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BONNET PLUME COALFIELD  
TONNAGES AND GRADE OF COAL  
IN SUPPORT OF  
A PROPOSED THERMAL GENERATING STATION  
IN THE  
YUKON TERRITORY

This report has been examined; de-  
clared acceptable as Representation  
Work under Section 32 and Schedule  
B of the Canada Mining Regulations  
and valued in the amount of \$173,851.00<sup>part of</sup>

Chief, *[Signature]*  
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CONCLUSIONS

The Bonnet Plume Basin contains a coalfield of potentially major proportions containing high quality thermal coal in sufficient quantity to supply a viable electric power base in the Yukon Territory for its immediate needs and future growth for many years to come.

1. Approximately 45,000,000 metric tonnes of mined-clean high volatile C bituminous coal are inferred, based on the surface exploration and diamond drilling conducted to date.
2. The inferred coal sales product will have the following qualities:-

Inherent Moisture	5.6%
Ash	13.5%
Volatile	35.1%
Fixed Carbon	45.8%
BTUs/lb.	10,130
Sulphur	<0.5%
Ash Fusion Temperature	>2400 <sup>o</sup> F

Numerous coal occurrences located by field mapping during the 1978 field season, but not confirmed by drilling, indicate that there may be several sites containing major coal reserves in addition to the potential mine area described in this report.

## INTRODUCTION

### Concepts

A new coalfield of potentially huge proportions (Plate 1) was discovered in 1977 and partially outlined by field mapping and surface drilling during the summer of 1978. The limited amount of exploration conducted to date indicates a major deposit of bituminous coal suitable for use in a thermal power station.

It is suggested that this deposit of potential energy presents an attractive alternative to hydro power in the Yukon Territory and could easily supply the electrical needs of the Yukon for many years to come. The advantages of this source of power are:-

1. The Bonnet Plume coal basin is ideally situated to provide coal derived electric power not only south to the present-day load centres in the Yukon, but also north to the MacKenzie delta area, west to provide pumping power to Dempster pipeline and to the southeast to supply the potential new mines of the Yukon and Northwest Territories.
2. Use of Bonnet Plume coal for energy would provide a base of between 400 and 600 direct employment situations for a minimum period of 30 years, a very important consideration to the economy of the Yukon.
3. Use of clean burning Bonnet Plume coal for energy is ecologically attractive since it negates the necessity to flood river valleys in the Yukon, particularly the Yukon River system.

These valleys represent important seasonal habitats and the only habitable places for man in the Yukon.

Interruption of the Yukon River system is governed by international treaty which guarantees the free navigation of the River upstream as far as Whitehorse.

The regulations of the salmon run on the Yukon River system governed by international treaty. This important source of protein must not be disrupted.

LOCATION, PHYSIOGRAPHY AND ACCESS

Pan Ocean Oil Ltd. controls 24 exploration licences in the Bonnet Plume basin of the Yukon Territory, (Plate 1). These licences covering 957,024 acres, are underlain by sedimentary rocks of Tertiary age containing lignitic coals in the north and Cretaceous age sedimentary rocks containing bituminous coal seams in the south, (Plate 2, end pocket).

The basin is contained entirely within the Wind River map-area (NTS-106E). The basin is bounded on the north by the Richardson Mountains, on the east by the Knorr Ranges, on the south by the Wernecke Mountains and on the west by a rather ill-defined low, hilly region about 5 miles west of the Wind River.

The basin forms a depression which is relatively featureless having elevations between 300 and 500 metres above sea level. Much of the area is covered by muskeg and swamp with a lesser part of the basin covered by scrubby tree growth of spruce, larch and birch, interspersed with willow and berry patches.

Both the Wind and Bonnet Plume Rivers flow, from south to north through the basin, into the Peel River, which flows from west to east along the northern margin of the basin.

A winter road from Keno Hill runs 165 km (100 miles) onto the property. Several lakes throughout the basin are of sufficient size and depth to allow float plane access. The Dempster Highway lies 130 km (80 miles) to the west of the property.

## GEOLOGY

The surface outcrops within the Bonnet Plume Basin consist of Recent alluvial and possible lacustrine deposits of glacial origin; Tertiary mudstones, sandstones and shales containing lignite beds; and Cretaceous sediments consisting of conglomerates, sandstones and shales containing coal seams. Local pre-Cretaceous fensters have been produced by faulting.

Little is known as yet of the detailed stratigraphy of the Cretaceous and Tertiary sedimentary rocks found within the Bonnet Plume Basin. Future stratigraphic mapping and surface diamond drilling accompanied by palynological analysis will hopefully provide a complete picture of the stratigraphic sequence. To date, the scattered stratigraphic sections that have been measured over such a vast area are difficult to correlate as a whole. However, within the area studied in detail and partially drilled during the 1978 field season, correlation does appear to be possible, at least within the section of the sequence explored by drilling, Plates 3, 4 and 5, Borehole Logs in end pocket).

In general it would appear that the southern half of the Bonnet Plume Basin contains outcrops of a sedimentary sequence which is primarily Cretaceous in age, termed the Lower Bonnet Plume Formation and the northern portion of the Basin is occupied by sedimentary rocks of Tertiary age, termed the Upper Bonnet Plume Formation. The exact stratigraphic relationship between these two units is not yet known, nor is the exact lateral extent within the Basin of each unit known.

Evidence of faulting occurring throughout the Bonnet Plume Basin is based on the interpretation of areal photographs. Detailed exploration of the coal is not yet at the stage to determine the extent to which mining would be affected by minor faults. Within the area explored by drilling, during the 1978 field season, the conglomerate bed overlying the coal seam does not appear to be affected by small scale faulting. Therefore, it is reasonable to assume that the coal seams within this area are not affected by small scale faulting.

Two major coal seams have been investigated through the surface drilling of three diamond drill boreholes (Plates 2-5). Borehole BP-78-1 was drilled in an area, termed Block A, having 35 degree dip to the south. The surface geology indicates a strike length of 7,000 metres for the units comprising this block. Boreholes BP-78-2 and BP-78-3 were drilled 4,000 metres apart in a separate area termed Block B. This Block has an average dip of 15 degrees to the east. Of the two major seams intersected by the three surface boreholes, the upper or No. 1 Seam Horizon averages 7.10 metres and the lower or No. 2 Seam Horizon averages 6.79 metres.

In the sections that follow, the set requirements of the fuel for the proposed power station are developed; followed by a hypothetical development of the several mining types and their required reserves; and finally a reserve calculation based on the mining methods developed in the hypothetical study.

FUEL REQUIREMENTS OF THE POWER STATION

Two cases were developed by Montreal Engineering for the proposed thermal power station:-

Case 1     2 x 70 MW Unit Station

Coal required = 702,800 short tons per annum or 702,800  
x 0.907185 = 647, 570 metric tonnes per annum.

Case 2     3 x 70 MW Unit Station

Coal required = 842,400 short tons per annum or 842,400  
x 0.907185 = 764,213 metric tonnes per annum.

Assuming a 30 year life of mine, the total sales tonnes required for the station would be:-

Case 1     637,570 tonnes/annum x 30 years = 17,127,100 tonnes

Case 2     764,213 tonnes/annum x 30 years = 22,926,390 tonnes

MINING

Three methods of mining the seams drilled to date have been developed using the average overall coal quality and quantity data obtained from the three surface boreholes drilled during the 1978 summer season, (Plates 2-5). No allowance has been made in this section for borehole location and/or mining blocks.

METHOD 1

-Strip mining the total seam horizon from both No. 1 and 2 seams.

-Total No. 1 & 2 seam thickness = 13.89 metres.

-Coal in situ per hectare:-

13.89 metres x 100 x 100 m = 138,900 cubic metres x  
1.3 specific gravity = 180,570 tonnes/ hectare.

-Sales tonnes per hectare:-

180,570 tonnes x 50% geological loss x 85% mining  
recovery x 63.2% washery yield at -1.90 specific gravity  
= 48,501 sales tonnes per hectare.

-Area required for mine:-

Case 1 - 19,127,100 tonnes ÷ 48,501 sales tonnes/hectare  
= 394 hectares.

Case 2 - 22,926,390 tonnes ÷ 48,501 sales tonnes/hectare  
= 473 hectares.

-Annual production of raw coal required:-

Case 1 - 19,127,100 sales tonnes ÷ 0.632 (Yield %) =  
30,264,398 tonnes to washery ÷ 30 years =  
1,008,813 tonnes per annum to washery.

Case 2 - 22,926,390 sales tonnes ÷ 0.632 (Yield %) =  
35,275,934 tonnes to washery ÷ 30 years =  
1,209,198 tonnes per annum mined coal to washery.

## METHOD 2

-Strip mining the Nos. 1 and 2 seams, excluding partings greater than 0.5 metres thick.

-Total Nos. 1 and 2 seams recovered thickness = 11.24 metres.

-Mineable coal in situ per hectare:-

11.24 metres x 100 x 100 m = 112,400 cubic metres x  
1.3 specific gravity = 146,120 tonnes per hectare.

-Sales tonnes per hectare:

146,120 tonnes x 50% geological loss x 85% mining  
recovery x 63.2% washery yield at -1.90 specific gravity  
= 39,248 sales tonnes per hectare.

-Area required for mine:-

Case 1 - 19,127,100 tonnes ÷ 39,248 sales tonnes/hectare  
= 487 hectares.

Case 2 - 22,926,390 tonnes ÷ 39,248 sales tonnes/hectare  
= 584 hectares.

-Annual production of raw coal required:-

Case 1 - 19,127,100 sales tonnes ÷ 0.74 (Yield %) =  
25,847,432 tonnes to washery ÷ 30 years =  
861,581 tonnes per annum to washery.

Case 2 - 22,926,390 sales tonnes ÷ 0.74 (Yield %) =  
30,981,608 tonnes to washery ÷ 30 years =  
1,032,720 tonnes per annum to washery.

### METHOD 3

-Underground mining extracting up to 3.5 metres from the best portion of the No. 1 and No. 2 seams.

-Total Nos. 1 and 2 seam recovered thickness = 6.57 metres.

-Mineable coal in situ per hectare:-

6.57 metres x 100 x 100 m = 65,700 cubic metres x  
1.3 specific gravity = 85,410 tonnes per hectare.

-Sales tonnes per hectare:-

85,410 tonnes x 50% geological loss x 50% mining  
recovery x 79.5% washery yield at 1.90 specific gravity  
= 16,975 sales tonnes per hectare.

-Area required for mine:-

Case 1 - 19,127,100 sales tonnes ÷ 16,975 sales tonnes/  
hectare = 1,127 hectares.

Case 2 - 22,926,390 sales tonnes ÷ 16,975 sales tonnes/  
hectare = 1,351 hectares.

-Annual production of raw coal required:-

Case 1 - 19,127,100 sales tonnes ÷ 0.795 (Yield %) =  
24,059,245 tonnes to washery ÷ 30 years =  
801,975 tonnes per annum to washery.

Case 2 - 22,926,390 sales tonnes ÷ 0.795 (Yield %) =  
28,838,226 tonnes to washery ÷ 30 years =  
961,274 tonnes per annum to washery.

It is evident from the above that a mine producing approximately 1 million tonnes per year covering a ground area no greater than 1,400 hectares is required to support the larger power station envisaged in Case 2. The section following, "COAL RESERVES", attempts to establish whether or not this is possible within the area drilled and mapped during the 1978 field season.

## COAL RESERVES

Due to the vast size of the Bonnet Plume Basin and the limited amount of exploration knowledge available in the area, no proven reserves exist. However, during the 1978 field season, numerous outcrops of coal or coal float were located throughout the Basin indicating that coal is present in large quantities, probably in sufficient amounts to support a major power generating facility.

Within the area drilled, (Plate 2, end pocket), there are inferred reserves (Table 1) of sufficient size to far exceed the requirements of the power station model of the Montreal Engineering Report. Boreholes, BP-78-1, 2 and 3, (Plates 3, 4, and 5, end pocket), all intersected the No. 1 seam. It is not certain whether or not the lower 2.43 metre seam intersected in Borehole BP-78-3 is the No. 2 seam. Nevertheless, the three boreholes indicate a constant stratigraphic relationship over a ground distance of 10,000 metres.

Since the coal seams appear to be continuous between Boreholes BP-78-2 and 3, a distance of 4,000 metres (Block B), it is inferred that the No. 1 and 2 coal seam horizons intersected by Borehole BP-78-1 that underlie an easily mapped surface outcrop of conglomerate (Plate 2), will be found throughout the mappable trace of that conglomerate, a distance of 7,000 metres (Block A).

Table 1 lists the inferred reserves and grade of the sales product for Blocks A & B based upon the assumption that open pit mining will be possible to a highwall depth of 60 metres and that underground mining is possible to a depth of 360 metres. An average dip is assumed of 35 degrees for Block A and 15 degrees for Block B.

TABLE 1 INFERRED TONNAGES AND GRADE IN AREAS DRILLED DURING 1978 SEASON

Block	Length	Width	Thick-ness	Tonnes in-situ (Assume 1.3 SG)	Percent Geological Loss	Percent Extraction	Mineable Tonnes	Washery Yield @ -1.90 SG	Sales Tonnes	Grade of Sales Product at -1.90 S.G.					Remarks
										IM	Ash	Vol	F.C.	BTU	
A	7,000	106	18.00	17,362,800	10	85	13,282,542	60.6	8,049,220	4.6	12.1	35.7	47.6	10599	Mining Method 1 - Total seam horizon strip highwall 60 metres. Underground mine to best 3.5 met res of seam to a depth of 360 metres
	7,000	532	6.80	25,323,200	10	65	14,814,072	82.8	12,266,052	4.8	9.0	37.6	48.6	10998	
	--	--	--	42,686,000	--	--	28,096,614	72.3	20,315,272	4.7	10.3	36.8	48.2	10840	
B	4,000	235	11.84	14,468,480	10	85	11,068,387	65.3	7,227,657	6.1	16.9	33.8	43.2	9505	
	4,000	1178	6.46	39,571,376	10	65	23,149,255	77.8	18,010,120	6.4	15.8	33.6	44.2	9581	
	--	--	--	54,039,856	--	--	34,217,642	73.8	25,237,777	6.3	16.1	33.7	43.9	9559	
A&B	--	--	--	96,725,856	--	--	62,314,256	73.1	45,553,049	5.6	13.5	35.1	45.8	10130	
A	7,000	106	13.47	12,993,162	10	85	9,939,769	74.2	7,375,309	4.6	10.8	36.2	48.4	10780	Mining Method 2 - Strip - selected portions of seam highwall 60 metres. Mine to best 3.5 metres of seam to depth of 360 metres.
	7,000	532	6.80	25,323,200	10	65	14,814,072	82.8	12,266,052	4.8	9.0	37.6	48.6	10998	
	--	--	--	38,316,362	--	--	24,753,841	79.3	19,641,361	4.7	9.6	37.1	48.6	10921	
B	4,000	235	10.13	12,378,860	10	85	9,469,828	73.9	6,998,203	6.2	16.3	34.0	43.5	9557	
	4,000	1178	6.46	39,571,376	10	65	23,149,255	77.8	18,010,120	6.4	15.8	33.6	44.2	9581	
	--	--	--	51,950,236	--	--	32,619,083	76.7	25,008,323	6.3	15.9	33.7	44.1	9574	
A&B	--	--	--	83,266,598	--	--	57,372,924	77.8	44,649,684	5.6	13.1	35.2	46.1	10166	

Using a combination of the mining methods outlined under the section headed "MINING", there is a total inferred sales tonnage of 45 million tonnes of coal suitable for use in the proposed thermal power station; almost twice the projected lifetime requirement of the station.













COORDINATES: Y X  
ELEVATION:  
DIP BEARING  
CORE SIZE CASING

BITS USED  
MUD USED  
FT LEFT IN HOLE

FT

DATE START  
DRILLER  
TESTS  
SAMPLED BY

FINISH  
OVERALL RECOVERY  
DATE

ANALYZED BY

LOGGED BY DATE  
SIGNED James S. McHenry

GEOLOGICAL LOG - SCALE:

DETAILS OF COAL SEAMS - SCALE:

Table with columns: GEOL. LOG (DEPTH, GRAPHIC LOG, THICKNESS, DESCRIPTION), SEAM LOG (DEPTH, GRAPHIC LOG, THICKNESS, DESCRIPTION), ANALYSIS (SIZE, WEIGHT PERCENT, CUMULATIVE WEIGHT PERCENT, CUMULATIVE SAMPLE VALUES, OTHER). Includes 'NO. 1 SEAM HORIZON' and 'SEE BP-78-2 (PAGE 1)'.





