UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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FEDERAL COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE ANTELOPE LOOKOUT MESA 7 1/2-MINUTE QUADRANGLE, McKINLEY COUNTY, NEW MEXICO

[Report includes 13 plates]

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ANTELOPE LOOKOUT MESA QUADRANGLE

CONTENTS

ILLUSTRATIONS

TABLES

INTRODUCTION

Purpose

This text complements the Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) maps of Antelope Lookout Mesa 7½ minute quadrangle, McKinley County, New Mexico. These maps and report are part of an evaluation of fifty-six 7½ minute quadrangles in northwestern New Mexico which were completed under U. S. Geological Survey Contract No. 14-08-0001-17459 (see figs. 1 and 2).

The purpose of this Coal Resource Occurrence-Coal Development Potential program, which was conceived by Congress as part of its Federal Coal Leasing Amendments Act of 1976, is to obtain coal resource information and to determine the geographical extent of Federal coal deposits. In addition, the program is intended to provide information on the amount of coal recoverable by various mining methods and to serve as a guide for land-use planning.

The U. S. Geological Survey initiated the program by identifying areas underlain by coal resources. These areas were designated Known Recoverable Coal Resource Areas based on the presence of minable coal thicknesses, adequate areal extent of these coal deposits, and the potential for developing commercial quantities of coal at minable depths.

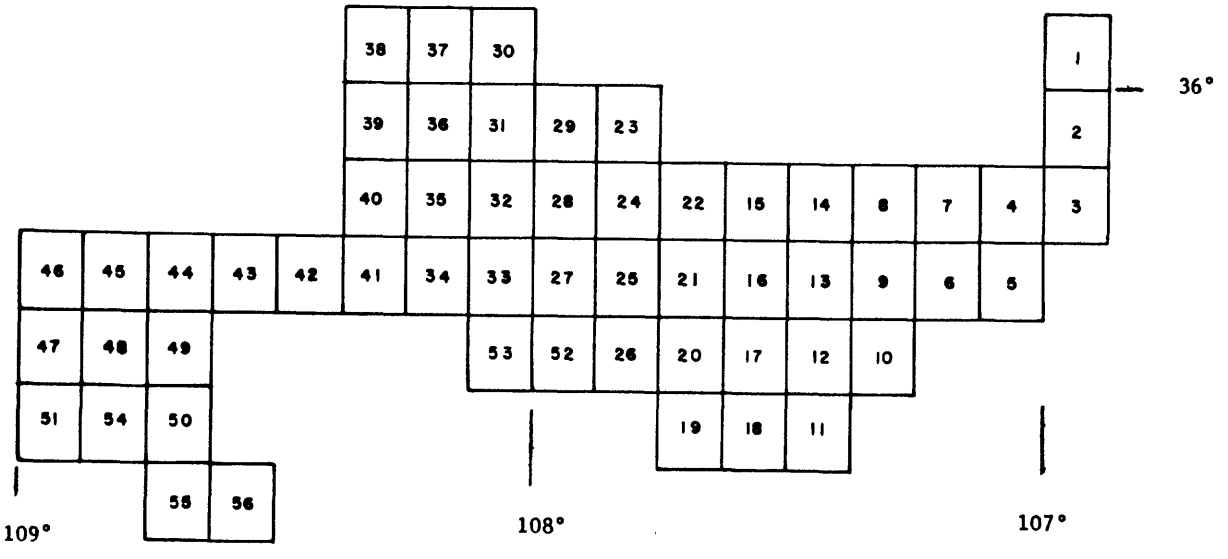
This report is limited to coal resources which are 3,000 ft (914 m) or less below ground surface. Published and unpublished public information was used as the data base for this study. No new drilling or field mapping was performed as part of this study, nor were any confidential data used.


LOCATION OF PROJECT AREA
PROJECT AREA
AREA OF THIS REPORT
COLORADO
ARIZONA
FARMINGTON
ALBUQUERQUE
Grants
Bloomfield
Bernalillo
Estancia
Window Rock
St. Michaels
Red Rock
Round Rock
Teec Nos Pos
Los Lunas
Milan
Shiprock

FIGURE 1

FIGURE 2.--Index to USGS 7 1/2-minute quadrangles and coal resource occurrence/ coal development potential maps for the southern San Juan Basin area, New Mexico

Map No.	Quadrangle	Open-file report	Map No.	Quadrangle	Open-file report
1	Cuba	79- 623	31	Nose Rock	79- 641
2	San Pablo	79- 624	32	Becenti Lake	79-1124
3	La Ventana	79-1038	33	Heart Rock	79- 642
4	Headcut Reservoir	79-1043	34	Crownpoint	79-1125
5	San Luis	79-1044	35	Antelope Lookout Mesa	79-1376
6	Arroyo Empedrado	79-1045	36	Milk Lake	79-1377
7	Wolf Stand	79-1046	37	La Vida Mission	79-1378
8	Tinian	79- 625	38	The Pillar 3 SE	79-1379
9	Canada Calladita	79- 626	39	Red Lake Well	79-1380
10	Cerro Parido	79- 627	40	Standing Rock	79-1381
11	El Dado Mesa	79- 628	41	Dalton Pass	80- 026
12	Mesa Cortada	79- 629	42	Oak Spring	80- 027
13	Mesita del Gavilan	79- 630	43	Hard Ground Flats	80- 028
14	Rincon Marquez	79- 631	44	Big Rock Hill	80- 029
15	Whitehorse Rincon	79- 632	45	Twin Lakes	80- 030
16	Mesita Americana	79- 633	46	Tse Bonita School	80- 031
17	El Dado	79- 634	47	Samson Lake	80- 032
18	Cerro Alesna	79- 635	48	Gallup West	80- 033
19	San Lucas Dam	79- 636	49	Gallup East	80- 034
20	Piedra de la Aguila	79-1039	50	Bread Springs	80- 035
21	Hospah	79- 637	51	Manuelito	80- 036
22	Whitehorse	79-1040	52	Borrego Pass	80- 037
23	Seven Lakes NE	79- 638	53	Casamero Lake	80- 038
24	Kin Nahzin Ruins	79- 639	54	Twin Buttes	80- 039
25	Orphan Annie Rock	79-1041	55	Pinehaven	80- 040
26	Mesa de los Toros	79-1122	56	Upper Nutria	80- 041
27	Laguna Castillo	79- 640			
28	Seven Lakes	79-1042			
29	Seven Lakes NW	79-1123			
30	Kin Klizhin Ruins	79-1047			



Location

The Antelope Lookout Mesa 7½ minute quadrangle includes acreage in Tps. 18 and 19 N., Rs. 12 and 13 W. of the New Mexico Principal Meridian, McKinley County, northwestern New Mexico (see figs. 1 and 2).

Accessibility

State Route 371 passes through the quadrangle and provides access to the town of Crownpoint, 5 mi (8 km) south of the quadrangle. Unimproved dirt roads traverse most parts of the area. The Atchison, Topeka, and Santa Fe Railroad line passes about 23 mi (37 km) due south of the quadrangle (see fig. 1).

Physiography

The Antelope Lookout Mesa quadrangle is in the Navajo section of the southernmost part of the Colorado Plateau Physiographic province (U. S. Geological Survey, 1965). The topography of the quadrangle is characterized by gently rolling flat lands.

No perennial streams are present in the quadrangle. Local drainage is provided by several intermittent arroyos. Elevations within the quadrangle range from less than 6,240 ft (1,902 m) in the northwest corner along Indian Creek to over 6,780 ft (2,067 m) on Antelope Lookout Mesa in the southeast.

Climate

The climate of this area is semiarid to arid. The following temperature and precipitation data were reported by the National Oceanic and Atmospheric Administration for the Chaco Canyon National Monument Station. The Antelope Lookout Mesa quadrangle is about 16 mi (26 m) SW of the Chaco Canyon National Monument Station. Average total annual precipitation for thirteen of the previous fifteen years is 8.75 in. (22.23 cm). Intense thunderstorms in July, August, and September account for the majority of precipitation. The area is susceptible to flash flooding associated with these thunderstorms. Mean annual temperature for eleven of the previous fifteen years is 48.4° F (91° C). The average daily temperatures in January and July are 26.3° F (-3.2° C) and 72.5° F (22.5° C), respectively.

Land status

The Federal Government holds the coal mineral rights to approximately 95 percent of the Antelope Lookout Mesa quadrangle. For the specific coal ownership boundaries, see plate 2. It is not within the scope of this report to provide detailed land-surface ownership. About 3,000 acres (1,214 ha) in the southern portion of the quadrangle are within the Crownpoint Known Recoverable Coal Resource Area. As of October 26, 1978, there were no Federal coal leases, coal preference right lease applications, or coal exploration licenses within the Antelope Lookout Mesa quadrangle.

GENERAL GEOLOGY

Previous work

Early reports on the area include that of Dobbin (1932) who mapped the area and reported coal outcrop measurements of the Menefee Formation. Sears (1934) also mapped the area and reported a Menefee Cleary coal outcrop in sec. 30, T. 18 N., R. 12 W. This outcrop was previously measured by Dobbin (1932). Shomaker, Beaumont, and Kottlowski (1971) reviewed the area and reported that none of the coals in the area were thick enough to justify reserve calculations.

Stratigraphy

Within the San Juan Basin, the shoreline positions of the Cretaceous seaways changed innumerable times. The overall regional alignment of the shorelines trended N. 60^{o} W. - S. 60^{o} E. (Sears, Hunt, and Hendricks, 1941). The transgressive and regressive shoreline migrations are evidenced by the intertonguing relationships of continental and marine facies. Rates of trough (geosynclinal) subsidence and the availability of sediment supplies are the major factors that controlled the transgressive-regressive shoreline sequences.

Exposed rock units in the Antelope Lookout Mesa quadrangle include some of the sedimentary units of Upper Cretaceous age. There is Quaternary alluvium along drainages in the area. Sears (1934) mapped areas of Quaternary terrace gravel deposits in the western part of the quadrangle. Coal beds have been identified in the Dilco Coal Member of the Crevasse Canyon

Formation and Cleary Coal Member of the Menefee Formation in this quadrangle. The Gallup Sandstone is a prominent sandstone marker in most of the southern San Juan Basin and is the oldest Upper Cretaceous unit cropping out in the area.

A major northeastward regression of the Cretaceous seaways resulted in deposition of the Gallup Sandstone in a beach or littoral environment. The Gallup Sandstone is composed of pink to gray, fine to medium grained massive sandstone with interbedded gray shales, and averages 160 ft (49 m) thick locally. The Dilco Coal Member of the Crevasse Canyon Formation overlies the Gallup Sandstone and represents the continental deposits which formed inland from the beach area during deposition of the Gallup Sandstone. Medium to dark gray siltstone with interbedded medium grained, tan sandstones and coal beds comprise the lithologies of the Dilco Coal Member, which averages 80 ft (24 m) thick in the area.

Increased rates of trough subsidence caused the regressive sequence to gradually slow, and finally stop. The seaways deepened and the shorelines advanced southwestward during the succeeding transgressive phase. The Mulatto Tongue of the Mancos Shale overlies the Dilco Coal Member which formed from the marine sands, silts, and muds, and is composed of light gray to tan, silty shale with interbedded reddish-tan, very fine grained sandstone, and averages 320 ft (98 m) thick in this area. A transitional contact of the Mulatto Tongue with the overlying Dalton Sandstone Member of the Crevasse Canyon Formation indicates the gradual reversal from transgressive to regressive depositional conditions.

The Dalton Sandstone Member is composed of yellowish-gray, very fine grained quartzose sandstone which formed in a nearshore environment and ranges from 0 to 80 ft (0 to 24 m) thick locally. The Gibson Coal Member of the

Crevasse Canyon Formation overlies the Dalton Sandstone Member and represents the continental deposits which formed inland from the beach area during deposition of the Dalton Sandstone. Medium gray, carbonaceous siltstone with interbedded gray to tan sandstone and coal beds comprise the lithologies of the Gibson Coal Member, which ranges from 0 to 90 ft (0 to 27 m) thick in the area.

The Dalton Sandstone Member and Gibson Coal Member pinch out in this quadrangle, indicating the approximate northeastward limit of withdrawal of the Cretaceous shoreline during this regressive phase. Deposition of the Mulatto Tongue continued in the northern part of the quadrangle through the remainder of this regressive phase.

Increased rates of trough subsidence resulted in the gradual reversal from regressive to transgressive conditions, and the Hosta Tongue of the Point Lookout Sandstone was deposited during the advancing shoreline sequence. The Hosta Tongue overlies the Gibson Coal Member in the southern part of the quadrangle and the Mulatto Tongue in the northern part of the quadrangle and is composed of light gray to reddish-brown, fine to medium grained sandstone with interbedded shales. Thickness of the Hosta Tongue averages 200 ft (61 m) locally.

As the transgression proceeded and the Cretaceous seaways deepened, the Satan Tongue of the Mancos Shale was deposited over the Hosta Tongue. The Satan Tongue is composed of light to dark gray silty shale with interbedded tan to buff sandstone, and averages 300 ft (91 m) thick locally. The Point Lookout Sandstone overlies the Satan Tongue, and represents nearshore or littoral deposits which formed during the most extensive northeastward retreat prior to the final withdrawal of the Cretaceous seaways in the

San Juan Basin (Sears, Hunt, and Hendricks, 1941). Lithology of the Point Lookout Sandstone is identical to the Hosta Tongue. It is 130 ft (40 m) thick locally. The continental sediments deposited inland from the beach area during the deposition of the Point Lookout Sandstone compose the overlying Menefee Formation.

The Menefee Formation consists of dark-gray to brown carbonaceous to noncarbonaceous shales, light-gray sandstones, and coal beds, and is divisible into the basal Cleary Coal Member and upper Allison Member. A massive channel sandstone sequence, which crops out in the northern part of this quadrangle, defines the boundary between the two members. The Cleary Coal Member contains the most important coal beds in this quadrangle and averages 350 ft (107 m) thick locally. The Allison Member has been partially eroded in this area. Only the lower 150 ft (46 m) of the member is present in the Antelope Lookout Mesa quadrangle. No Allison Member coal beds have been identified in this area.

Depositional environments

The Cretaceous System sedimentary units in the quadrangle represent transgressive and regressive depositional conditions. There were innumerable minor cycles of widely varying duration and extent within the major sedimentary sequences. The paucity of data in this quadrangle and the intended scope of this report permit only general interpretations of the depositional environments.

The Cretaceous coal deposits of the San Juan Basin are products of former coastal swamps and marshes. These swamps and marshes were supported by heavy precipitation and a climate conducive to rapid vegetal growth in moderately fresh water. Due to the relatively low sulfur contents of the

San Juan Basin coals, Shomaker and Whyte (1977) suggest the coals formed in fresh-water environments.

Most of the coal-bearing units were deposited in coastal plain environments. The majority of the peat deposits formed in a transition zone between lower and upper deltaic sediments during periods of relative shoreline stability. Coals also formed in lake margin swamps inland from the coastal area. Shoreline oscillations and the subsequent influx of continental or marine debris upon the peat accumulations produced the vertical buildup or "stacking" of peat deposits. This sediment debris is represented by variable ash contents, rock partings, and splits within the coal seams.

The peat accumulated in lenses or pods which were generally parallel to the ancient shorelines. The coals in the lower portions of the coal-bearing units represent regressive depositional conditions (Sears, Hunt, and Hendricks, 1941). The coals in the upper portions of these units are relatively sporadic in occurrence.

Structure

The Antelope Lookout Mesa quadrangle is in the Chaco Slope structural division in the southern portion of the structural depression known as the San Juan Basin (Kelley, 1950). Dips of the rock units range from 1^{o} to 2^{o} N to NE. Neither Dobbin (1932) nor Sears (1934) identified any faults in the area. No localized folding is present in the quadrangle.

COAL GEOLOGY

In this quadrangle, the authors identified two coal beds and two coal zones in oil and gas well logs and Dobbin's (1932) surface mapping. These beds and zones are here informally called the Crevasse Canyon Dilco coal zone, Menefee Cleary No. 1 and No. 3 coal beds, and the Menefee Cleary coal zone.

The Crevasse Canyon Dilco coal zone contains a single 3.5 ft (1.1 m) thick coal bed including a 0.5 ft (0.2 m) thick rock parting. The zone bed occurs about 1,196 ft (365 m) below the top of the Point Lookout Sandstone.

The Menefee Cleary No. 1 coal bed is the first persistent coal above the Point Lookout Sandstone. It occurs from 0 to 9 ft (0 to 3 m) above the Point Lookout Sandstone in this area. About 79 ft (24 m) above the Menefee Cleary No. 1 coal bed, the Menefee Cleary No. 3 bed occurs. These beds are inferred to be continuous although they may be several individual beds that are stratigraphically equivalent.

The Menefee Cleary coal zone contains up to two coals which occur from 29 to 66 ft (9 to 20 m) above the Point Lookout Sandstone. These zone coals may be correlated for limited distances in portions of the area, but they lack sufficient continuity with poorly defined stratigraphic position to be designated as persistent coal beds.

There are no published coal quality analyses for coal beds from the Antelope Lookout Mesa quadrangle. Analyses of five coal samples from two core test holes of Cleary Coal Member beds have been reported by Shomaker, Beaumont, and Kottlowski (1971) and are shown in table 1. Core test hole

No. 3A is about 4.5 mi (7.2 km) west of the quadrangle and Core test hole No. 3B is about 5.5 mi (8.8 km) west of the area. The Cleary Coal Member beds analyzed are probably similar to the Cleary Coal Member beds in this quadrangle. Rank of the Cleary Coal Member beds is probably subbituminous A in this area.

Menefee Cleary No. 3 coal bed

The Menefee Cleary No. 3 coal bed was identified in one oil and gas well log and four measured sections by Dobbin (1932). Thickness of the bed ranges from 0.6 to 3.1 ft (0.2 to 1.0 m) as measured along its outcrop in the southern part of the quadrangle. Existence and character of the Menefee Cleary No. 3 coal bed are unknown in the northern part of the Antelope Lookout Mesa quadrangle because of insufficient data.

Menefee Cleary No. 1 coal bed

The Menefee Cleary No. 1 coal bed was identified in four oil and gas well logs, and contains from 2 to 3 ft (0.6 to 0.9 m) of coal. The bed has been identified only in the eastern part of the quadrangle so its configuration is that of a N. - S. trending pod. Existence and character of the Menefee Cleary No. 1 coal bed are unknown in most parts of the quadrangle because of insufficient data.

Table 1. - Analyses of coal samples from the Cleary Coal Member of the Menefee Formation.

[Form of analysis: A, as received; B, moisture free; C, moisture and ash free]

from Shomaker, Beaumont, and Kottlowski, 1971

Sample	Type of sample	Location	Form of analysis	Proximate analysis (percent)					Heating value (Btu/lb)
		Sec. T. N. R. W.		Moisture	Volatile matter	Fixed carbon	Ash	Sulfur	
1	core test hole No. 3A	NW¼SW¼ NE¼ 16 18 14	A	15.3	36.9	40.7	7.1	0.5	10,620
			B	----	43.6	48.0	8.4	0.5	12,540
			C	----	47.6	52.4	----	0.6	13,690
2	core test hole No. 3A	NW¼SW¼ NE¼ 16 18 14	A	17.3	34.5	43.3	4.9	0.5	10,810
			B	----	41.7	52.4	5.9	0.6	13,070
			C	----	44.3	55.7	----	0.7	13,900
3	core test hole No. 3A	NW¼SW¼ NE¼ 16 18 14	A	16.4	31.8	37.7	14.1	1.0	9,520
			B	----	38.1	45.0	16.9	1.2	11,390
			C	----	45.8	54.2	----	1.4	13,710
4	core test hole No. 3B	NW¼NE¼ NE¼ 8 18 14	A	16.0	31.1	34.5	18.4	0.5	8,870
			B	----	37.1	41.5	21.9	0.6	10,570
			C	----	47.5	52.5	----	0.7	13,530
5	core test hole No. 3B	NW¼NE¼ NE¼ 8 18 14	A	15.4	33.2	37.5	13.9	0.8	9,480
			B	----	39.2	44.4	16.4	1.0	11,200
			C	----	46.9	53.1	----	1.2	13,390

Remarks: A moist, mineral-matter-free (MMMF) calculation, using the Parr formula (American Society for Testing and Materials, 1973) yields heating values of 11,509 Btu/lb (26,770 kJ/kg, sample 1), 11,421 Btu/lb (26,565 kJ/kg, sample 2), 11,244 Btu/lb (26,153 kJ/kg, sample 3), 11,077 Btu/lb (25,765 kJ/kg, sample 4), and 11,035 Btu/lb (25,667 kJ/kg, sample 5). The free-swelling index of each sample indicates all of the above samples are nonagglomerating.

COAL RESOURCES

The U. S. Geological Survey requested resource evaluations of the Menefee Cleary No. 3 and No. 1 coal beds, where the beds are 3.0 ft (0.9 m) or more thick. The evaluation is restricted to Federal coal lands.

The following procedures were prescribed by the U. S. Geological Survey for the calculation of reserve base. Criteria established in the U. S. Geological Survey Bulletin 1450-B were used to areally divide the beds into measured, indicated, and inferred reserve base categories. Reserve base was calculated for each category, by section, using data from the isopach and overburden maps (plates 4, 6, 7, and 9). The acreage in each category (measured by planimeter) multiplied by the average coal bed thickness and subbituminous coal conversion factor (1,770 tons of coal per acre-ft) yields the reserve base for that category. Coal beds with 3.0 ft (0.9 m) minimum thickness are included in reserve base and reserve data rather than the 28 in. (71 cm) minimum thickness prescribed in U. S. Geological Survey Bulletin 1450-B. Reserve figures are derived from reserve base totals by applying recovery factors of 85 percent and 50 percent for coal beds 0 to 200 ft (0 to 61 m) and 200 to 3,000 ft (61 to 914 m) deep, respectively. All reserve base and reserve values are rounded to the nearest 10,000 short tons (9,072 t).

Total reserve base data for the Menefee Cleary No. 3 and No. 1 coal beds, which include all reserve base categories, are shown by section on plate 2. Reserve base and reserve data in the various categories are shown on plates 10 and 11.

COAL DEVELOPMENT POTENTIAL

The factors used to determine the development potential are the presence of a potential coal-bearing formation, and the thickness and overburden of correlative coal beds. The U. S. Geological Survey supplied the criteria to evaluate the coal development potential for Federal lands in this quadrangle. These criteria are based on current industry practice, U. S. Geological Survey Bulletin 1450-B, and anticipated technological advances. All available data were utilized for the surface and subsurface coal development potential evaluations.

Any area underlain by a potential coal-bearing formation with 200 ft (61 m) or less of overburden has potential for surface mining. The U. S. Geological Survey designated the 200 ft (61 m) maximum depth as the stripping limit. Areas where a potential coal-bearing formation is overlain by more than 200 ft (61 m) of overburden have no potential for surface mining. Areas with no correlative coal bed or a correlative coal bed less than 3.0 ft (0.9 m) in thickness and overlain by 200 ft (61 m) or less of overburden have unknown surface mining potential. Areas which have a correlative coal bed 3.0 ft (0.9 m) or more thick with surface mining potential are assigned a high, moderate, or low development potential based on the mining ratio (cubic yards of overburden per short ton of recoverable coal). The formula used to caluclate mining ratio is:

$$MR = \frac{t_o\ (C)}{t_c\ (Rf)}$$

Where MR = Mining ratio

t_o = Thickness of overburden in feet

t_c = Thickness of coal in feet

Rf = Recovery factor

C = Volume-weight conversion factor

(.896 yd^3/short ton for bituminous coal)

(.911 yd^3/short ton for subbituminous coal)

High, moderate, and low development potential areas have respective surface mining ratio values of 0 to 10, 10 to 15, and greater than 15.

Any area underlain by a potential coal-bearing formation with 200 to 3,000 ft (61 to 914 m) of overburden has potential for subsurface mining. Areas where a potential coal-bearing formation is overlain by more than 3,000 ft (914 m) of overburden have no subsurface mining potential. Development potential for subsurface mining is unknown where a potential coal-bearing formation within 200 to 3,000 ft (61 to 914 m) of the surface contains no identified correlative coal bed or a correlative coal bed less than 3.0 ft (0.9 m) thick. High, moderate, and low development potential areas have respective overburden values of 200 to 1,000 ft (61 to 305 m), 1,000 to 2,000 ft (305 to 610 m), and 2,000 to 3,000 ft (610 to 914 m). The no and unknown development potential boundaries for surface mining methods (plate 12) are defined at the contact of the coal-bearing Menefee Formation with the underlying noncoal-bearing Point Lookout Sandstone. These contacts are approximated due to the inaccuracies of adjusting old geologic maps to modern topographic bases.

Boundaries of coal development potential areas coincide with the boundaries of the smallest legal land subdivision (40 acre or lot). When a land subdivision contains areas with different development potentials, the potential shown on the map is that of the areally largest component area. When an area is underlain by more than one bed, the potential shown on the map is

that of the bed with the highest potential.

Reserve base (in short tons) in the various development potential categories for surface and subsurface mining methods are shown in tables 2 and 3, respectively.

The coal development potential maps are subject to revision. Map boundary lines and reserve base values are based on coal resource occurrence map isopachs, overburden isopachs, and coal bed correlations that are interpretive and subject to change as additional coal information becomes available.

Development potential for surface mining methods

The coal development potential for surface mining methods in the Antelope Lookout Mesa quadrangle is shown on plate 12. Based on coal development criteria, all Federal coal lands have high, moderate, low, unknown, or no surface mining potentials. Refer to table 4 for reserves and planimetered acreage, by section, for Federal coal lands with surface mining potential.

Development potential for subsurface mining methods and in situ gasification

The coal development potential for subsurface mining methods in the Antelope Lookout Mesa quadrangle is shown on plate 13. Based on coal development criteria, all Federal coal lands have high or unknown subsurface mining potentials. Refer to table 5 for reserves and planimetered acreage,

by section, for Federal coal lands with subsurface mining potential.

In situ gasification of coal has not been done on a commercial scale in the United States and criteria for rating the development potential of this method are unknown.

Table 2. - Reserve base data (in short tons) for surface mining methods for Federal coal lands in the Antelope Lookout Mesa quadrangle, McKinley County, New Mexico.

[Development potentials are based on mining ratios (cubic yards of overburden/ton of underlying coal). To convert short tons to metric tonnes, multiply by 0.9072; to convert mining ratios in yds^3/ton coal to m^3/t, multiply by 0.842].

Coal Bed	High Development Potential (0-10 Mining Ratio)	Moderate Development Potential (10-15 Mining Ratio)	Low Development Potential (greater than 15 Mining Ratio)	Total
Menefee Cleary No. 3	1,810,000	1,440,000	780,000	4,030,000
Menefee Cleary No. 1	---	---	230,000	230,000
Total	1,810,000	1,440,000	1,010,000	4,260,000

Table 3. - Reserve base data (in short tons) for subsurface mining methods for Federal coal lands in the Antelope Lookout Mesa quadrangle, McKinley County, New Mexico.

[Development potentials are based on thickness of overburden. To convert short tons to metric tonnes, multiply by 0.9072].

Coal Bed	High Development Potential (200'-1,000' overburden)	Moderate Development Potential (1,000'-2,000' overburden)	Low Development Potential (2,000'-3,000' overburden)	Total
Menefee Cleary No. 1	7,630,000	---	---	7,630,000
Total	7,630,000	---	---	7,630,000

Table 4. - Reserves and planimetered acreage, by section, for Federal coal lands in the Antelope Lookout Mesa quadrangle with surface mining potential.

[To convert acres to hectares, divide acres by 2,471; convert short tons to metric tonnes (t), multiply short tons by 0.9072].

Potential category	Coal bed	Sec.	T. N.	R. W.	Acres (planimetered)	Reserves (in short tons)
High	Menefee Cleary No. 3	17	18	12	1.5	less than 10,000
		19			30.4	130,000
		20			21.2	90,000
		21			1.0	less than 10,000
		29			59.3	280,000
		30			205.3	960,000
		31			4.5	20,000
Moderate	Menefee Cleary No. 3	17	18	12	7.6	30,000
		19			30.4	130,000
		20			205.3	950,000
		21			1.0	less than 10,000
		30			10.0	50,000
		31			4.5	20,000
Low	Menefee Cleary No. 3	17	18	12	13.7	50,000
		20			121.6	550,000
		30			4.0	10,000
		31			4.5	20,000
	Menefee Cleary No. 1	8	18	12	42.6	190,000

Table 5. - Reserves and planimetered acreage, by section, for Federal coal lands in the Antelope Lookout Mesa quadrangle with subsurface mining potential.

[To convert acres to hectares, divide acres by 2.471; to convert short tons to metric tonnes, multiply short tons by 0.9072].

Potential category	Coal bed	Sec.	T. N.	R. W.	Acres (planimetered)	Reserves (in short tons)
High	Menefee Cleary No. 1	29	19	12	44.4	120,000
		31			38.0	100,000
		33			3.0	10,000
		4	18	12	50.1	130,000
		5			638.5	1,950,000
		6			123.1	330,000
		7			9.1	20,000
		8			370.9	1,110,000
		9			3.0	10,000

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coal bed--A stratified sequence of coal, composed of relatively homogeneous material, exhibiting some degree of lithologic unity and separated from the rocks above and below by physically rather well defined boundary planes.

coal bed separation line--A line on a map plate separating areas where different coal beds or zones are mapped.

coal bench--One of two or more divisions of a coal bed separated by rock.

coal conversion factor--A factor used to convert acre-feet of coal into short tons of coal; bituminous coal is 1800 tons/acre-ft; subbituminous coal is 1770 tons/acre-ft.

coal development potential--A subjective determination of the comparative potential of Federal coal lands for development of a commercially viable coal mining operation.

coal exploration license--An area of Federal coal lands in which the licensee is granted the right, after outlining the area and the probable methods of exploration, to investigate the coal resources. An exploration license has a term not to exceed 2 years and does not confer rights to a lease.

coal lease--An area of Federal coal lands in which the Federal Government has entered into a contractual agreement for development of the coal deposits.

coal split--A coal bed resulting from the occurrence of a noncoal parting within the parent coal bed which divides the single coal bed into two or more coal beds.

coal zone--A distinctive stratigraphic interval containing a sequence of alternating coal and noncoal layers in which the coal beds may so lack lateral persistence that correlating individual beds in the zone is not feasible.

Federal coal land--Land for which the Federal Government holds title to the coal mineral rights, without regard to surface ownership.

hypothetical resources--Undiscovered coal resources in beds that may reasonably be expected to exist in known mining districts under known geologic conditions. In general, hypothetical resources are in broad areas of coal fields where points of observation are absent and evidence is from distant outcrops, drill holes or wells. Exploration that confirms their presence and reveals quantity and quality will permit their reclassification as a Reserve or Identified Subeconomic Resource.

identified resources--Specific bodies of coal whose location, rank, quality, and quantity are known from geologic evidence supported by engineering measurements.

indicated--Coal for which estimates for the rank, quality, and quantity have been computed partly from sample analyses and measurements and partly from reasonable geologic projections.

inferred--Coal in unexplored extensions of demonstrated resources for which estimates of the quality and quantity are based on geologic evidence and projections.

isopach--A line joining points of equal bed thickness.

Known Recoverable Coal Resource Area (KRCRA)--Formerly called Known Coal Leasing Area (KCLA). Area in which the Federal coal land is classified (1) as subject to the coal leasing provisions of the Mineral Leasing Act of 1920, as amended, and (2) by virtue of the available data being sufficient to permit evaluation as to extent, location, and potential for developing commercial quantities of coal.

measured--Coal for which estimates for rank, quality, and quantity can be computed, within a margin of error of less than 20 percent, from sample analyses and measurements from closely spaced and geologically well known sample sites.

mining ratio--A numerical ratio equating the in-place volumes, in cubic yards, of rocks that must be removed in order to recover 1 short ton of coal by surface mining.

overburden--A stratigraphic interval (composed of noncoal beds and coal beds) lying between the ground surface and the top of a coal bed. For coal zones, overburden is the stratigraphic interval lying between the ground surface and the structural datum used to map the zone.

parting--A noncoal layer occurring along a bedding plane within a coal bed.

Preference Right Lease Application (PRLA)--An area of Federal coal lands for which an application for a noncompetitive coal lease has been made as a result of exploration done under a coal prospecting permit. PRLA's are no longer obtainable.

quality or grade--Refers to measurements such as heat value; fixed carbon; moisture; ash; sulfur; phosphorus; major, minor, and trace elements; coking properties; petrologic properties; and particular organic constituents.

rank--The classification of coal relative to other coals, according to degree of metamorphism, or progressive alteration, in the natural series from lignite to anthracite (Classification of coals by rank, 1973, American Society for Testing and Materials, ASTM Designation D-388-66).

recovery factor--The percentage of total tons of coal estimated to be recoverable from a given area in relation to the total tonnage estimated to be in the Reserve Base in the ground.

reserve--That part of identified coal resource that can be economically mined at the time of determination. The reserve is derived by applying a recovery factor to that component of the identified coal resource designated as the reserve base.

reserve base--That part of identified coal resource from which Reserves are calculated.

stripping limit--A vertical depth, in feet, measured from the surface, reflecting the probable maximum, practical depth to which surface mining may be technologically feasible in the forseeable future. The rock interval, expressed in feet, above the stripping limit is the "strippable interval."

structure contour--A line joining points of equal elevation on a stratum or bed.