MOUNT KLAPPAN COAL PROJECT

PROSPECTUS

GULF CANADA RESOURCES INC.

FEBRUARY, 1984

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1.0 SUMMARY

The Mount Klappan Anthracite Property, in Northwestern British Columbia, ranks as a world class resource in terms of its size and its potential to be a competitive source of surface mined anthracite.

Preliminary geological exploration has identified a sedimentary coal bearing sequence approximately 550 metres thick. Several anthracite seams each in excess of 5 metres thick and other additional thinner seams have been drilled to date. Although the seams are folded and faulted, the geological structure in the Mount Klappan region lends itself to open pit mine planning in areas where the coal seams are brought to the surface.

The Mount Klappan property has an inferred resource of 900 million tonnes of anthracite in place which would be capable of sustaining an open pit mine producing 5 million tonnes per year, of mixed products, for more than 20 years. The actual level of initial production would be determined by market and economic conditions prevailing at the time that a decision is made to bring the property into production.

The anthracite quality is suitable for potential markets in North America, Europe and Asia. The ash content of the anthracite products, that can be produced from this property, ranges from a low of 5% to a high of 25%. This range of products meets the diverse requirements of the market which is based on a wide variety of uses in consuming countries.

Access to the project is currently by air but three bridges are being installed to provide restricted road access for exploration and development equipment. This road access will be north along the B.C. Railway right-of-way to the Ealue Lake road which connects to Highway 37 between Cassiar and Stewart. Railroad access can be readily established as the British Columbia Railways' road bed crosses the property some 85 kilometres from the end of steel. Several options exist to provide permanent railroad access to tidewater. These options, which range from 300 to 1400 kilometres in distance, would provide access to Ridley Island, Alice Arm, or Stewart. At this time no clear-cut preference can be identified as studies are required not only to determine the optimum trade-off between capital and operating costs but also to identify the most cost-effective shiploading alternative. As graded anthracite must be carefully handled to reduce breakage, additional facilities would have to be developed in the Prince Rupert area if the Ridley terminal is used while entirely new facilities would be required at Alice Arm or Stewart.

This prospectus provides an outline of a typical mining project which would produce 3.5 million tonnes of anthracite per year. A project of this size would employ some 1100 persons and require 2500 man years of construction labour to complete.

The mining project would require the construction of a major open pit mining complex with offices, maintenace shops, warehousing, conveyors, waste disposal areas, a coal preparation plant, and a coal load-out. The coal preparation plant would be built to produce at least three products simultaneously and would be designed with a closed water circuit for water to be recycled from the tailings pond back to the plant.

The nominal schedule for bringing the project into production requires two years for development drilling, mine planning and completion of the approvals process. Approximately another two years would be required to construct the mine and related facilities. Actual scheduling will have to take market and other conditions into consideration. Exploration and development work will continue and a feasibility study will be done to assess the economics of the project. On this schedule, large scale production could be achieved by late 1987 or early 1988.

This type of operation would also require more direct road access, a townsite, and a permanent supply of electricity. The location or routing of these elements of the project infrastructure has not been determined. One potential townsite has been identified but it has not yet been studied. Similarily, there are a number of road routes that go west to highway 37 that may have less environmental impact than the temporary route to the north. Electrical power could be provided by building a power line north from Hazelton, developing a small hydro site, or by building a thermal power station at the mine site. These options are all under consideration.

An initial review of environmental data for this area suggests that there may be no environmental conditions which would preclude development of the Mount Klappan anthracite project. Also, a preliminary economic assessment indicates that the project would be a net benefit to British Columbia and to Canada.

2.0 INTRODUCTION

2.1 Preamble

The Mount Klappan property has an extensive, surface mineable, anthracite resource. The size and availability of this resource compares favourably with those in traditional anthracite mining areas which have been producing, for the most part, since the early 1800's. Much of the worlds' production is now coming from difficult underground mines, from mines with relatively high strip ratios or from mines in countries with poorly developed or inefficient infrastructure.

In a number of countries in Europe, the present anthracite mines are so difficult and costly to operate that many of these countries are faced with the neccessity of closing unprofitable operations. This situation creates significant opportunities for new supply sources as anthracite is used in a variety of processes for which substitution is difficult. It is against this background that the potential significance of the Mount Klappan project, in world anthracite trade, may be measured.

2.2 Location and Physiography

The Mount Klappan coal licences are located in northwestern British Columbia, approximately 150 kilometres northeast of Stewart (population 1445) and 530 kilometres northwest of Prince George (population 69 300).

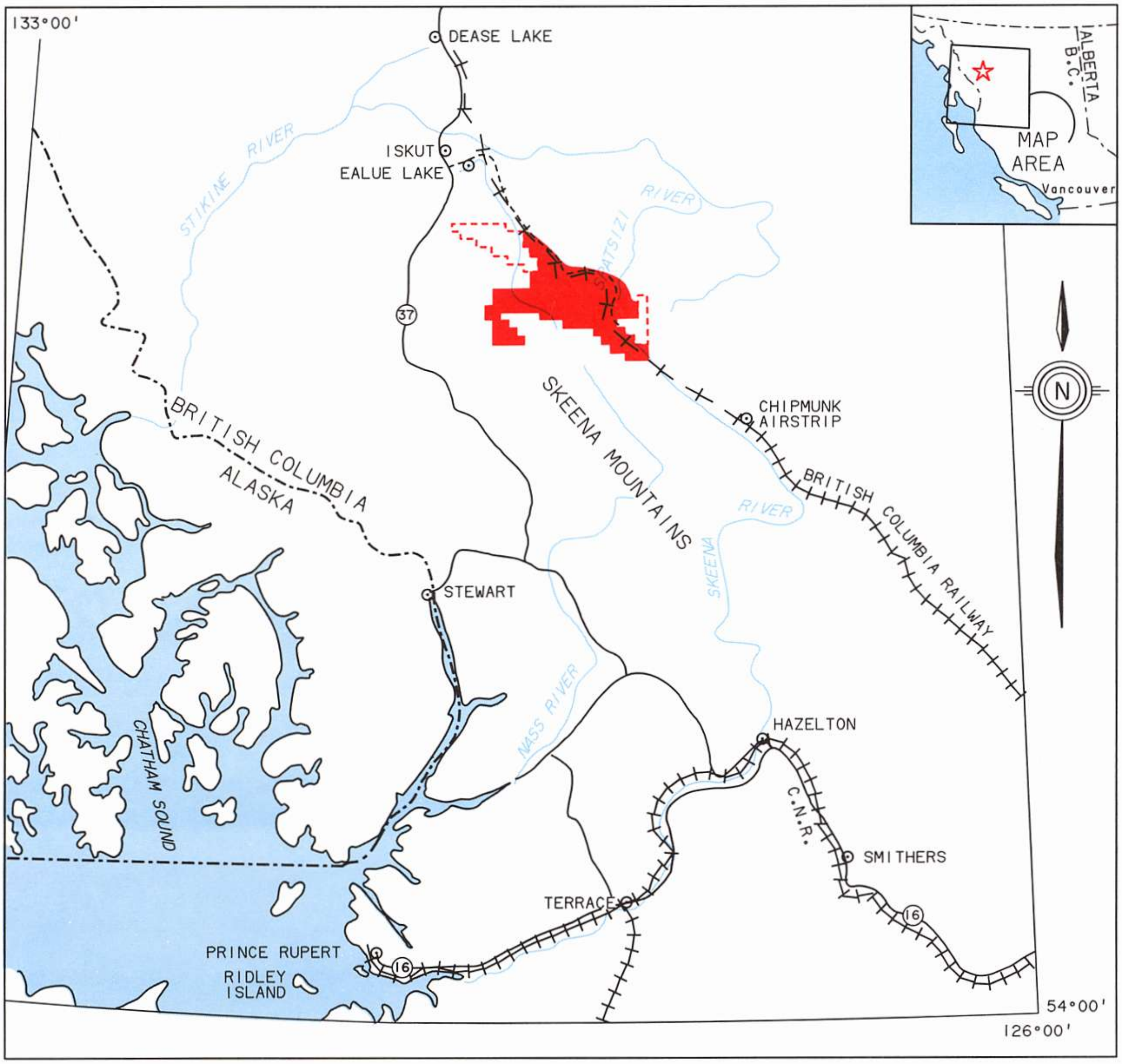
The nearest community is the village of Iskut (population 500) which lies 100 kilometres to the northwest on the Stewart-Cassiar Highway (Figure. 2.1).

The property is located in the Skeena Mountains physiographic region at the headwaters of the Little Klappan and Skeena Rivers between 57° 06' and 57° 22' north latitude and 128° 37' and 129° 09' west longitude. Locally the topography is characterized by broad open valleys and generally subdued mountains, with elevations ranging from 1100 to 2000 metres above sea level. Scattered coniferous forest interspersed with grass, shrubs, meadows and shallow bogs occur below the tree line, which is at 1500 metres of elevation. Above the treeline, alpine meadows give way to weathered bedrock at higher elevations.

FIGURE 2.1

MT. KLAPPAN COAL PROPERTY

PROPERTY ACCESS



LEGEND

- ROAD ACCESS
- SEASONAL ROAD ACCESS
- EXISTING RAILWAY
- EXISTING RAILWAY SUBGRADE
- MT. KLAPPAN LICENCE AREA
- LICENCES UNDER APPLICATION

SCALE

0 20 40 60 80 km

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2.3 Climate

The property is situated in the interior transitional climatic zone. Indications are that precipitation is on the order of 300 millimetres per year. The average yearly minimum temperature is on the order of -41°C and the average yearly maximum temperature is about 26°C, values which are approximately equivalent to those of Calgary, Alberta (Table 2.2).

Table 2.2

COMPARATIVE METEROLOGICAL INFORMATION FOR THE MT. KLAPPAN
COAL PROPERTY (DIDENE) AND OTHER WESTERN CANADIAN REPORTING STATIONS

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
DIDENE (1979-1981) (Mt. Klappan)												
Mean Daily Minimum (°C)	-14.9	-12.9	-11.7	-8.1	-1.9	0.9	3.2	1.3	-0.2	-3.4	-9.9	-18.5
Mean Daily Maximum (°C)	-12.5	-8.2	0.6	1.1	8.7	13.9	16.7	16.0	9.5	3.8	-1.1	-9.9
Total Precipitation (mm)	16.8	10.0	17.5	21.2	32.4	27.8	49.1	31.3	57.5	51.8	19.8	36.2
FORT NELSON (1951-1980)												
Mean Daily Minimum (°C)	-28.2	-22.6	-16.2	-4.7	3.0	8.0	10.4	8.6	2.8	-4.1	-16.2	-24.9
Mean Daily Maximum (°C)	-19.3	-11.2	-3.2	7.9	16.2	20.7	22.8	21.0	14.5	6.2	-7.8	-17.0
Total Precipitation (mm)	24.9	19.5	24.4	16.7	41.7	69.1	84.3	61.2	41.6	24.3	22.7	21.4
CRANBROOK (1951-1980)												
Mean Daily Minimum (°C)	-14.4	-10.1	-6.6	-1.3	2.7	6.8	8.9	8.2	3.5	-1.1	-6.9	-11.1
Mean Daily Maximum (°C)	-3.9	1.6	5.9	12.3	18.2	22.1	26.8	25.8	19.6	12.2	2.8	-1.7
Total Precipitation (mm)	54.0	37.5	27.9	27.8	43.0	45.5	27.5	34.6	28.8	25.0	40.0	59.6
CALGARY (1951-1980)												
Mean Daily Minimum (°C)	-17.6	-12.9	-9.6	-2.9	2.8	7.0	9.4	8.3	3.8	-1.3	-8.6	-13.8
Mean Daily Maximum (°C)	-6.0	-1.5	1.7	9.4	16.0	19.9	23.3	22.1	17.4	12.3	3.3	-1.8
Total Precipitation (mm)	16.2	15.5	16.1	32.6	48.7	89.4	65.4	55.4	38.2	17.6	12.7	16.0

Meteorological Notes

	Extreme Yearly Minimum Temperature (°C)	Extreme Yearly Maximum Temperature (°C)
Didene (1979-1981)	-41.0	26.1
Fort Nelson (1951-1980)	-51.7	36.7
Cranbrook (1951-1980)	-41.1	38.9
Calgary (1951-1980)	-45.0	36.1

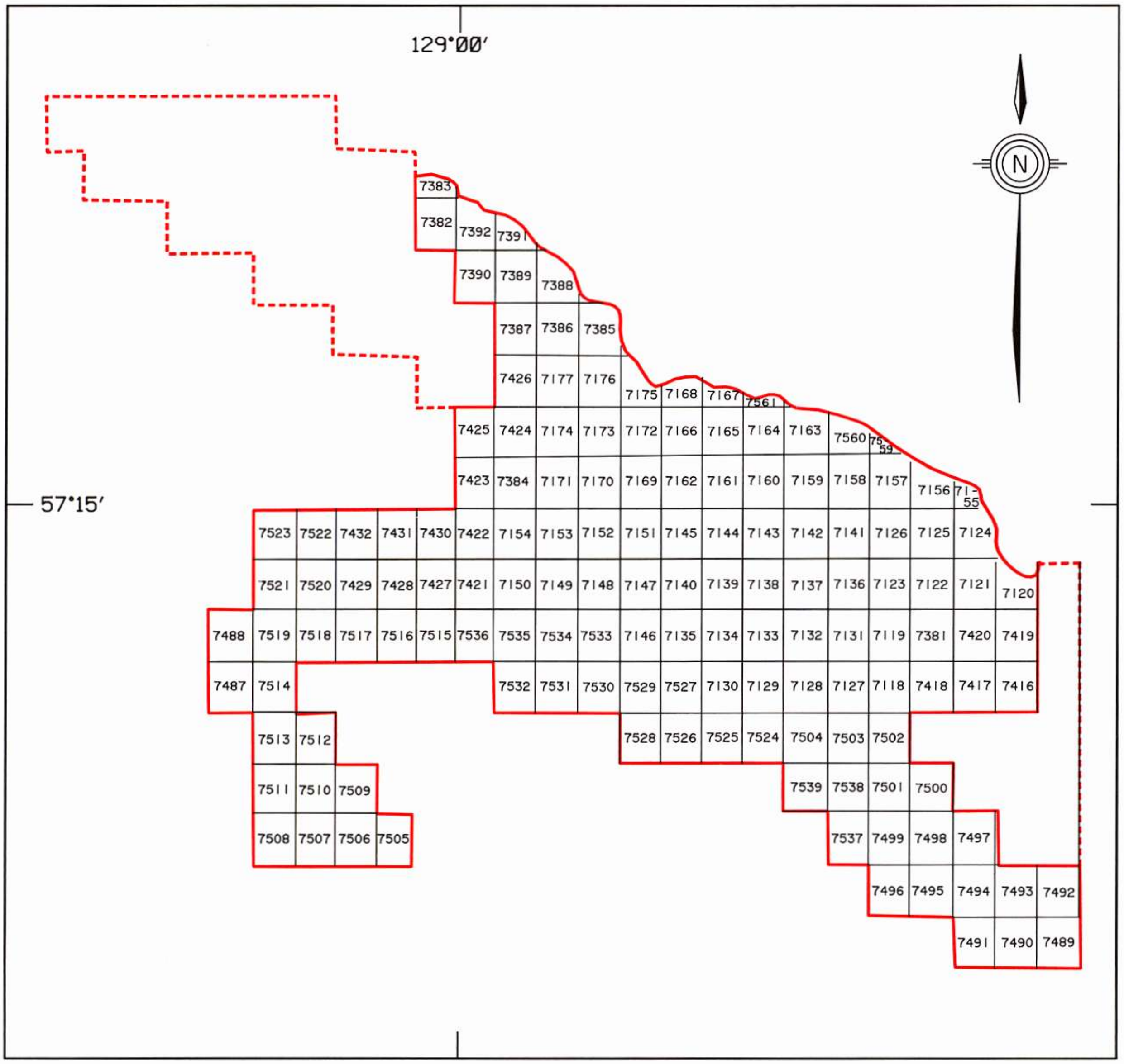
2.4 Property Description

The property comprises a total of 50 470, hectares of which 12 332 hectares are currently under coal licence application to the Government of British Columbia. The Mount Klappan licences are for coal rights on crown land and are held by Gulf Canada Resources Inc. of Calgary, Alberta. The licences held and under application are illustrated on Figure 2.2.

FIGURE 2.2

MT. KLAPPAN COAL PROPERTY

LICENCES



LEGEND

LICENCE AREA

LICENCES UNDER APPLICATION

SCALE

0 1 2 3 4 5 km

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2.5 Access

The Mount Klappan property straddles the partially completed British Columbia Railway line between Prince George and Dease Lake. Prior to cessation of work on the construction of the line, steel was laid to within 85 kilometres of the property, and, with the exception of a short stretch south of the licences, the subgrade was constructed through and beyond the property to the Stikine River just south of Dease Lake.

At present the property is accessed by helicopter or by fixed-wing aircraft which land at the 1000 metre long Summit airstrip, located at the north end of the property. Temporary road access to the property, from Highway 37 via the Ealue Lake road, will be provided along the British Columbia Railway subgrade by constructing a bridge crossing the Klappan River during 1984 and by replacing two small bridges along the subgrade (Figure 2.1). The engineering design of the Klappan bridge is in progress.

2.6 Evaluation Status

Since 1981 Gulf Canada Resources has completed two years of exploration on the property. A total of 14 500 hectares have been mapped in detail at a 1:10 000 scale, with reconnaissance coverage undertaken on the remaining area. Seven HQ core diamond drill holes have been completed for a total of 1223 metres of HQ core (Figure 2.3). In addition, 50 trenches were excavated by hand, in coal seams in excess of 0.5 metres of true thickness, for an aggregate length of 285 metres. Six small diameter drill holes were drilled to test the adit location.

Coals recovered from drilling operations were subjected to detailed analysis of rank, washability characteristics and coal quality parameters.

In late 1982, Phillips Barratt Kaiser Engineering Ltd. of Vancouver was retained to do mine assessments of the property, based on the geological interpretation and exploration data obtained by Gulf Canada Resources Inc. to the end of 1982. Two potential surface mine projects have been identified, one in the Hobbit-Broatch area and the other in the Lost Fox area as indicated on Figure 4.1. Elements addressed by the mine assessments include: conceptual mine plans and production schedules, the processing of the coal, infrastructure, financial analysis, and reviews of socioeconomic factors. The potential environmental impact of the project was also given a preliminary assessment. The latter two studies were undertaken by Price Waterhouse and Environmental Management Associates respectively. Phillips Barratt Kaiser was responsible for the overall compilation of the assessment.

2.7 Exploration and Development Programs

The 1983 exploration program comprised of detailed mapping at a scale of 1:5000, the drilling of 3 diamond drill holes and the mining of an Adit from which a 35 tonne bulk sample was obtained. The sample is being analyzed and washed to obtain samples of anthracite products for testing by potential customers.

Future exploration work will consist of continued mapping, trenching, diamond drilling, rotary drilling, bulk sampling and associated activities required to explore the property, determine the quality and distribution of the coal on the property and to identify potential surface mine areas.

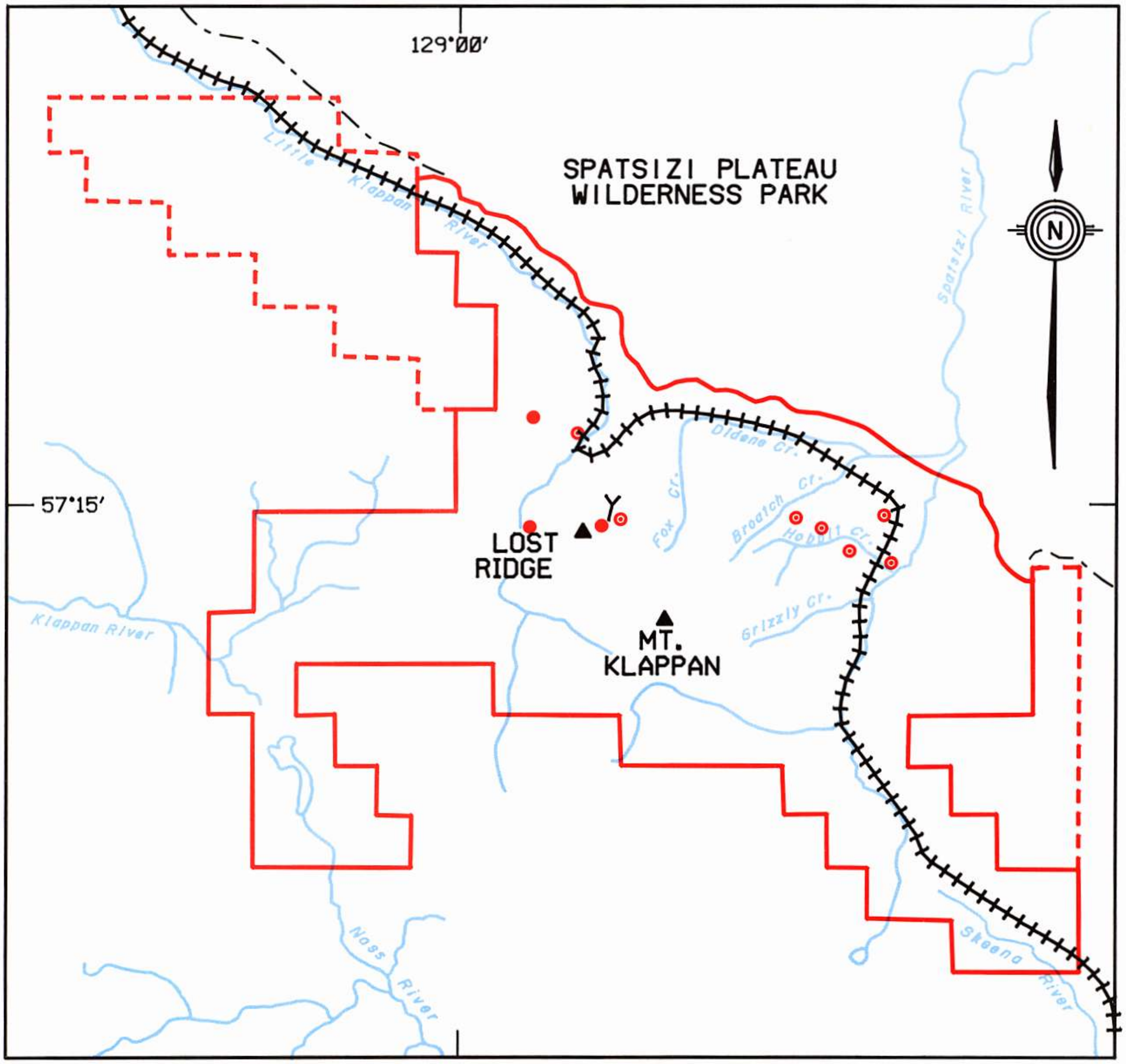
Proposed mine areas will then be drilled and sampled in more detail to determine the quality and tonnage of coal and the strip ratio at which it is available.

The technical data in this prospectus is based on 1982 geological data. However the 1983 adit location and drill holes are shown on the various drawings. It is anticipated that the resource base of anthracite will be increased substantially when all of the 1983 geological data has been interpreted and incorporated in geological and mining plans.

FIGURE 2.3

MT. KLAPPAN COAL PROPERTY

DRILL HOLE DISTRIBUTION



++++++++	PREPARED RAIL BED
— - — - —	PROVINCIAL PARK BOUNDARY
⊙	HQ DIAMOND DRILL HOLE - 1982
●	HQ DIAMOND DRILL HOLE - 1983
≻	ADIT 1983
- - - - - -	LICENCES UNDER APPLICATION

SCALE

0 1 2 3 4 5 km

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3.0 GEOLOGY

3.1 Regional Geology

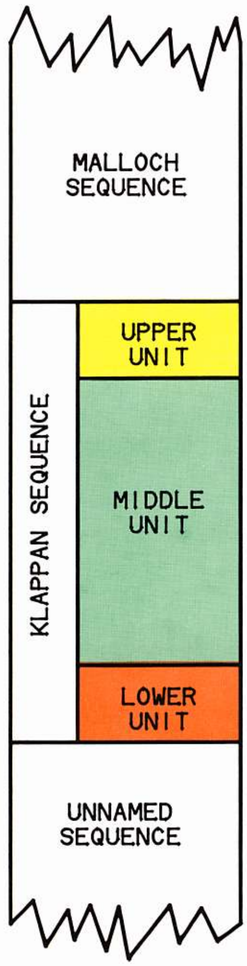
The coal measures of the Mount Klappan property are contained within a series of sediments deposited in the Bowser Basin during Middle Jurassic to Early Cretaceous time. Gulf geologists have subdivided the Upper Jurassic - Lower Cretaceous sediments locally into three sequences, which, in ascending order are: an unnamed Sequence, the Klappan and Malloch Sequences. The Klappan Sequence is the main coal-bearing unit (Figure 3.1).

The sediments of the Bowser Basin were subjected to two periods of compression and folding. The first period created the northwest-southeast trending folds and faults which generally dip to the southwest. The second compression period created broad, shallow plunging folds striking generally northeast-southwest. This second phase of folding has the effect of creating reversing plunges on the first set.

FIGURE 3.1

MT. KLAPPAN COAL PROPERTY

STRATIGRAPHY



LEGEND

- UPPER KLAPPAN SEQUENCE
- MIDDLE KLAPPAN SEQUENCE
- LOWER KLAPPAN SEQUENCE

SCALE

VERTICAL SCALE 1:2000

0 – 20 – 40 METRES

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3.2 Property Geology

The Mount Klappan Coal Property is underlain predominantly by the Klappan Sequence although both the unnamed and Malloch Sequences do occur on the property (Figure 3.1).

3.2.1 The unnamed Sequence

Although not mapped in detail on the licences, the unnamed Sequence outside the property is described as a succession of fine to medium-grained, medium to thick-bedded gray sandstones, gradationally associated with subordinate interbeds of recessive claystone and siltstone.

3.2.2 Klappan Sequence

The Klappan Sequence is 500 to 550 metres thick. It overlies the unnamed Sequence and is subdivided into lower, middle and upper units based primarily on the concentration of thick coal seams within the middle unit of the sequence.

The lower unit, which is approximately 105 metres thick, comprises massive, fine-grained, well indurated sandstones interbedded with nodular siltstones and thin coal seams.

The middle unit, which contains the majority of thick coal seams, is composed of conglomerate, sandstone, siltstone, claystone and coal. The thickness varies from 300 to 350 metres.

The upper unit, estimated at 100 metres of thickness, consists of repetitive sequences of interbedded sandstone, siltstone, claystone and minor coal.

3.2.3 Malloch Sequence

The Malloch Sequence, which conformably overlies the Klappan Sequence, is composed of a series of fining upward units of interbedded fine-grained sandstone, siltstone, and mudstone. Thin coals were noted and plant fragments are abundant.

3.2.4 Middle Klappan Sequence - Coal Development

Drilling to date indicates that the Middle Klappan Sequence contains up to 12 seams. Individual seam thicknesses vary from approximately 0.5 metres up to 5.5 metres, although structural thickening has produced thicknesses in excess of the 5.5 metres.

3.3 Structure

The property covers the faulted northeast limb of the northwesterly trending Mt. Biernes synclinorium which lies to the southwest of the property and is well defined by massive resistant conglomerates of the Malloch Sequence. The less competent Klappan Sequence is folded into a number of parasitic folds which are upright or overturned to the northeast and cut by southwest dipping thrust faults (Figure 3.2).

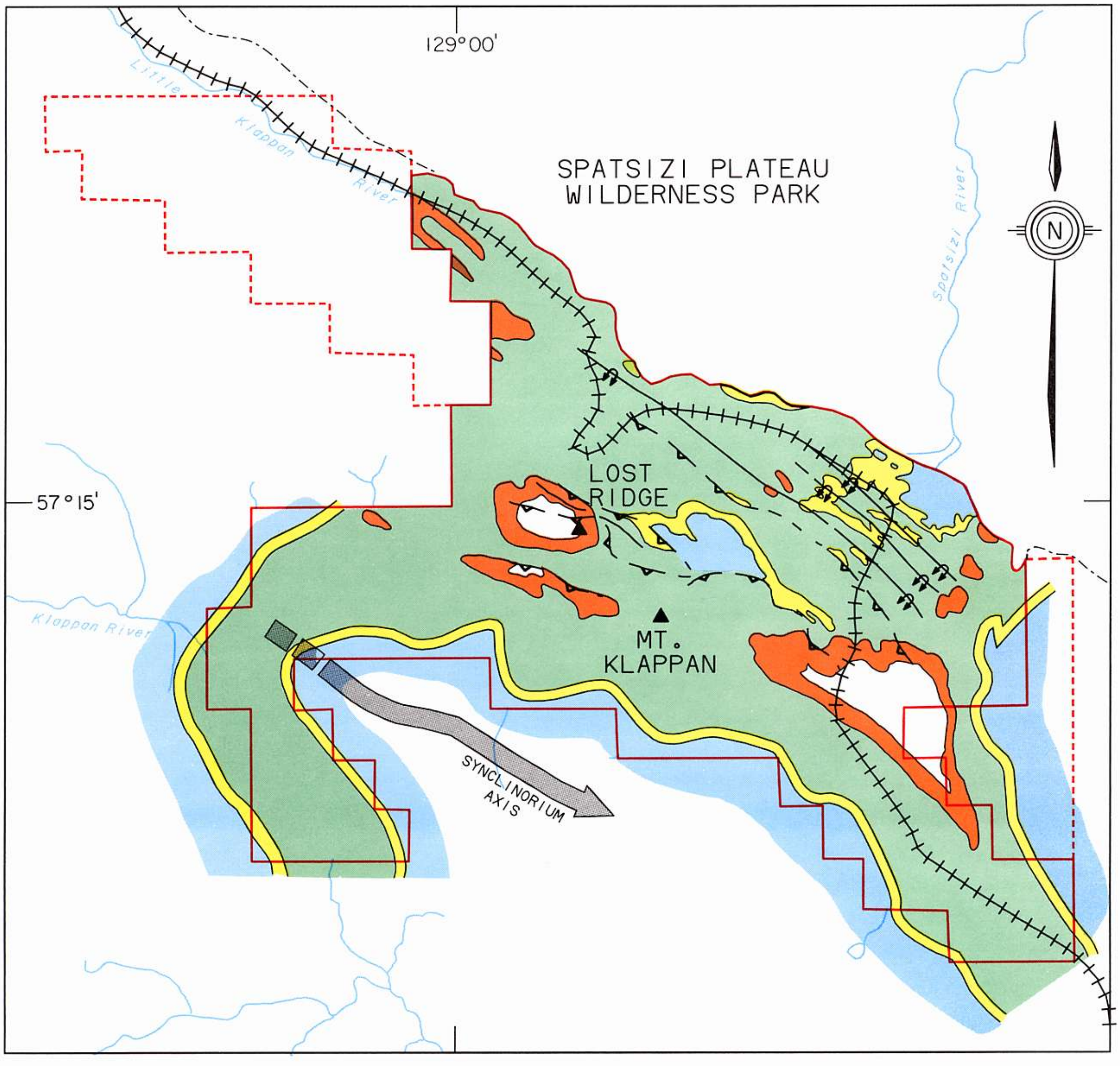
Two major thrusts, the Klappan and B.H.G. thrusts, subdivide the property into three structural blocks. The upper structural block lies to the southwest of the Klappan thrust and is characterized by open, upright folds. The structural style of the southern portion of the middle structural block between the Klappan and B.H.G. thrust, is similar to that of the upper structural block, but, within the northern part, the folds become progressively overturned to the northeast. The overturning of the folds is even more pronounced in the lower structural block beneath the B.H.G. thrust. The folds are generally characterized by long, gently dipping southwesterly limbs and shorter, vertical or overturned northeast limbs.

To date mapping has indicated the presence of a second phase of folding trending roughly perpendicular to the main regional trend of northwest-southeast folding. This second phase manifests itself as regular plunge changes along the axes of the primary folds.

FIGURE 3.2

MT. KLAPPAN COAL PROPERTY

SCHEMATIC GEOLOGICAL MAP



PREPARED RAIL BED
PROVINCIAL PARK BOUNDARY
MALLOCH SEQUENCE
UPPER KLAPPAN SEQUENCE
MIDDLE KLAPPAN SEQUENCE
LOWER KLAPPAN SEQUENCE
UNNAMED SEQUENCE
LICENCES UNDER APPLICATION

SCALE

0 1 2 3 4 5 km

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3.4 Resources

Based on drill hole and selected data obtained from trenches to the end of 1982, three areas, Hobbit-Broatch, Lost-Fox and Summit, were defined as containing inferred resources (Figure 3.3). Within these three areas a total inferred resource of 890 million tonnes has been calculated of which 620 million tonnes underlie the Hobbit-Broatch area, 240 million occur within the Lost-Fox area, and 30 million tonnes are calculated within the Summit area.

For the Hobbit-Broatch area, nine seams were used for this in-situ resource calculation. The nine seams on which the resource calculation is based, have a weighted average aggregate thickness of 21.75 metres.

For Lost-Fox the 1982 assessment was based on a coal section which had a weighted aggregate average thickness of 17.86 metres. The 1983 data indicate this thickness is substantially greater.

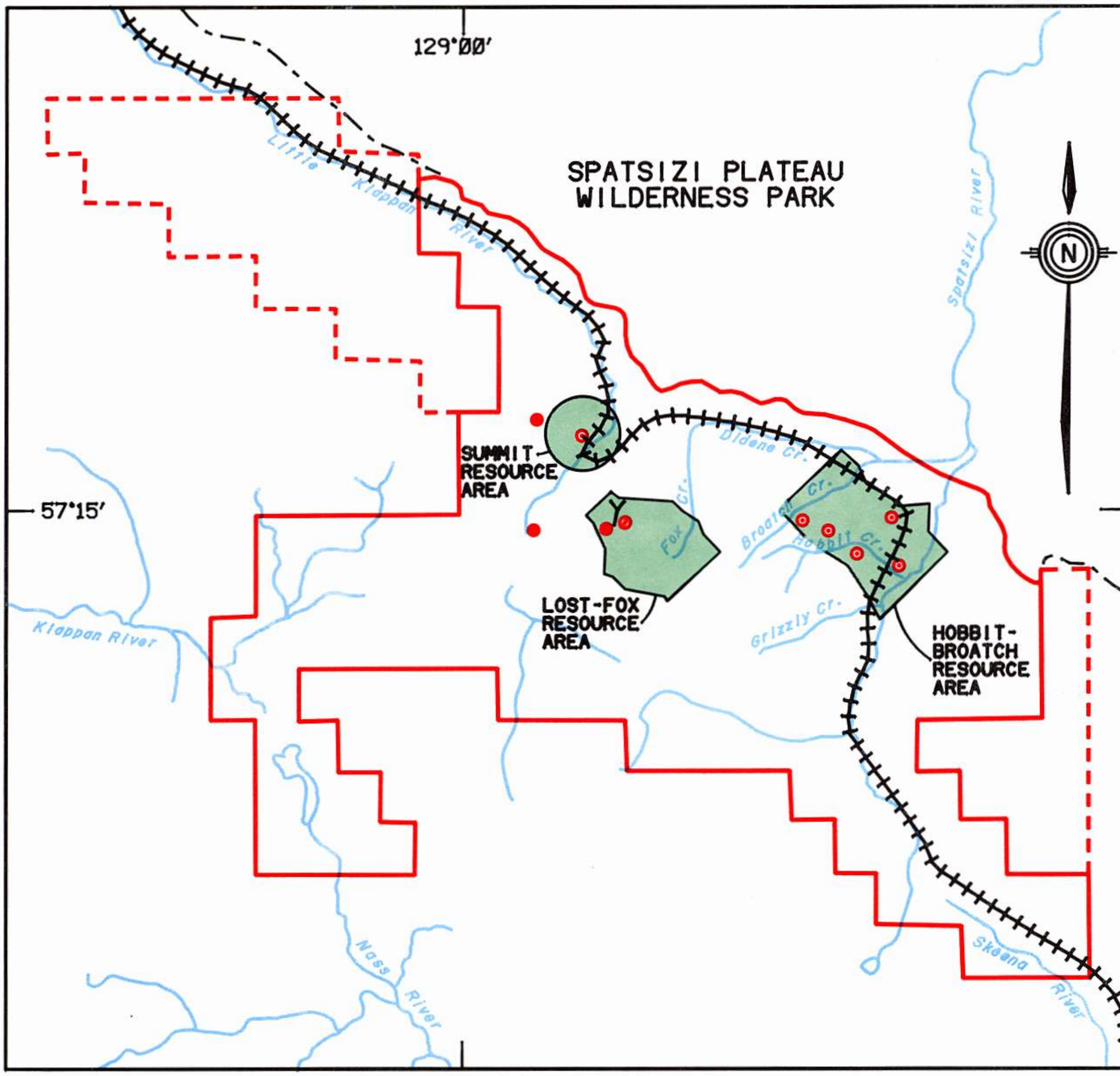
It is also anticipated that when the 1983 field data have been compiled and interpreted the total coal thickness in the Summit resource area will also be increased from the 7.91 metres assigned to the area in 1982.

The exploration work has identified two areas with surface mineable resources, and each may be capable of supporting potential mine developments producing up to 5 million tonnes per year of product coal for more than 20 years.

FIGURE 3.3

MT. KLAPPAN COAL PROPERTY

INFERRED RESOURCE AREAS



PREPARED RAIL BED
PROVINCIAL PARK BOUNDARY
HQ DIAMOND DRILL HOLE - 1982
HQ DIAMOND DRILL HOLE - 1983
ADIT
INFERRED RESOURCES AREA
LICENCES UNDER APPLICATION

SCALE

0 1 2 3 4 5 km

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Gulf

3.5 Coal Quality

3.5.1 Anthracite Markets

Investigations of the current uses of anthracite in the world and therefore, of the potential markets for coal from the Klappan property indicate that in Asia, particularly in Korea, a major use of anthracite is for making coal briquettes for home heating. In this use a coal with high ash (up to 25%) is preferred.

In Europe, North America and Asia, a premium low ash anthracite is required as:

(1) a smokeless fuel for heating of Industrial and Residential Complexes

(2) a low pollution fuel for the thermal generation of electricity in heavily populated areas.

(3) a reductant for certain metallic ores, such as titanium ore.

(4) a supplementary heat and carbon source in conventional steel making, particularly for sintering or pelletizing of iron ores.

(5) a carbon source in the production of carbon electrodes for the electrical smelting of aluminum.

(6) a water filtration agent in commercial water treatment plants.

Extensive coal quality analyses were performed on the coal samples recovered in the 1982 drill program and the resulting data was processed through a computer simulation of a coal preparation plant. This data indicated that the Klappan property could produce the range of coal products required by the market.

These tests indicated that the Mount Klappan Property is underlain by anthracite which can be washed to produce a variety of low sulphur, clean coal products, ranging from premium quality anthracites (5 to 6% and 9 to 11% ash) to briquetting coal (20 - 25% ash).

Testing completed to date on the 1983 Bulk Sample has verified the range of quality products that can be obtained and has indicated that the Klappan property can provide the size consist required by the users.

A discussion of the product coal quality is given in the following sections.

3.5.2 Premium Anthracites - Low Ash Content

Selected seams can be washed to produce a premium quality anthracite with an ash content in the range of 5 to 6%. Gross calorific value of the premium low ash product is just under 8000 calories per gram on an air dried basis at 5% ash. Sulphur content averages 0.5% and the Hardgrove Grindability Index averages 35.

On an air dried basis the fixed carbon content averages 88.3%. (Table 3.1).

Washing of the rejects from low ash premium coal production can produce a 20% ash briquetting coal product with a gross calorific value of 6450 calories per gram (air dried basis).

Table 3.1

Low Ash Premium Anthracite

		Air Dry	Dry Basis
Proximate Analysis			
Residual Moisture	%	0.6	-
Ash	%	4.9	4.9
Volatile Matter	%	6.2	6.3
Fixed Carbon	%	88.3	88.8
Total Sulphur	%	0.5	0.5
Combustible Sulphur	%	0.5	-
Chlorine	%	0.03	-
HGI		35	
Net Calorific Value	(cal/g)	7800	7850
Gross Calorific Value	(cal/g)	7950	8000

3.5.3 Medium Ash Premium Anthracite

Selected seams can be washed to produce a medium ash premium quality anthracite with an ash content between 9 and 11%. The gross calorific value of the 10.0% ash premium anthracite is 7450 calories per gram on an air dried basis. Sulphur content averages 0.7%, (combustible sulphur 0.5%) and the Hardgrove Grindability Index averages 43, ranging from 38 in the Lost-Fox area to 46 in the Hobbit-Broatch area. Fixed carbon content, on an air dried basis is 82.8% (Table 3.2).

Processing of the rejects from the medium ash anthracite product can produce a middlings product of 25.1% ash having a gross calorific value of 5850 calories per gram (air dried basis).

Table 3.2

Medium Ash Premium Anthracite

		Air Dry	Dry Basis
Proximate Analysis			
Residual Moisture	%	0.8	-
Ash	%	9.6	9.7
Volatile Matter	%	6.8	6.8
Fixed Carbon	%	82.8	83.5
Total Sulphur	%	0.6	0.6
Combustible Sulphur	%	0.5	-
Chlorine	%	0.03	-
HGI		43	
Net Calorific Value	(cal/g)	7300	7350
Gross Calorific Value	(cal/g)	7450	7500

3.5.4 Briquetting Anthracite

A washed blend of all the seams on the property will produce briquette upgrading quality coal of 19% ash content (Table 3.3). This product can be produced either as an alternative to, or in addition to the premium coals. Instead of producing the low ash and medium ash products all the mine production can be used to produce this briquette upgrading coal product. The quality of this coal is reported in Table 3.3.

As indicated in Table 3.3 gross calorific value of this product is 6500 calories per gram (air dried basis). Total sulphur content averages 0.7%. Fixed carbon content on an air dried basis is 71.6%.

The quality of this coal is similar to that of the briquetting coal obtained after allowing for separate exploitation of the premium seams to produce the premium quality coals. It could be used as a briquette upgrading or a blending coal as its' specifications exceed the present requirements of the main market in Korea.

Coal with a 25% ash content can be produced for briquetting purposes.

Table 3.3

Briquette Upgrading Anthracite

		Air Dry	Dry Basis
Proximate Analysis			
Residual Moisture	%	1.6	-
Ash	%	18.6	18.9
Volatile Matter	%	8.2	8.3
Fixed Carbon	%	71.6	72.8
Total Sulphur	%	0.7	0.7
Combustible Sulphur	%	0.5	-
Chlorine	%	0.03	-
HGI		48	
Net Calorific Value	(cal/g)	6400	6500
Gross Calorific Value	(cal/g)	6500	6600

3.6 Environmental Impact and Reclamation of Programs to Date

The exploration program has had minimal impact on the environment. Access to the property has been by fixed wing with personnel housed in tent camps on sites cleared during the construction of the British Columbia Railway subgrade. Drilling has been helicopter supported and all trenches have been hand excavated.

Replacement of three bridges over the Klappan River and two creeks will establish road access along the British Columbia Railway subgrade to the property. This will permit access for mechanical equipment which will be required for future adit work and for the access of truck mounted rotary drills which would be employed for infill drilling in development areas.

4.0 PROPOSED MINING AND DEVELOPMENT PLANS

4.1 Introduction

At the end of the 1982 exploration program the exploratory drilling had been concentrated in the Hobbit-Broatch area, consequently this area received the most detailed mining assesment and a less detailed assessment was made of the Lost-Fox area.

However, in 1983, exploration expenditures were focussed in the Lost-Fox area. Although the results of the 1983 program are still being interpreted, it is anticipated that both the resource base and the surface mining potential of the Lost-Fox area will be improved.

The Lost-Fox area will be subjected to a mining assessment based on the results of the 1983 exploration program.

Although only the Hobbit-Broatch potential pit is described within this report, the mining method, coal preparation facilities and infractructure requirements are conceptually similar to those which would be employed in the Lost-Fox area.

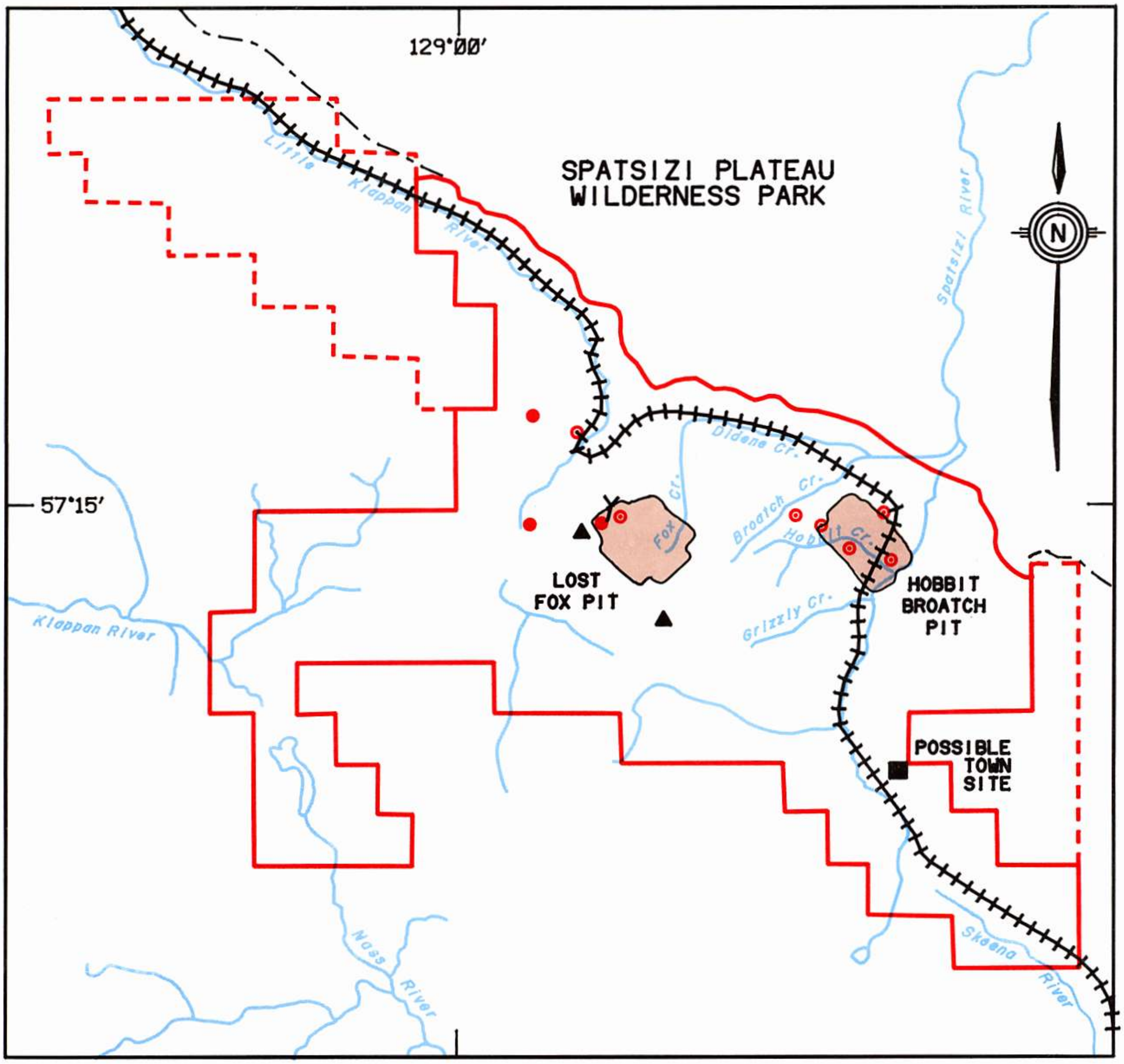
The mining plans, coal preparation facilities and associated drawings are taken from a mining assessment done by Phillips Barrett Kaiser Engineering Ltd. of Vancouver, B.C.

Text for the socio-economic review is from work done by Price Waterhouse Associates Ltd. of Vancouver, B.C. and the environmental data was compiled by Environmental Management Associates of Vancouver, B.C.

FIGURE 4.1

MT. KLAPPAN COAL PROPERTY

POTENTIAL OPEN PIT MINES



PREPARED RAIL BED

PROVINCIAL PARK BOUNDARY

HQ DIAMOND DRILL HOLE - 1982

HQ DIAMOND DRILL HOLE - 1983

ADIT

PITS

LICENCES UNDER APPLICATION

SCALE

0 1 2 3 4 5 km

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4.2 Hobbit-Broatch Pit

4.2.1 Geology

The Hobbit-Broatch pit area is underlain by Middle Klappan coal-bearing sediments which have been folded into a number of folds that are overturned to the northeast. The major structural feature is the Hobbit anticline-syncline pair which has characteristically long, shallow dipping southwest limbs and a steep overturned northeast limb (Figures 4.2 and 4.3).

Within the pit area, 7 of the 11 seams have been intersected in drilling to date, and it is only these seams, seams E through K, that are considered for mining in the mine assessment.

4.2.2 Mine Plans and Production Goals

In the conceptual mine plans and economic evaluations two scenarios were considered, one yielding 1,000,000 tonnes of product coal, the other producing on the order of 3.5 million tonnes of product per year. These scenarios are not mutually exclusive, initial production could be on the order of 1,000,000 tonnes with production increasing as the product gains market acceptance.

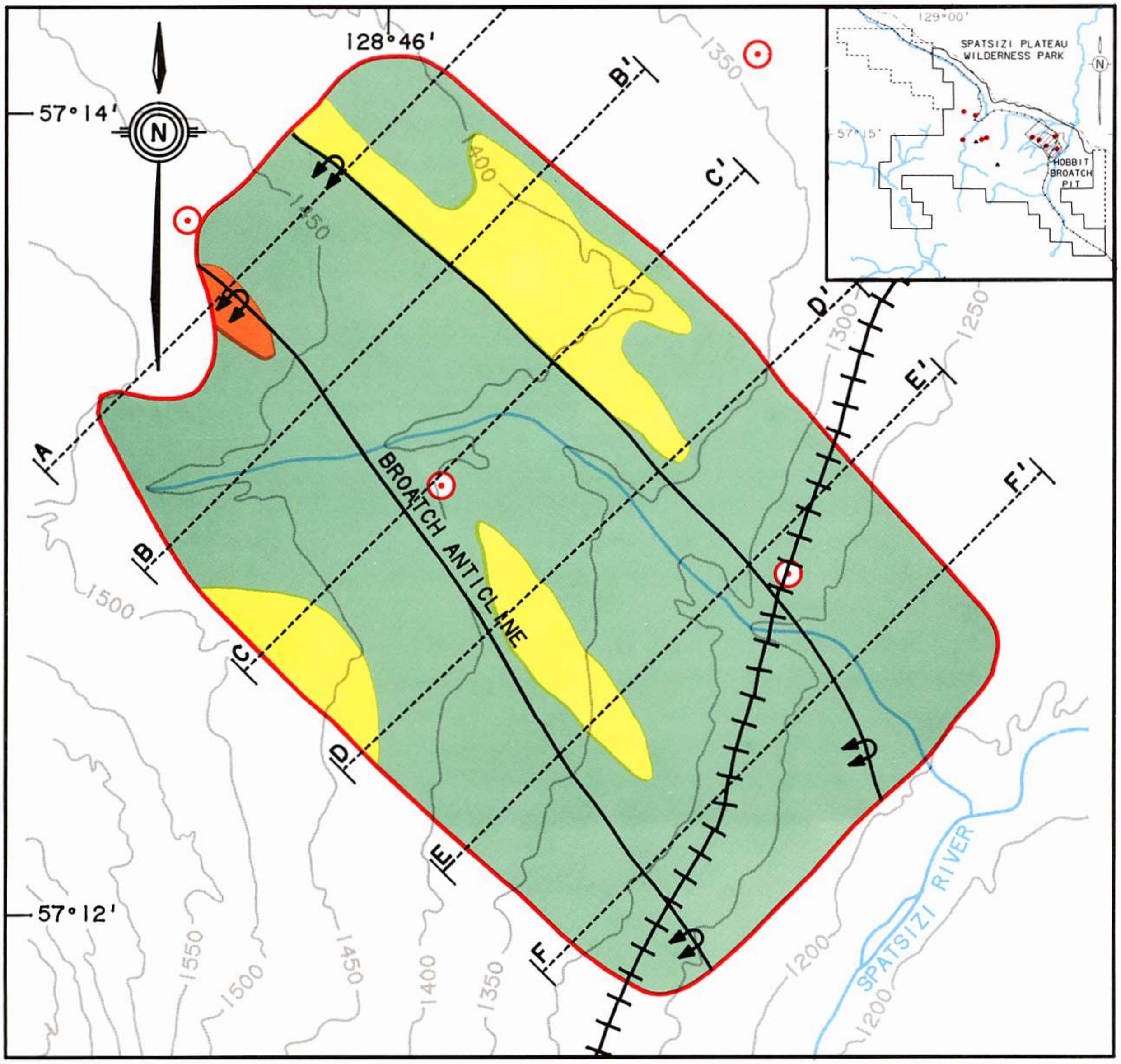
Because the maximum impact would occur at the higher production volumes, the production scenario described in this section is for the production of a total of 3.5 million annual tonnes of a mix of saleable products at 5%,10% and 20 to 25% ash, over a minimum of 20 years. To increase the production rate beyond 3.5 million tonnes of saleable coal per year, the mine area could be extended.

The design is a conventional truck and shovel open pit benching operation. The box cut is sited at the southern portion of the mine area. The benches run from southwest to northeast and mining progresses towards the northwest (Figure 4.4).

FIGURE 4.2

MT. KLAPPAN COAL PROPERTY

GEOLOGY OF THE HOBBIT - BROATCH PIT



LEGEND

- UPPER KLAPPAN SEQUENCE
- MIDDLE KLAPPAN SEQUENCE
- LOWER KLAPPAN SEQUENCE
- PIT OUTLINE

SCALE

0 500 1000 m

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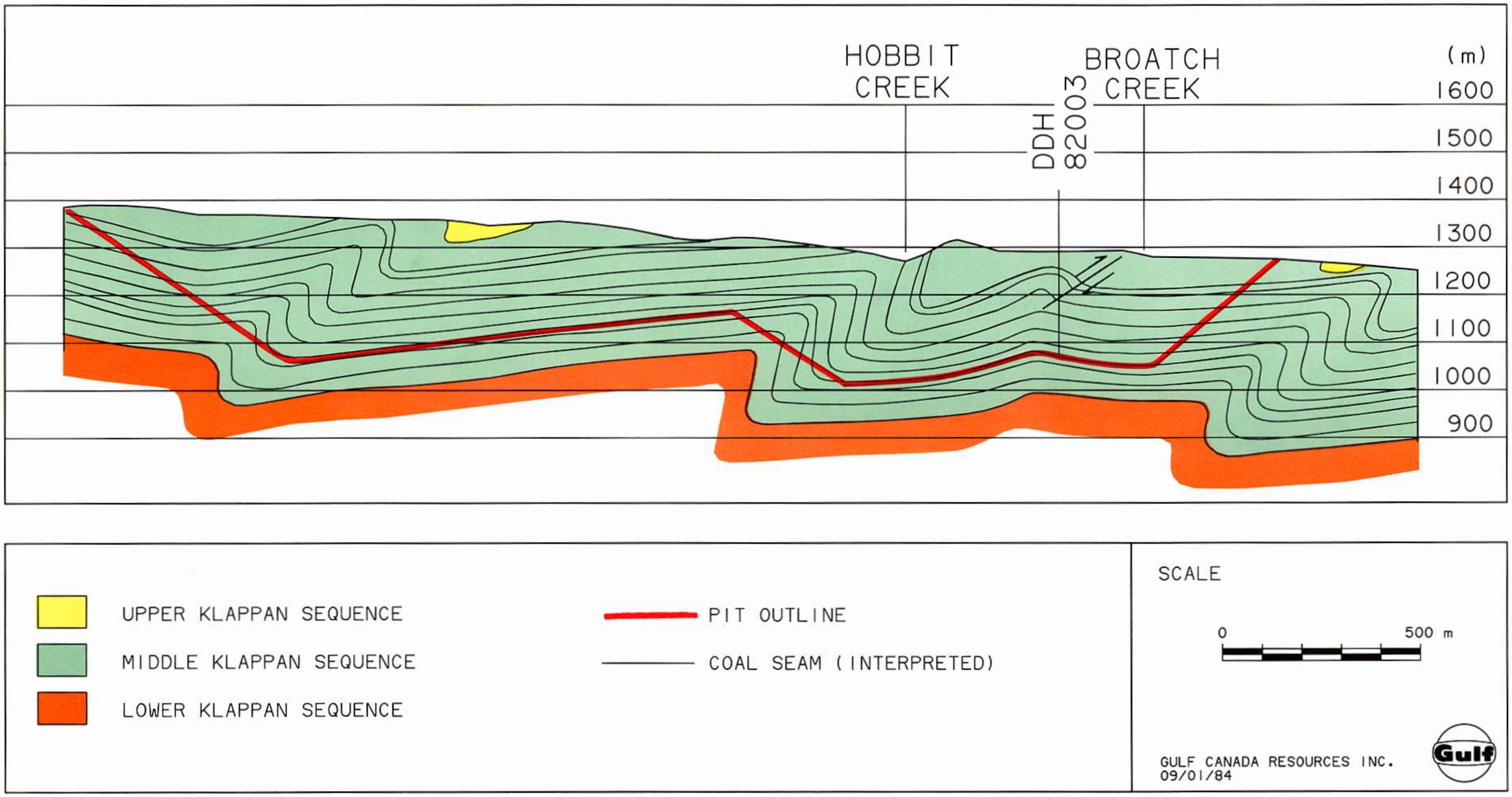
FIGURE 4.3

MT. KLAPPAN COAL PROPERTY

TYPICAL CROSS SECTION OF HOBBIT-BROATCH PIT



A total of 147 million tonnes of run of mine (R.O.M.) coal and 930 million cubic metres of waste will be mined for a R.O.M. strip ratio of 6.3 bank cubic metres/metric tonne of raw coal. This pit design has not been optimized, consequently the strip ratios may be high.

4.2.3 Materials Movement

Mining operations begin with the removal of the top soil and root zone material which is stripped and stockpiled for future use in reclamation.

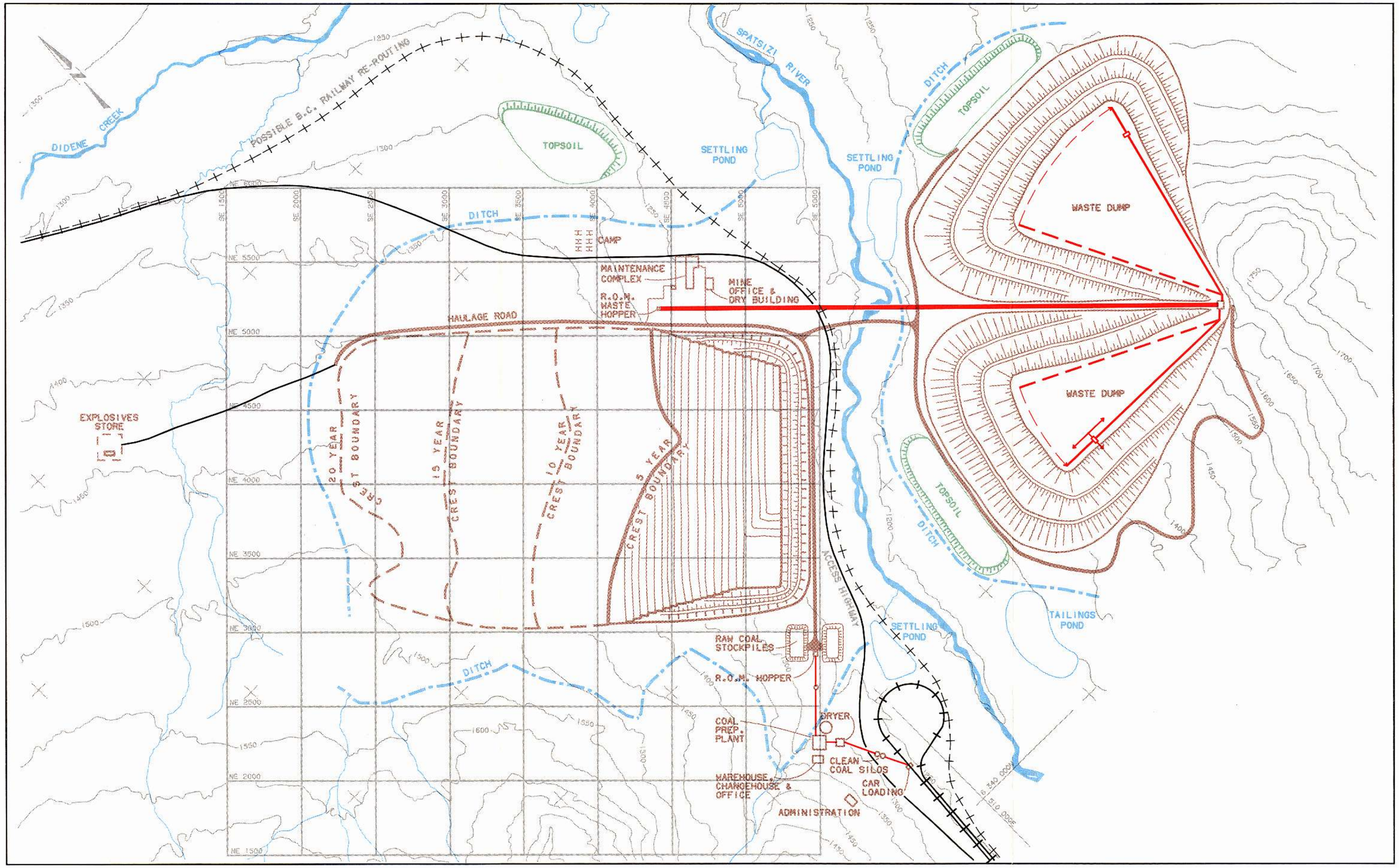
For the first nine years all mine waste is conveyed to a mountain side dump site on the south side of the Spatsizi River. This dump was chosen because there is no evidence of near surface coal and it is in close proximity to the pit. In addition the dump site offers the opportunity of merging a man-made structure into the natural topography.

Waste rock is trucked from the pit and dumped into a conveyor hopper, and/or onto a pad, to be dozed to a grizzly, where the oversize is scalped off and crushed prior to loading. The plan presented locates the conveyor hopper and surrounding pad on the southeastern edge of the pit (Figure 4.4), however it is anticipated that relocation of the conveyor hopper to the centre of the pit would result in considerable cost improvements. As the mine plan is conceptual in nature, such optimization has not been undertaken at this stage.

FIGURE 4.4

MT. KLAPPAN COAL PROPERTY

HOBBIT-BROATCH RESOURCE AREA
GENERAL ARRANGEMENT-5 MTPY CASE



MINE GRID	ACCESS HIGHWAY	FUTURE RAILWAY
N.T.S. GRID	MINE TRUCK HAULAGE ROAD	CONTOURS (50m Intervals)
DRAINAGE DITCH	RAILWAY	

SCALE 0 500 1000m

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REDRAWN FROM: PHILLIPS BARRATT KAISER PLATE 3.2

A conveyor moves the waste to the dump site where it is distributed by a 50 metre boom spreader fed by a lateral conveyor. Initial construction of the waste dump is from the spreader/lateral conveyor by regular lineal extension with later radial shifting of the conveyor as the dumps are built out laterally. Two dump wings are provided to insure continuity of disposal (Figure 4.5).

After completion of the box cut in year 9, two thirds of the waste is backfilled into the pits, and the remaining one third is conveyed to the off-site waste dump for the years 10-15. The off-site disposal of waste is still required during this period because the pit floor rises to the north. In year 15 the conveyor operation is shut down, and waste mined for the remainder of the mine's life is backfilled. Figures 4.6, 4.7 and 4.8 illustrate the mining and backfill progression for years 5, 10 and 20 respectively.

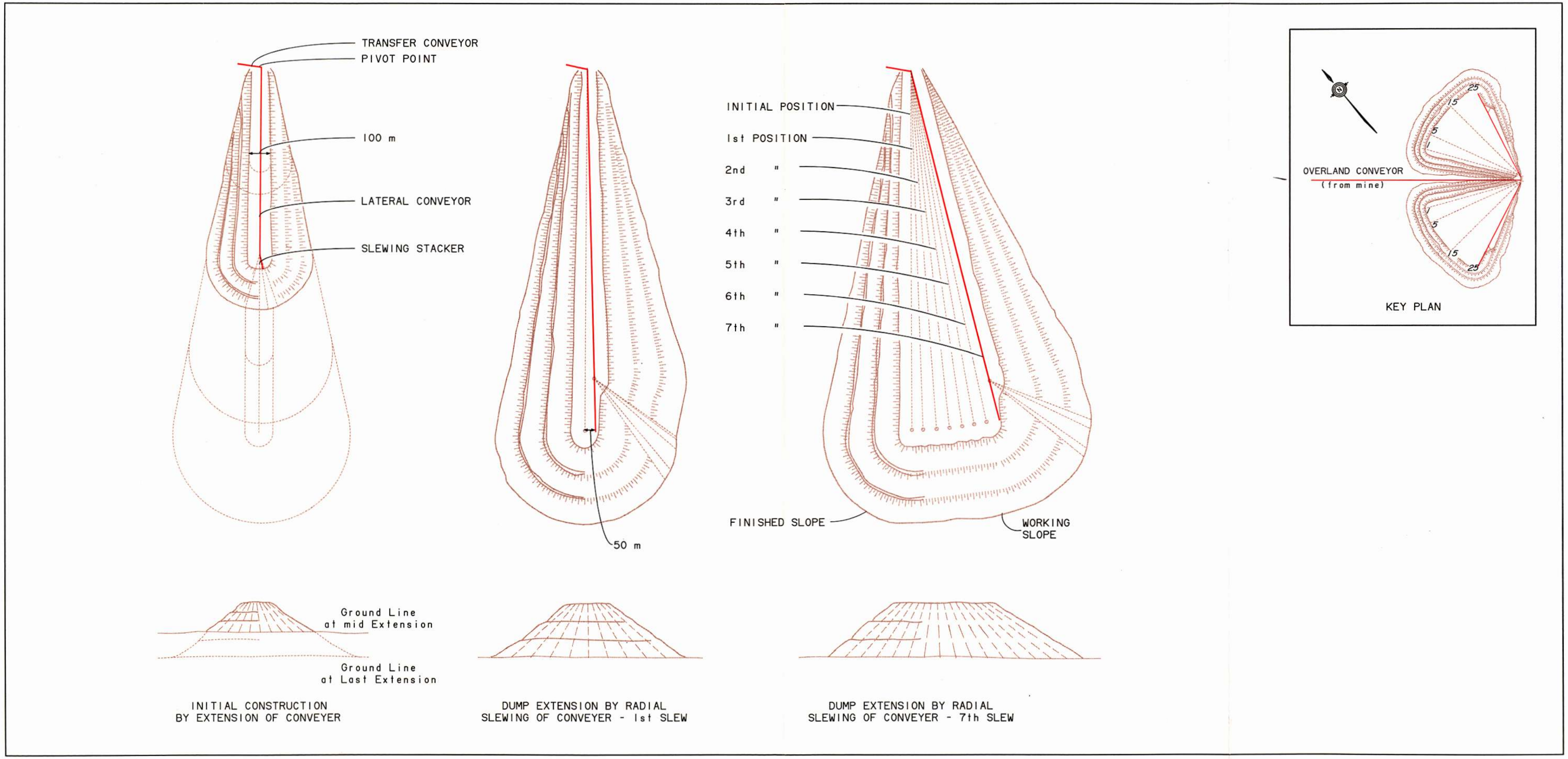
The waste rock, of which 95% is estimated to require drilling and blasting, is loaded by 24.5 cubic metre shovels onto a fleet of 154 tonne end dump trucks. A hydraulic shovel with a 14 cubic metre bucket completes the loading fleet. Drilling of the waste rock is by 300 mm electric and 250 mm diesel-electric drills.

Coal is mined and loaded by 21 cubic metre hydraulic shovels with assistance from a 15 cubic metre front end loader. The coal is loaded onto 154 tonne end dump trucks

FIGURE 4.5

MT. KLAPPAN COAL PROPERTY

HOBBIT-BROATCH MINE
WING WASTE DUMP CONSTRUCTION



REDRAWN FROM: PHILLIPS BARRATT KAISER FIGURE 3.8

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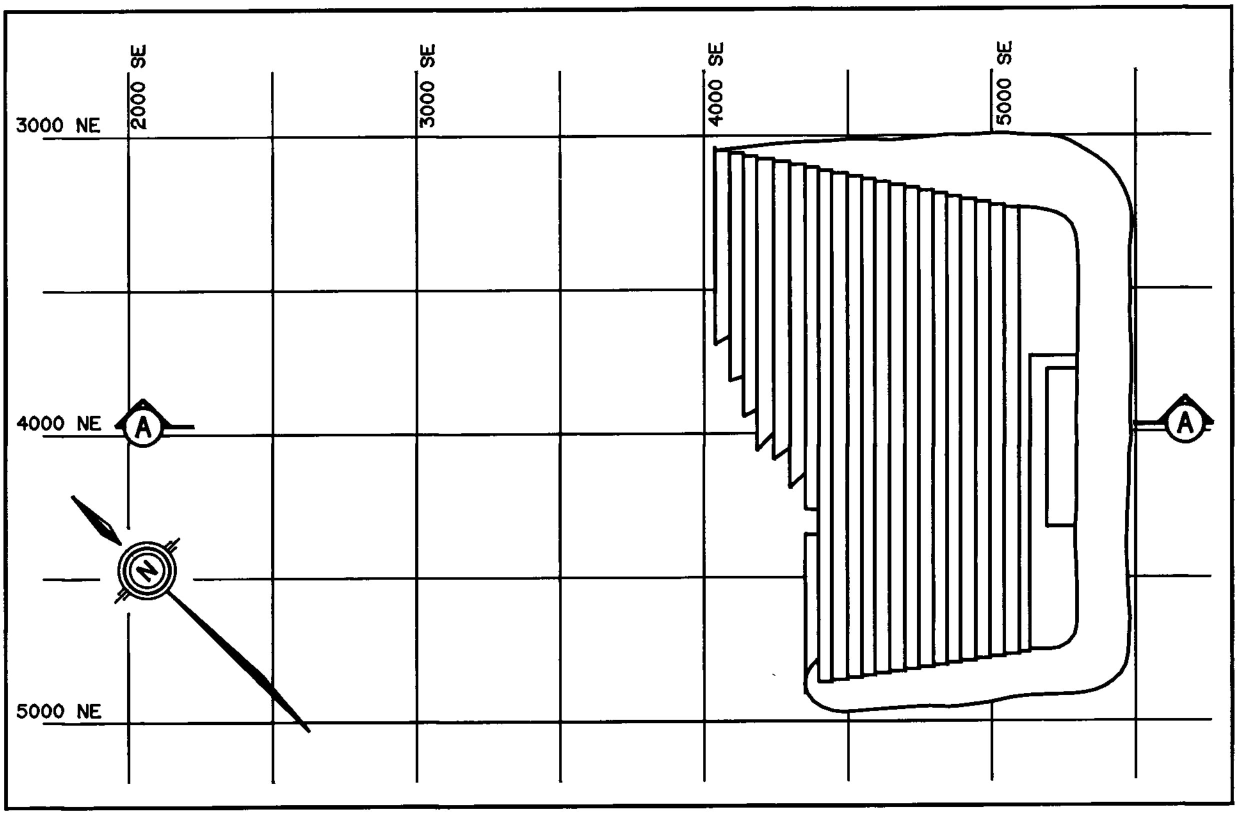
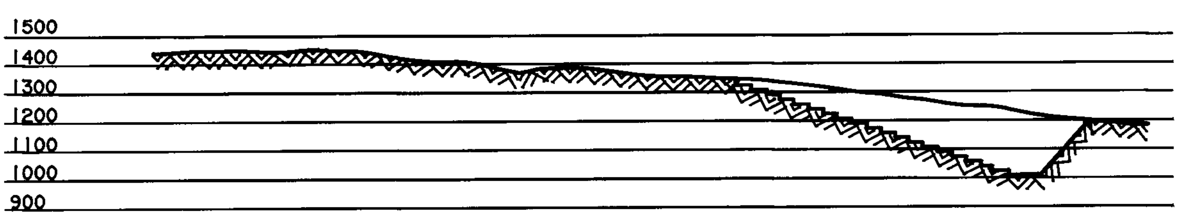
FIGURE 4.6

MT. KLAPPAN COAL PROPERTY

MINE PROGRESSION AT END OF YEAR 5



SECTION A-A



SCALE

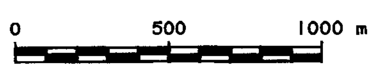


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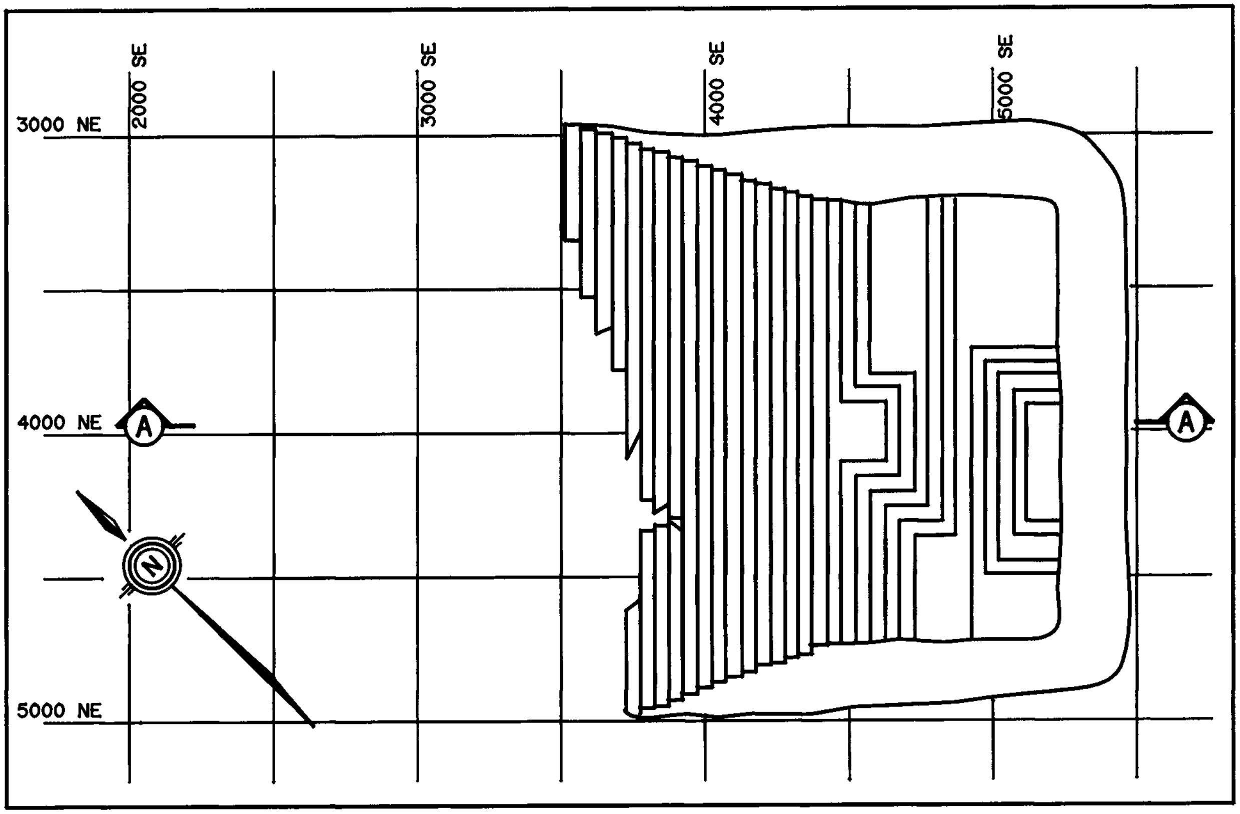
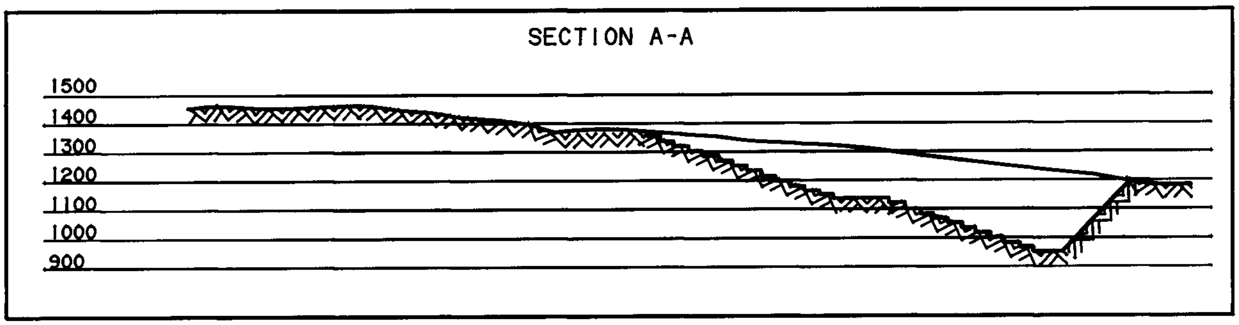
FIGURE 4.7

MT. KLAPPAN COAL PROPERTY

MINE PROGRESSION AT END OF YEAR 10





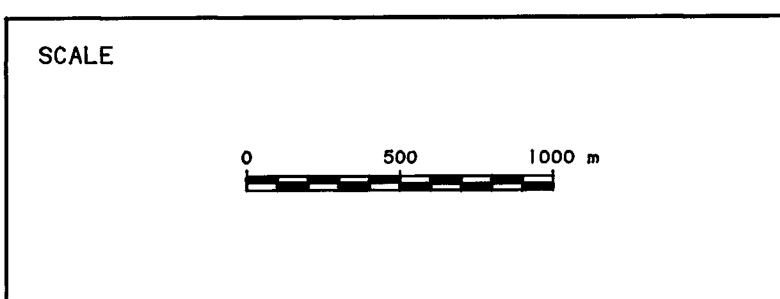


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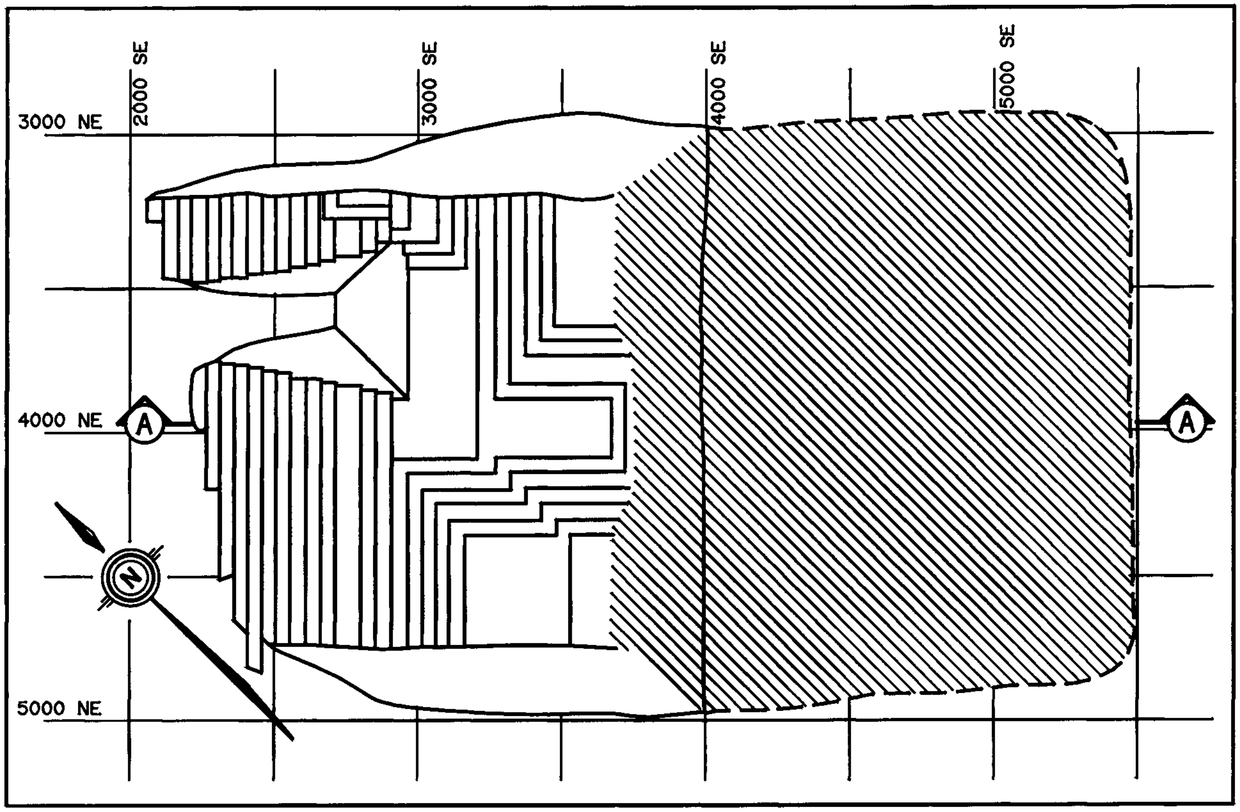
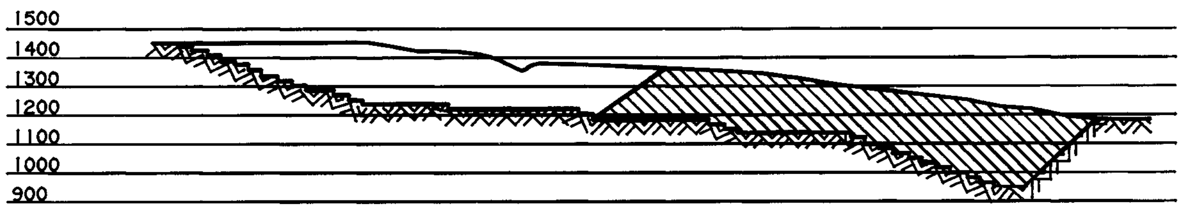
FIGURE 4.8

MT. KLAPPAN COAL PROPERTY

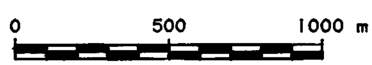
MINE PROGRESSION AT END OF YEAR 20





LEGEND

SCALE



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equipped with coal boxes and delivered to a run-of-mine hopper close to the coal preparation facility (Figure 4.4). Preparation plant coarse rejects are handled by coal trucks returning to the mine and dumping either at the conveyor dump or as backfill after year 9. Dozer support for both waste rock and coal is provided. A schedule of major mine equipment is reproduced in Table 4.1. The main maintenance facilities are located at the mine site (Figure 4.4).

4.2.4 Labour

Total labour requirements will rise from an average of 809 during the first five years of operation to an average of 1091 during years 6 to 20. A breakdown of personnel by Mining, Coal Preparation and Administration is presented in Table 4.2.

Table 4.1

Major Mine Equipment List

Equipment Type	Initial Purchase
Shovels (24.5 cu. m.)	6
Shovel - (Hydraulic)	3
Trucks - 154T	74
Waste Conveyor System	1
Waste Stacker Systems	2
Drills	6
Front End Loader	1
Dozers & Graders	20
Trucks - 50T	3
Crane - 110T	1

Table 4.2

Labour Requirement

Mining	
Non-Supervisory	773
Supervisory	92
Preparation	
Non-Supervisory	88
Supervisory	36
Administration	
Staff	102
Total	1091

5.0 PROCESS DESCRIPTION

5.1 Introduction

To produce 5%, 10% and 20% ash products, the conceptual preparation plant facility includes raw coal handling facilities, a heavy media washplant and clean coal handling facilities. The plant is sized to process 1100 raw tonnes per operating hour.

Figure 5.1 is a site plan of the preparation facilities and Figure 5.2, illustrates the preparation plant flow chart. Table 5.1 contains a listing of the major equipment utilized in the coal preparation process.

Both the flow sheet and the site plan for the preparation plant facility are subject to change depending on the slate of products to be produced and the final mine location. The slate of products will be determined by the market requirements.

FIGURE 5.1

MT. KLAPPAN COAL PROPERTY

COAL PROCESSING FACILITY SITE PLAN

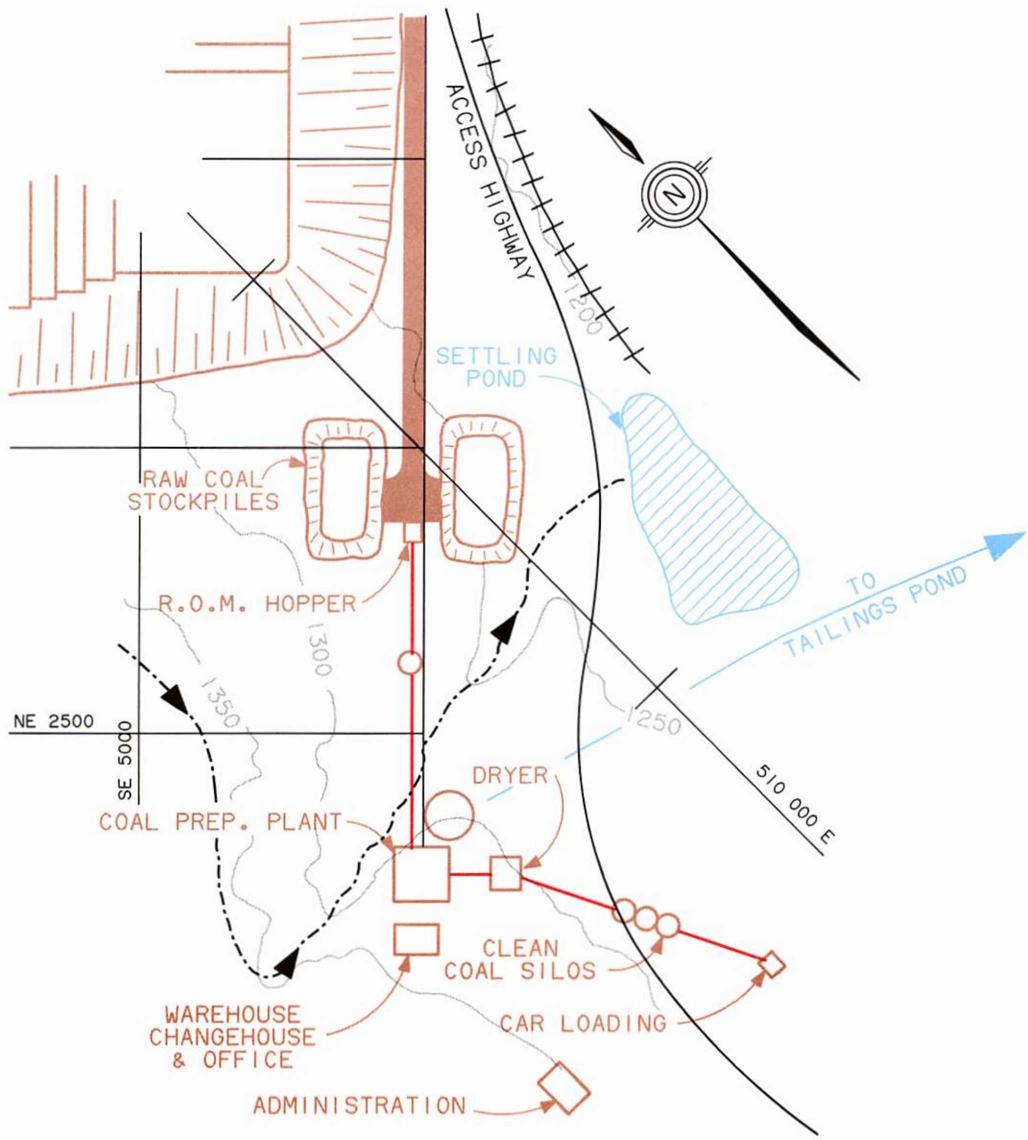

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Table 5.1

Preparation Plant Equipment

Equipment Type	Initial Purchase
Raw Coal Handling	
Apron Feeder	2
Scalping Screen	2
Rotary Breaker	1
Reclaim Feeders	7
Dust Collector	1
Raw Coal Silo	1
Conveyors (Raw Coal)	3
Preparation Plant	
Screens	74
Heavy Media Vessel	2
Hammermill Crusher	2
Centrifuge	9
Magnetic Separator	17
Pumps	48
Cyclones	150
Screen Bowl Centrifuge	5
Magnetite Thickener	2
Refuse Thickener	1
Plant Feed Conveyor	1
Clean Coal Handling	
Vibrating Feeder	16
Track Scale	1
Dust Collector	2
Conveyors	6
Clean Coal Silo	3
Stacking Tube	1
Loadout Bin and System	1
Sampling System	1

5.2 Raw Coal Handling

During mining, the run-of-mine coal is transported from the mine area to a truck dump. Apron feeders recover material from the truck dump and feed scalping screens, which reduce the load to the rotary breaker by removing 100 mm x 0 raw coal. The rotary breaker reduces the 600 mm x 100 mm run-of-mine material to 100 mm x 0 and removes rock and scrap material, which is discharged from the breaker and conveyed to an open stockpile.

Scalping screen underflow and rotary breaker crushed material are conveyed to a single 10 000 tonne silo which provides slightly more than eight hours of storage capacity.

Vibrating feeders reclaim anthracite from the raw coal silo and discharge it onto the plant feed conveyor. These feeders have grizzlies at their discharge points to prevent large frozen lumps from entering the preparation plant and plugging chutes in the feed system.

A description of the plant circuits as described by Phillips Barratt Kaiser in their report is given on the following pages.

5.3 Preparation Plant

5.3.1 Heavy Media Vessel Circuit

Raw anthracite is reclaimed from the raw coal silo and conveyed to the preparation plant (Figure 5.2). Raw coal and pre-wet screens size the plant feed at 12 mm. The overproduct from the raw coal screens is gravity fed to a drag-chair-type heavy media vessel which is used as a scalper to remove the high ash material. The specific gravity of separation in this unit is 1.60. The float and sink products are fed independently to drain and rinse screens. The sink material, or reject, is transported by conveyor to the refuse pile.

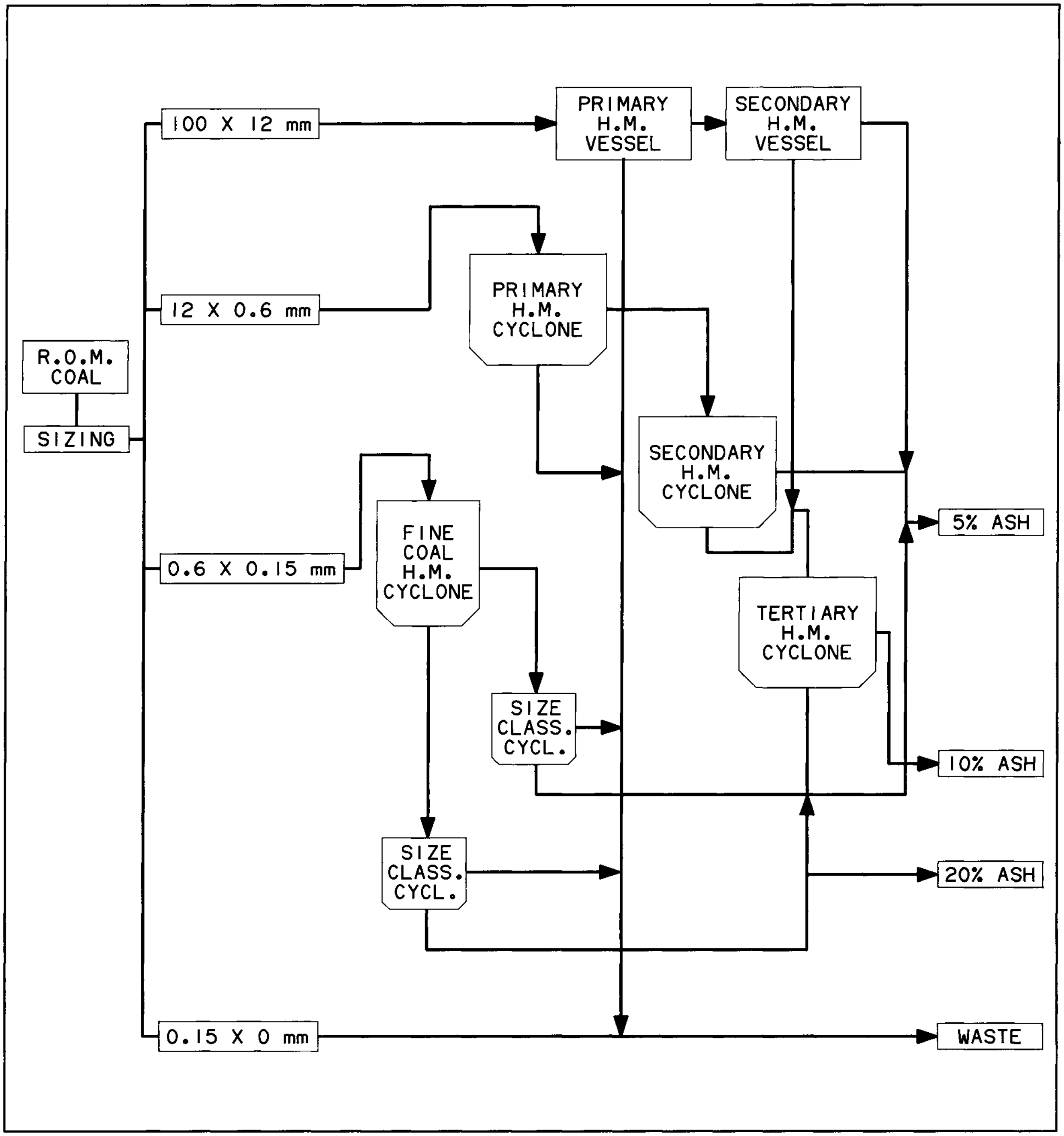
The float fraction is recleaned by a second stage heavy media vessel with a specific gravity of separation of 1.40. The coarse clean coal (100 mm x 40 mm) is crushed to market specifications and the fine clean coal (40 mm x 12 mm) is dewatered by a centrifugal dryer. Both products feed to the 5% ash conveyor.

The second stage heavy media vessel sink material is crushed to 12 mm top size for recleaning in the tertiary heavy media cyclone circuit.

FIGURE 5.2

MT. KLAPPAN COAL PROPERTY

HOBBIT-BROATCH MINE
PREPARATION PLANT SCHEMATIC FLOWSHEET



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5.3.2 Coarse Heavy Media Cyclone Circuit

The 12 mm x 0 undersize from the raw coal screens is deslimed at 0.6 mm and the oversize fraction is pumped to primary heavy media cyclones. Desliming is accomplished by sieve bends and horizontal vibrating screens. The primary heavy media cyclone circuit will operate at 1.60 specific gravity.

Refuse from the heavy media cyclone, containing heavy media is handled by a sieve bend-screen combination. The sieve bend and the first one-fourth of the screen are used for media draining, and the refuse is rinsed on the remaining part of the screens to remove magnetite.

The heavy media cyclone product is drained of magnetite by two stages of sieve bends and fed by gravity to the secondary heavy media cyclone feed sump and pump. The secondary (separating gravity 1.40) heavy media cyclone product is handled by sieve bend-screen combinations and dewatered by centrifugal dryers. The dryer product goes to the 5% ash conveyor.

Refuse from the secondary heavy media cyclone is drained of magnetite by sieve bends and fed by gravity to the tertiary heavy media cyclone sump. At this point, the secondary heavy media vessel sink material is added to the secondary heavy media cyclone refuse and pumped to the tertiary heavy media cyclones.

The tertiary heavy media cyclone overflow is handled b by sieve bend-screen combinations and dewatered by centrifugal dryers after which the dryer product discharges to the 10% ash conveyor. Underflow is drained and rinsed of magnetite by sieve bends and screens, dewatered by centrifugal dryers and the dryer product is discharged to the 20% ash product conveyor.

5.3.3 Fine Coal Cleaning Circuit

The desliming sieve bend and screen underflow (0.6 mm x 0) is cleaned in a water only cyclone recycle circuit operating at 1.90 separating gravity. Underflow from the primary units is recleaned in the secondary units, and the overflow product (clean product or misplaced product from the secondaries) is recycled to the primary units. Secondary water only underflow is sluiced to the refuse thickener. The 0.15 mm x 0 fraction is cleaned in the water only cyclone circuit where the fine coal screen overproduct is sent to the heavy media circuit and the classifying cyclone overflow reports to the refuse thickner.

5.3.4 Magnetite Recovery and Storage Circuit

The magnetite recovery circuits for the heavy media vessel, coarse heavy media cyclone and fine heavy media cyclone circuits are designed separately. Each uses magnetite drain equipment and magnetic separators to recover the magnetite. Magnetic separator effluents from the heavy media vessel and coarse heavy media cyclone circuits are combined and further processed in an additional group of magnetic separators. Magnetite delivered to the plant is stored in magnetite thickeners.

5.3.5 Water Clarification Circuit

A refuse thickener is provided for water clarification. The feed to this unit is classifying cyclone overflow and secondary water only cyclone reject. The feed is flocculated using an automatic system. Overflow of the thickener is returned to the plant. While underflow is pumped to a tailings pond.

Seepage from the tailings pond is collected in a sump and pumped back to the tailings pond. A decant pumping system pumps water from the pond back to the refuse thickener.

The ultimate disposal of the tailings will depend upon the results of the environmental impact assessments which will determine the toxicity or non-toxicity of these tailings materials.

5.4 Clean Coal Storage and Loadout

The three products produced require separate conveying and storage facilities. Three 12 000 tonne capacity silos are provided with stacking tubes for ground storage at each end. A system of flop gates in the plant and transfer conveyors on top of the silos allow sufficient flexibility for routing the three products and blending if required. The 12 000 tonne capacity silos allow uninterrupted loading of unit trains and over 3 days storage for each plant product. The stacking tubes allow ground storage in case unit train deliveries are delayed.

5.5 Refuse Disposal

Coarse reject (plus 0.6 mm) feeds by reject conveyor to an open refuse pile. A front-end loader reclaims the material for loading 154 tonne coal trucks which carry the reject to the mine overburden disposal system.

Refuse thickener underflow is pumped to a tailings pond located on the east side of the Spatsizi River. The initial pond has a seven year life with sufficient tailings disposal area, adjacent to the initial pond, available for the life of the mine.

The tailings pond starter dyke is constructed from material excavated from within the reservoir area. After plant start-up, the remainder of the dam is built from coarse refuse material.

5.6 Support Facilities

Support facilities included are; warehouse, shop, office, laboratory and shower facilities housed in one building separate from the preparation plant.

6.0 INFRASTRUCTURE

6.1 Railway

The coal from the Klappan project could be shipped either to the Ridley Island coal port at Prince Rupert, or to the port at Stewart, British Columbia. A third possibility is a port located on Alice Arm.

If the coal is to be shipped to Ridley Island then railroad access to the property could be established via the Dease Lake British Columbia Railway (B.C.R.) branch line. This would require completion of 85 kilometers of subgrade which is approximately 65% completed at the present time. The laying of 85 kilometers of rail would then complete the initial railroad access via Prince George to Prince Rupert.

When sufficient annual tonnage is produced to justify the economics of constructing the Skeena River cut-off (Route 2 in figure 6.1) the total rail distance from Mt. Klappan to Prince Rupert can be reduced from 1420 kilometers (via Prince George) to 607 kilometers via the cut-off route. The length of the cut-off route to be constructed is approximately 176 kilometers.

The British Columbia Railway branchline will require some upgrading to accomodate unit trains. However, should the cut-off be constructed for the start of production, the upgrading of the B.C.R. branchline would not be required.

The British Columbia Government's publication "Northwest Economic Development Studies" cites the possibilities of a rail route from the Klappan property extending from the BCR subgrade south of the property, via a new grade along Slowmaldo Creek and Damdochax Creek to the Nass Valley to Meziadin and then over Bear Pass to Stewart, a distance of 303 kilometres. This is the shortest distance to port from the property and is about one half of the 607 kilometres to Prince Rupert via the Hazelton cut-off.

The short and less expensive haulage distance could be offset however by:

1) Potentially difficult and costly construction through the Bear Pass.
2) The need to develop storage, coal handling and docking facilities at Stewart.

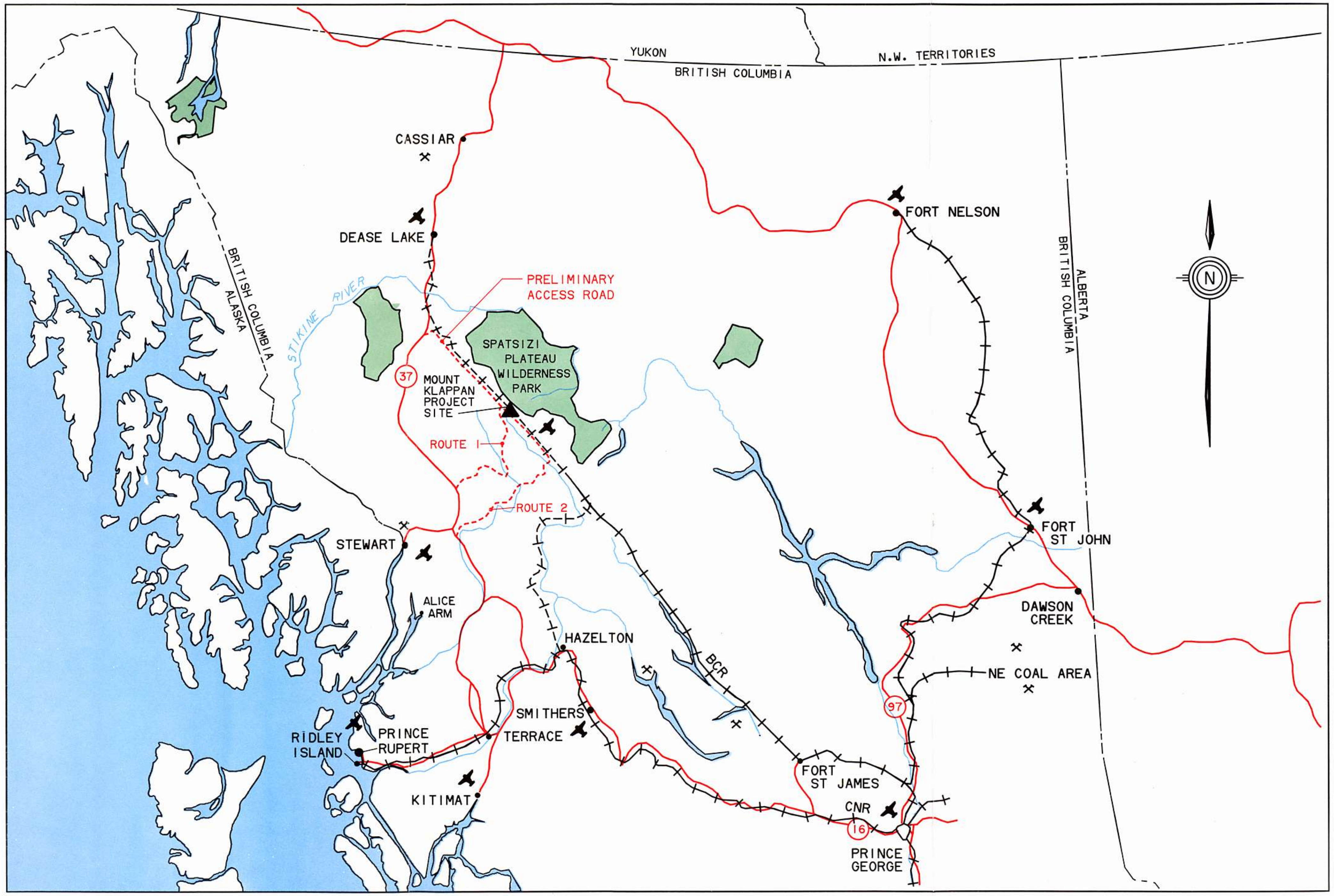
A comparative study of the costs of both routes will be required.

Similarily, a port at Alice Arm and railroad access to this area will be assessed to determine the capital and operating costs relative to Stewart and Prince Rupert.

FIGURE 6.1

MT. KLAPPAN COAL PROPERTY

REGIONAL ACCESS MAP



LEGEND			
EXISTING RAILWAYS	BCR BRITISH COLUMBIAN RAILWAY	EXISTING HIGHWAYS	AIR STRIPS
PROPOSED RAILWAYS	CNR CANADIAN NATIONAL RAILWAY	PROPOSED ROADS	EXISTING MINES

SCALE 0 50 100 km

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Gulf

REDRAWN FROM: PHILLIPS BARRATT KAISER PLATE 1.1

6.2 Port

If the coal is shipped to Prince Rupert there is sufficient excess capacity at the Ridley Island Coal Port to handle both the production from the northeast coal field and the production from Klappan. However, handling and loading facilities would have to be modified to handle anthracite gently at the transfer and discharge points.

The port at Stewart would require development of transport, storage and loading facilities. A preliminary investigation of the port alternatives has been undertaken.

A third possibility is to utilize the Alice Arm area for development of a new port. Very preliminary information indicates that costs of development at Alice Arm are similar to those for Stewart.

6.3 Road Access

Initial road access to the property during exploration and the project construction will be provided along the British Columbia Railway grade running north from Mt. Klappan. This will be done early in 1984 by reconstructing two bridges on the right-of-way and rebuilding a third bridge over the Klappan River to provide a connection between the Ealue Lake road and the railroad right-of-way. The Ealue Lake road joins Highway 37 thereby providing road access to the provincial highway system. Installation of the Klappan bridge is now in progress. Arrangements will be made to restrict public access to the east side of the Klappan River and the Spatsizi Plateau Wilderness Park.

Two possible routes, illustrated on Figure 6.1, could be constructed to provide future permanent access. The northern route (1) involves 146 kilometres of new construction, while the southern route (2), requires 226 kilometres of construction. Construction of either of these roads is not necessary to start the Mt. Klappan project but would be needed for public access to the townsite at a later date. An access road from the west (Highway 37), terminating at the minesite would have the added benefit of restricting access to the Spatsizi Plateau Wilderness Park on a long term basis.

6.4 Townsite

The work force for the Hobbit-Broatch mine, estimated at 1091 in the 3.5 million tonnes per year case, will require housing in a public townsite relatively close to the mine. Neither Iskut, 100 air kilometers to the north, nor Smithers, 280 air kilometers to the south, are suitable because the shift work at the mine requires that personnel be located less than 50 road kilometers from the mine site.

If initial production is on the order of 1,000,000 tonnes of product coal, the personnel would be housed at an existing town site, possibly Smithers, and flown to the mine on a rotational basis. A camp would be established at the mine site for housing personnel during a work period. The work force for such a mine would be in the order of 300 employees.

If production is increased to a level of 2 to 3 million tonnes per year, consideration will have to be given to the building of a town. Evaluation of a number of sites by both Gulf and the B.C. Government will be required before a final choice is made. An initial site which appears favourable on preliminary examination is located near the southeast edge of the property as shown on Figure 4.1.

6.5 Electrical Power

Electricity for the initial construction activity would be supplied from diesel electric units. Based on a preliminary assessment a permanent supply of power could be delivered to the property by construction of a 138 Kv line from Hazelton or by an anthracite fired thermal plant on site. Development of a small hydro site is a third option for a permanent power supply.

Additional studies will have to be done to evaluate the relative merits of these power options.

7.0 PROPOSED EXPLORATION AND DEVELOPMENT SCHEDULE

7.1 Introduction

This section presents, year by year, a nominal schedule by which Gulf Canada Resources Inc. could bring the property through to a "decision to proceed". The actual date, at which such a decision could be made is, and will be, dependent on market and economic evaluations for the project. The nominal schedule covers a 4 year period with the decision to proceed being made in Year 2 and production commencing in the latter part of year 4 or early in year 5. This schedule is a guideline only and individual phases may be delayed or started earlier as required.

Due to the nature of the anthracite market it may be necessary to provide a limited, but significant, tonnage of coal for market testing prior to full scale development of the project.

7.2 Schedule

7.2.1 Year 1

The Year 1 program of the nominal schedule comprises exploration and development drilling, the removal of bulk samples for analytical work, and the construction of exploration roads to facilitate rotary drilling of prospective open pit areas. Baseline studies required for a Stage I submission under the "Guidelines For Coal Development" are initiated and continue throughout the year. Work on a feasibility study begins during the last quarter of Year 1.

7.2.2 Year 2

During the first quarter of Year 2 the feasibility study is completed and a Stage I submission made. Project economics are evaluated and if the market conditions are favourable a decision to proceed with development of the project can be made during the latter part of the year.

Development drilling, both diamond and rotary, and bulk sampling continue. Work on a Stage II submission begins and continues through the latter part of Year 2.

7.2.3 Year 3

The Stage II submission is completed during the first quarter of Year 3.

A decision to proceed in year 2 would result in the commencement of project development and construction during year 3.

In year 3 of the nominal schedule, construction of railroad access to the property as well as construction of a powerline to Mt. Klappan commences. Stage III approvals are sought. If the decision is made to ship the coal to Prince Rupert and sufficient sales are obtained to justify the cut-off rail route, this construction work starts or, alternately, if the economics are favourable the railroad route to Stewart or Alice Arm is undertaken rather than development of the Skeena route.

7.2.4 Year 4

Construction at the mine site continues and is completed by the end of Year 4. Production may commence near the end of the year.

7.2.5 Year 5

Full scale production as determined by railroad availability.

8.0 SOCIOECONOMIC IMPACT

The development of the Mt. Klappan property has the potential to create significant positive socioeconomic impacts provincially and, more particularly, in the northwest region of British Columbia. The main impact area includes Smithers, Hazelton, Telegraph Creek, Stewart, Iskut, Terrace, Prince Rupert, and possibly, Alice Arm. The following outline is based on the assumption that the project would be built to produce 3.5 million tonnes per year of mixed anthracite product.

The project will contribute to economic stability and long term growth of the northwest region. Through innovative training programs the general level of skills available to the mining communities can be developed and enhanced. The preliminary study indicates that the specific socioeconomic impacts arising from the development of the Mt. Klappan mine will include:

- up to 1101 direct, and 551 indirect jobs created in the northern sector of the northwest region of British Columbia;

- regional income increased by $40 million per year for the duration of the project;

- total provincial employment increased by 2750 and provincial income increased by $50 million per year;

- a new townsite near the mine site with a range of facilities including schools, health care services, community facilities and retail consumer services;

- some 2500 man years of construction labour to build the mine. Constructions labour will also be required in the building of the infrastructure;

- a maximum regional population increase of 3800 people. Regional population increases will be determined by the extent to which local employment resources are under-utilized at the time the project is developed. There could be some shift to the new town from established communities. The maximum townsite population would be 3500;

- about 1200 housing units at the townsite, of which some 1100 will be required in the first four years of production;

- capital expenditures on infrastructure development of over $535 million. Significant additional costs will be incurred on infrastructure components for which costs are not yet available;

- mine capital expenditures of $578 million, of which $431 million will be expended in the first five years of development and production;

- operating expenditures of $125 million per year will be required.

9.0 ENVIRONMENT

9.1 Summary

The basic finding of a preliminary review of existing data undertaken by Environmental Management Associates in 1983 is that no environmental factor was found which precludes development of the Mount Klappan coal project. Environmental impacts will occur as a result of project development, but proper planning, design, construction, operation and reclamation will reduce the significance of these impacts.

To provide the environmental base line data for planning the mitigative measures required in the mine design, the following studies will be undertaken in 1984.

(1) Climate and Air Quality
(2) Surficial Geology/Vegetation
(3) Wildlife
(4) Fisheries
(5) Water Quality and Hydrology

The proximity of the Spatsizi Plateau Wilderness Park to the potential mine area requires carefull consideration as the project plans are developed.

9.2 Land Use

The land use can be described under two categories, Resource Use and Land Status.

9.2.1 Resource Use

9.2.1.1 Mines

The recently completed study by the British Columbia Government entitled "Northwest Economic Development Studies" has indicated that the potential for development of the mineral industry of northwest British Columbia is heavily dependant upon the provision of transportation, power and suitable municipal infrastructure. The Mount Klappan coal project has the potential to "spearhead" the establishment of such infrastructure.

9.2.1.2 Forestry

In the Mount Klappan project area the timber is of poor quality consisting primarily of western hemlock and Balsam fir. Further south, particularly in the Hazelton area, there are several timber operations. The rail access required for the Klappan project could stimulate timber harvesting in areas that are at present economically unattractive because of the lack of such access.

9.2.1.3 Agriculture

There is no agricultural development either at the Mount Klappan site or along its potential access corridors except in the river valleys in the vicinity of Hazelton. Near Hazelton, the principle activity is cattle ranching, with limited scale forage and vegetable crop production. This type of production could be extended along the river valleys adjacent to the routes selected for the Mount Klappan railway and/or highway access.

9.2.2 Land Status

9.2.2.1 Government, Residental, Commercial

The Klappan area and most of the related corridors are located on provincial crown land. It is therefore possible for the government to direct and encourage settlement and commercial development, by granting land deeds in a manner which is beneficial to the area as a whole.

9.2.2.2 Historical and Cultural Uses.

The only known historical area of archaeological significance for either the project area or associated corridors occurs within the Kispiox Valley. Further investigation of these cultural values is needed.

9.3 Physical Environment

The physical environment can be described under three broad classifications; Atmospheric Environment, Terrestrial Environment and Aquatic Environment.

9.3.1 Atmospheric

9.3.1.1 Climate

The Skeena mountain range west of the Klappan property limits the influx of warm moist pacific air and gives the property a drier and colder climate than areas to the west of these mountains. Precipitation is about 300 millimetres per year; similar to that at Calgary, Alberta. The average yearly minimum temperature is -41°C, the average maximum is 26°C which compares to values of -45°C and 36°C at Calgary.

Winds are variable but in general the prevailing direction is from the southwest. Detailed meterological studies on the Klappan property based on the records from the Didene weather station located at the property site are in progress.

9.3.1.2 Air Quality

Air quality studies have been commissioned but at the present time no data is available. It is anticipated that quality will be of a pristine nature.

The present studies of base line data will provide the information required to set standards which can be incorporated into the mine and plant designs.

9.3.2 Terrestrial Environment

9.3.2.1 Surficial Geology/Vegetation

The two major surficial materials on the Klappan property are weathered bedrock at higher elevations and glacial morraine or outwash at lower elevations. The bedrock above tree line (which occurs at about 1500M) is either barren of vegetation or supports a sparse low growth of the mountain heather variety. This Alpine Tundra covers about 60% of the property.

A Subalpine Fir Zone occurs as a transition from the Alpine Tundra to the lower forest area. The area of transition which supports low vegetation and stunted trees comprises 10 to 15% of the property.

Within the forest area well drained sites support Subalpine Fir, Lodgepole Pine and Engelmann Spruce; less well drained areas support White and/or Black Spruce.

The poor drainage characteristics of the impervious glacial silts and clays give rise to peat bogs and muskegs which cover about 10% of the property.

Detailed and site specific studies of the vegetation cover on the property will be undertaken in 1984.

9.3.2.2 Wildlife

Caribou, mountain goat, stone sheep, moose, mule deer, grizzley bear, black bear and wolf are known to occur on or near the Klappan property. In addition, fur bearing species such as lynx and wolverine also range through the area. Raptors (birds of prey) have been observed as well as upland game birds, notably ptarmigan.

A wildlife study has been initiated which will collect data on these species for a full year. Important times to be included in the study are winter range occupancy, breeding areas, (calving, lambing and kidding areas) migration routes, mineral licks and denning and nesting areas.

The caribou are of particular concern. This species have been seen on the property. Informal observations made during the winter months however have indicated a low occurrence of any animal tracks within the property, although such tracks were abundant north of the property. Such observations suggest the property is not utilized as a winter range, however careful and systematic documentation will be undertaken in 1984.

To augment the Consultant's site specific studies of caribou and wolves on or adjacent to the Klappan property, Gulf has made a research grant to the Spatsizi Association for Biological Research to support their regional studies of these species.

9.3.3 Aquatics Environment

9.3.3.1 Fisheries

In streams within the property boundaries, only Dolly Varden and Rainbow trout species are anticipated and these are believed to have a relatively low population.

Studies have been initiated which will identify the existing biophysical environment with particular emphasis on sport and commercially valuable species.

Studies will be directed towards:

(1) Documentation of the distribution and composition of the fish community in lakes and streams. The upstream limit of salmon and other andromous species in the Skeena, Nass and Klappan rivers will be carefully documented.

(2) Obtaining information on the crucial habitat dependencies of the important fish in the area. Overwintering areas, spawning areas for spring and fall spawners, major fish food items, location of important migratory routes, and distribution of benthic invertebrates must also be studied.

9.3.3.2 Water Quality and Hydrology

A program of measurement of both water quality and quantity on the Klappan property has been initiated and will provide one year of base line data during 1984. These studies will measure the parameters of water quality as outlined in the B.C. Coal guidelines.

The initial parameter list is as follows:

P.H.

Total Solids

Disolved Solids

Phenols

Total Alkalinity

Organic Carbon

Suspended Sediment

Turbidity

Specific Conductance

Temperature

Sulphate

Total Iron

Hardness

The nutrient quality of the water will also be assessed.

Water quantity measurements will be obtained and staff gauge sites will be established. These measurements will be made on the Spatsizi, Didene Creek, Little Klappan River and the Nass River and other minor creeks within the property.

PBK Phillips Barratt Kaiser Engineering Ltd.

MOUNT KLAPPAN COAL PROJECT

Gulf GULF CANADA RESOURCES INC.