free)

U.S. Bureau Mines Lab No.	Well or Other Source	Location			Approx. Depth Interval of Sample (ft.)	Form of Analysis	Proximate, percent					Heating Value (Btu)	Remarks
		Section	T.N.	R.W.			Moisture	Volatile matter	Fixed Carbon	Ash	Sulfur		
H-35925	El Paso Nat. Gas Turner No. 3	SE¼ 28	30	9	2,385-2,390	A	1.5	39.9	45.5	13.1	2.2	12,960	
						B	---	40.5	46.2	13.3	2.2	13,150	
						C	---	46.7	53.3	----	2.5	15,170	
H-19882	El Paso Nat. Gas Ludwick No. 20	SW¼ 29	30	10	2,340-2,360	A	2.3	33.1	39.9	24.7	0.7	10,800	
						B	---	33.9	40.9	25.2	0.7	11,060	
						C	---	45.3	54.7	----	0.9	14,790	
H-19883	El Paso Nat. Gas Ludwick No. 20	SW¼ 29	30	10	2,505-2,515	A	2.6	41.7	44.5	11.2	0.6	13,080	
						B	---	42.9	45.6	11.5	0.6	13,420	
						C	---	48.4	51.6	----	0.7	15,160	
H-13062	Aztec Oil & Gas Ruby Jones No. 1	NE¼ 7	30	11	2,020-2,030	A	1.4	37.2	44.1	17.3	0.6	12,010	
						B	---	37.7	44.8	17.5	0.6	12,180	
						C	---	45.7	54.3	----	0.7	14,770	

To convert Btu's/lb by kj/kg, multiply Btu's/lb by 2.326.
To convert feet to meters, multiply feet by 0.3048.

Fruitland 1 Coal Bed

The coal bed has been mapped only in areas of less than 3,000 ft (914 m) of overburden (the study limit). As indicated by the structure contour map (CRO Plate 5) the coal bed dips less than 1° to the northeast. As a result of topography and dip, overburden (CRO Plate 6) varies from less than 2,200 ft (671 m) in the San Juan River Valley to greater than 3,000 ft (914 m) in the north. The isopach map (CRO Plate 4) illustrates that the coal bed has a maximum thickness of greater than 20 ft (6.1 m) in the northeast. The coal bed is absent in the central and the southeast parts of the quadrangle.

Chemical Analyses of the Fruitland 1 Coal Bed - Analyses of several coals of the Fruitland Formation from this quadrangle and the surrounding area are given in Table 1 (Fassett and Hinds, 1971).

Fruitland 2 Coal Bed

The coal bed has been mapped only in areas of less than 3,000 ft (914 m) of overburden (the study limit). As indicated by the structure contour map (CRO Plate 9) the coal bed dips less than 1° to the northeast. As a result of topography and dip, overburden (CRO Plate 10) varies from less than 2,100 ft (640 m) in the San Juan River Valley to greater than 3,000 ft (914 m) in the north. The isopach map (CRO Plate 8) illustrates that the coal bed has a maximum thickness of greater than 10 ft (3.0 m) in the south-central area of the quadrangle. The coal bed is absent in the southeast, northeast, and west.

Chemical Analyses of the Fruitland 2 Coal Bed - Analyses of several coals of the Fruitland Formation from this quadrangle and the surrounding area are given in Table 1 (Fassett and Hinds, 1971).

Fruitland 3 Coal Bed

The coal bed has been mapped only in areas of less than 3,000 ft (914 m) of overburden (the study limit). As indicated by the structure contour map (CRO Plate 13) the coal bed dips less than 1° to the northeast. As a result of topography and dip, overburden (CRO Plate 14) varies from less than 2,100 ft (640 m) in the San Juan River Valley to greater than 3,000 ft (914 m) in the north. The isopach map (CRO Plate 12) illustrates that the coal bed has a thickness of greater than 20 ft (6.1 m) in the southwest and decreases in thickness in all directions. The coal is absent in portions of the east and west.

Chemical Analyses of the Fruitland 3 Coal Bed - Analyses of several coals of the Fruitland Formation from this quadrangle and the surrounding area are given in Table 1 (Fassett and Hinds, 1971).

Fruitland 4 Coal Bed

The coal bed has been mapped only in areas of less than 3,000 ft (914 m) of overburden (the study limit). As indicated by the structure contour map (CRO Plate 17) the coal bed dips less than 1° to the northeast. As a result of topography and dip, overburden (CRO Plate 18) varies from less than 2,000 ft (610 m) in the San Juan River Valley to greater than 3,000 ft

(914 m) in the north. The isopach map (CRO Plate 16) illustrates that the coal bed has a thickness of greater than 15 ft (4.6 m) in the north-central and west-central parts of the quadrangle. The coal decreases in thickness from these areas and is absent in a part of the south.

Chemical Analyses of the Fruitland 4 Coal Bed - Analyses of several coals of the Fruitland Formation from this quadrangle and the surrounding area are given in Table 1 (Fassett and Hinds, 1971).

Fruitland 5 Coal Bed

The coal bed has been mapped only in areas of less than 3,000 ft (914 m) of overburden (the study limit). As indicated by the structure contour map (CRO Plate 21) the coal bed dips less than 1° to the northeast. As a result of topography and dip, overburden (CRO Plate 22) varies from less than 2,400 ft (732 m) near the San Juan River to greater than 3,000 ft (914 m) in the north. The isopach map (CRO Plate 20) illustrates that the coal bed has a thickness of greater than 10 ft (3.0 m) in the northwest and decreases in thickness in all directions. The coal is absent in the extreme northwest corner and southern parts of the quadrangle.

Chemical Analyses of the Fruitland 5 Coal Bed - Analyses of several coals of the Fruitland Formation from this quadrangle and the surrounding area are given in Table 1 (Fassett and Hinds, 1971).

Fruitland 6 Coal Bed

The coal bed has been mapped only in areas of less than 3,000 ft (914 m) of overburden (the study limit). As indicated by the structure contour map (CRO Plate 24), the coal bed dips less than 1° to the northeast. As a result of topography and dip, overburden (CRO Plate 25) varies from less than 2,400 ft (732 m) in the south to greater than 3,000 ft (914 m) in the north. The isopach map (CRO Plate 23) illustrates that the coal bed has a maximum thickness of greater than 10 ft (3.0 m) in the northeast. The coal is absent in the south and west.

Chemical Analyses of the Fruitland 6 Coal Bed - Analyses of several coals of the Fruitland Formation from this quadrangle and the surrounding area are given in Table 1 (Fassett and Hinds, 1971).

COAL RESOURCES

Coal resource data from oil and gas wells and pertinent publications were utilized in the construction of isopach and structure contour maps of coals in this quadrangle. All of the coals studied in the southeast quarter of the Aztec 15-minute quadrangle are more than 200 ft (61 m) below the ground surface and, thus, have no outcrop or surface development potential.

The U.S. Geological Survey designated the Fruitland 1, Fruitland 2, Fruitland 3, Fruitland 4, Fruitland 5, and Fruitland 6 coal beds for the determination of coal resources in this quadrangle. Coals of the Fruitland coal zone were not evaluated because they are discontinuous, noncorrelative, and generally less than the reserve base thickness (5 ft [1.5 m]).

For Reserve Base and Reserve calculations, each coal bed was areally divided into measured, indicated, and inferred resource categories (CRO Plates 7, 11, 15, and 19) according to criteria established in U.S. Geological Survey Bulletin 1450-B. Data for calculation of Reserve Base and

Reserves for each category were obtained from the respective coal isopach (CRO Plates 4, 8, 12, 16, 20, and 23) and areal distribution maps (CRO Plates 7, 11, 15, and 19) for each coal bed. The surface area of each isopached bed was measured by planimeter, in acres, for each category, then multiplied by both the average isopached thickness of the coal bed and 1,800 short tons of coal per acre-foot (13,239 tons/hectare-meter), the conversion factor for bituminous coal. This yields the Reserve Base coal, in short tons, for each coal bed.

In order to calculate Reserves, a recovery factor of 50 percent was applied to the Reserve Base tonnages for underground coal. However, in areas of underground coal exceeding 12 ft (3.7 m) in thickness, the Reserves (mineable coal) were calculated on the basis of a maximum coal bed thickness of 12 ft (3.7 m), which represents the maximum economically mineable thickness for a single coal bed in this area by current underground mining technology.

Reserve Base and Reserve values for measured, indicated, and inferred categories of coal for the Fruitland 1, Fruitland 2 and Fruitland 5, Fruitland 3 and Fruitland 6, and Fruitland 4 beds are shown on CRO Plates 7, 11, 15, and 19, respectively, and are rounded to the nearest hundredth of a million short tons. The total coal Reserve Base, by section, is shown on CRO Plate 2 and totals approximately 544.5 million short tons (494.0 million metric tons).

The coal development potential for each bed was calculated in a manner similar to the Reserve Base, from planimetered measurements, in acres, for areas of high, moderate, and low potential for subsurface mining methods. The southwest quarter of the Aztec 15-minute quadrangle has development potential for subsurface mining methods only (CDP Plate 26).

COAL DEVELOPMENT POTENTIAL

Coal beds of 5 ft (1.5 m) or more in thickness which are overlain by 200 to 3,000 ft (61-914 m) of overburden are considered to have potential for underground mining and are designated as having high, moderate, or low development potential according to the overburden thickness: 200 to 1,000 ft (61-305 m), high; 1,000 to 2,000 ft (305-610 m), moderate; and 2,000 to 3,000 ft (610-914 m), low. Table 2 summarizes the coal development potential, in short tons, for underground coal of the Fruitland 1, Fruitland 2, Fruitland 3, Fruitland 4, Fruitland 5, and Fruitland 6 coal beds.

Development Potential for Surface Mining Methods

All coals studied in the southeast quarter of the Aztec 15-minute quadrangle occur more than 200 ft (61 m) below the ground surface and, thus, they have no coal development potential for surface mining methods.

Development Potential for Subsurface Mining Methods

Underground coal of the Fruitland 1, Fruitland 2, Fruitland 3, Fruitland 4, Fruitland 5, and Fruitland 6 beds has low development potential in most of the quadrangle area encompassed by the KRCRA (CDP Plate 26). The coal resource areas outlined on the respective areal distribution maps (CRO Plates 7, 11, 15, and 19) for each coal bed are areas of low development potential. Coal bed thicknesses in these areas include: 5 to 20 ft (1.5-6.1 m) for the Fruitland 1 and Fruitland 3 (CRO Plates 4 and 12); 5 to 10 ft

TABLE 2

COAL RESOURCE DATA FOR UNDERGROUND MINING METHODS FOR FEDERAL COAL LANDS (in short tons) IN THE SOUTHEAST QUARTER OF THE AZTEC 15-MINUTE QUADRANGLE, SAN JUAN COUNTY, NEW MEXICO

(To convert short tons to metric tons, multiply by 0.9072)

Coal Bed	High Development Potential	Moderate Development Potential	Low Development Potential	Total
Fruitland 6	--	--	9,600,000	9,600,000
Fruitland 5	--	--	29,640,000	29,640,000
Fruitland 4	--	--	153,270,000	153,270,000
Fruitland 3	--	--	150,700,000	150,700,000
Fruitland 2	--	--	111,960,000	111,960,000
Fruitland 1	--	--	89,320,000	89,320,000
TOTAL	--	--	544,490,000	544,490,000

(1.5-3.0 m) for the Fruitland 2 and Fruitland 6 (CRO Plates 8 and 23); 5 to 18 ft (1.5-5.5 m) for the Fruitland 4 (CRO Plate 16); and 5 to 13 ft (1.5-4.0 m) for the Fruitland 5 (CRO Plate 20). The overburden thickness values vary for each coal bed in the respective low potential areas. They are: Fruitland 1, 2,400 to 3,000 ft (732-914 m) (CRO Plate 6); Fruitland 2, 2,300 to 3,000 ft (701-914 m) (CRO Plate 10); Fruitland 3, approximately 2,200 to 3,000 ft (671-914 m) (CRO Plate 14); Fruitland 4, 2,500 to 3,000 ft (762-914 m) (CRO Plate 18); Fruitland 5, 2,800 to 3,000 ft (853-914 m) (CRO Plate 22; and Fruitland 6, 2,600 to 2,800 ft (792-853 m) (CRO Plate 25).

Areas with unknown coal development potential occur in the southeast and the west-northwest. In these areas the individual coal beds are less than 5 ft (1.5 m) thick and some of the coals occur outside the 3,000-foot (914-m) overburden study limit. Unpatterned areas shown on CDP Plate 26 are outside the KRCRA and are not included in the resource evaluation.

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