

SHELL  
K-HORSESHOE RIDGE 80(1)A

April 30/81

HORSE SHOE RIDGE  
COAL PROJECT  
SHELL CANADA RESOURCES LTD.  
C.L.# 295, 296, 299, 368, 369, 373  
82-0-15  
DAVE HANCOY

404

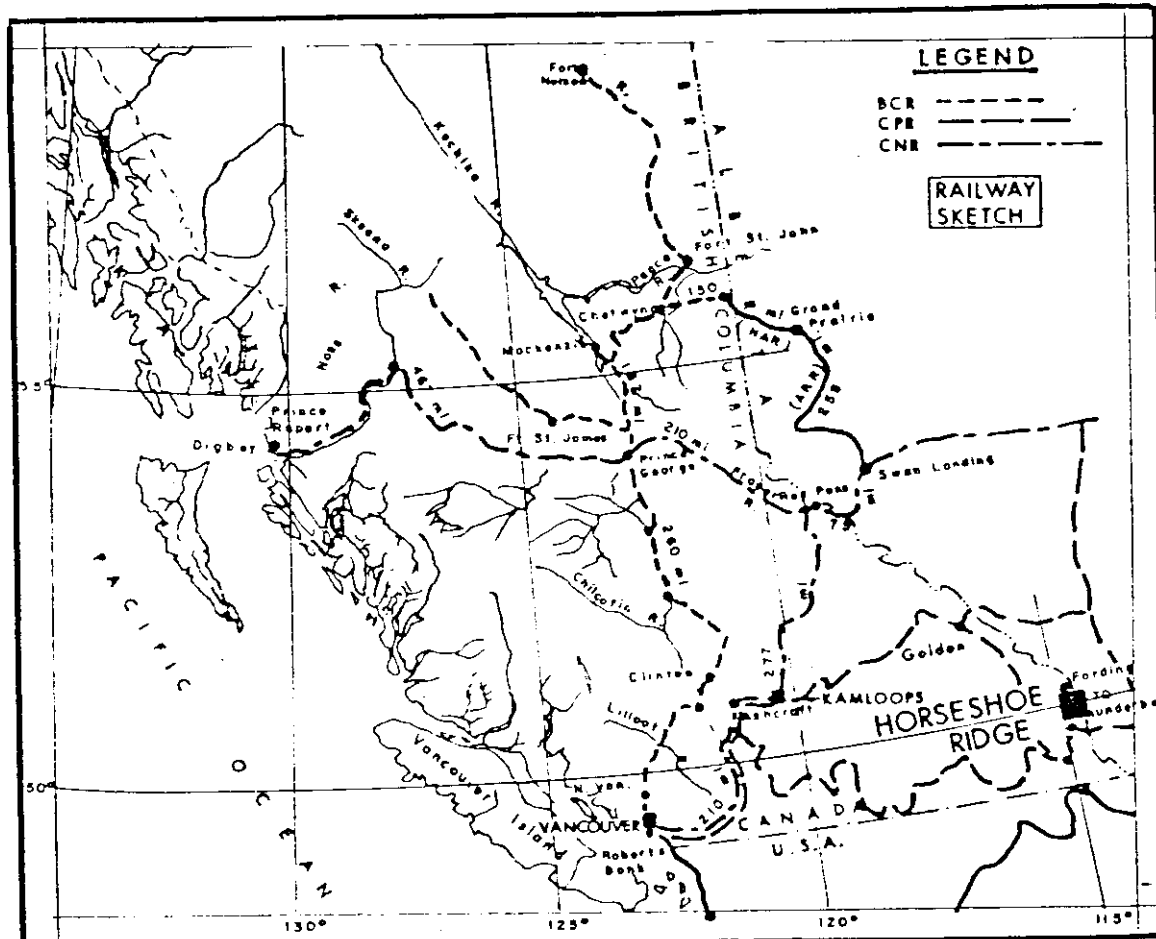
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**GEOLOGICAL BRANCH GEOLOGICAL BRANCH  
ASSESSMENT REPORT ASSESSMENT REPORT**

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# HORSESHOE RIDGE COAL PROJECT



1980 GEOLOGICAL REPORT

COAL LICENCE NO'S  
295, 296, 299, 368, 369, 373  
KOOTENAY LAND DISTRICT  
N.T.S. 82G/15  
LATITUDE: 49°57' NORTH  
LONGITUDE: 114°45' WEST

HELD BY: SHELL CANADA RESOURCES LIMITED  
OPERATED BY: CROWS NEST RESOURCES LIMITED

REPORT COMPILED BY: DAVE HANDY      EXPLORATION PERIOD: JUNE-SEPTEMBER, 1980  
GEOLOGIST  
C.N.R.L.      SUBMITTED: APRIL 30, 1981

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refer  
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Horseshoe  
Ridge  
80(4)A

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- APPENDIX 5 ✓ Survey Traverse Map

REFER TO: Confidential Coal Analysis File  
K-Shell - Horseshoe Ridge 80(4)A

1.0 SUMMARY

The Horseshoe Ridge Project is contained within six B.C. Licences covering 1425 ha. and forming part of Group #263. The licences are held by Shell Canada Resources Limited and operated by its wholly-owned subsidiary, Crows Nest Resources Limited.

The property is located in the Crows Nest Pass area of the Rocky Mountains in southeastern British Columbia about 1150 kilometres east of Vancouver and 25 km northeast of Sparwood. Horseshoe Ridge lies directly east of CNRL's Line Creek Mine which is 9.5 km from the coal preparation plant and rail loop currently under construction.

The upper part of the Kootenay Formation-Coal Bearing Member is eroded on Horseshoe Ridge. The existing 245 to 400 metres of coal bearing section includes 10 coal seams of 45 metres aggregate thickness. The coal bearing strata have been folded into a north plunging syncline with the east limb forming most of the west slope of the ridge. The west limb of the syncline has been truncated by the Fording River thrust zone, thus the lower west slope strata are intensely deformed by faulting and folding.

Previous exploration concentrated on the upper west slope where 38 million tonnes of open pit (raw recoverable, after mining loss) reserves have been delineated at an overburden ratio of 7.8:1 bank cubic metres



waste per tonne of coal. In 1980 the quality data for these reserves was supplemented by the extension and bulk sampling of Adit 13 (Seam 8 Upper) and Adit 14 (Seam 8 Lower and 8 Rider). A new adit, Adit 19 was driven in Seam #7 and bulk sampled.

Most of the 1980 exploration program concentrated on the lower part of the west slope with the purpose of finding additional reserves in the truncated west limb of the Horseshoe syncline. Three stretches of road were constructed and coal showings were backhoe trenched. The roads were mapped in detail and one rotary drill hole was completed. This work indicates the Coal Bearing Member is highly disrupted by the Fording River Fault Zone in the west limb and axis area of the syncline. Several coal seams were located but their stratigraphic position and continuity is questionable. It is apparent that the coal reserve potential of the west limb is extremely limited. The total 1980 field expenditure was \$386,679.

## 2.0 INTRODUCTION

### 2.1 Location and Access

Enclosure 1: Index and Location Map.

The Horseshoe Ridge Project is located in the front ranges of the Rocky Mountains in south eastern British Columbia. Horseshoe Ridge is centered at approximately:

Latitude 49° 57'N

Longitude 114° 45'W

The project lies immediately east of CNRL's Line Creek Mine Development, 9.5 km from the Line Creek Coal Preparation Plant and rail loop, both of which are presently under construction. Horseshoe Ridge is situated roughly midway between two major operating metallurgical coal mines, B.C. Coal's Harmer Ridge to the south and Fording Coal to the north.

Vehicular access into the area is via the Line Creek haul road or via the Grave Lake road from the south.

## 2.2 Tenure

Enclosure 2: Coal Land Disposition Map

Enclosure 3: B.C. Land Tenure Standing

Group #263 consists of ten B.C. Coal Licences (Nos. 295, 296, 299, 300, 302, 303, 368, 369, 370, 373) and covers an area of 2203 hectares. These licences are held by Shell Canada Resources Limited and operated by its wholly-owned subsidiary Crows Nest Resources Limited.

The Horseshoe Ridge Project is located in the northern section of Group #263 and is covered by six of the above licences (295, 296, 299, 368, 369, 373, totalling 1425 hectares in area). Another project (TeePee Mountain) is located on the southern part of Group #263.

### 3.0 WORK DONE

#### 3.1 Summary of Previous Work

Work has been conducted on Horseshoe Ridge by Crows Nest Industries and Crows Nest Resources Limited and has consisted of:

- o road construction
- o adit drivage/sampling
- o rotary/diamond drilling
- o topographic surveying
- o field geologic mapping.

#### 1968

Spartan Air Services photographed the licence area and provided air photos at scales of:

1:24,000

1:36,000

Based on information obtained during geological mapping, cross-sections were drawn at 1:4,800 scale.

Four adits totalling 176.6 metres were driven into the #8 Seam.

<u>Adit No.</u>	<u>Seam Designation</u>	<u>Drivage (m)</u>
1	8 Lower	33.5
2	8 Upper	66.4
13	8 Upper	31.6
14	8 Lower	45.1

Adits were bulk sampled for the purpose of coal testing.

1970

Twelve rotary drill holes (3,089 metres) were drilled on the west face. Nine of these holes were located on the southern half of the ridge. Main seams intersected were: #6, #7 and #8. Holes were TD'd in the #9 sandstone. One drill hole (HSR-D-101) drilled through the seams mentioned above and was TD'd in the Basal Sandstone member. Coal samples were taken for analyses and BPB ran a geophysical log suite on each hole which included:

- o gamma ray
- o density
- o neutron - neutron
- o caliper

- 7 -

Aerial photography was flown by Northwest Survey Limited to produce:

- 1:20,000 air photos
- 1:40,000 air photos
- 1: 2,000 topographic maps

Topographic surveying was conducted by Shell personnel.

1979

Field operations were carried out by Jeff Schlender and Jack Livingstone of Crows Nest Resources Limited (CNRL).

Exploration included:

- detailed field geologic mapping (1:5000 scale)*
- geologic mapping of existing road cuts
- backhoe trenching
- diamond drilling
- rotary drilling
- adit rehabilitation.

The field mapping program concentrated on delineating and designating prominent sandstone units.

Three diamond core holes (835 metres) and seven rotary air holes

(1352 metres) provided subsurface data. Coal seam samples were sent to the CNRL laboratory in Fernie for analysis.

Two adits: #13 (8 Upper Seam) and #14 (8 Lower Seam) were cleaned and retimbered for future sampling.

### 3.2 Work Done in 1980

Field operations were supervised by Dave Handy of Crows Nest Resources Limited. Exploration included:

- o detailed geologic mapping (1:2,000)
- o construction of 3 new bulldozer roads
- o backhoe trenching
- o rotary drilling
- o adit drivage and bulk sampling.

Field mapping was concentrated on the unexplored lower west slope of the ridge.

Three stretches of road were constructed to provide access to the lower west slope. Coal showings were backhoe trenched.

One rotary drill hole was completed to a depth of 294.1 m. Neilsen Drilling Ltd., using a Schramm 65 rig, drilled from 0 to 123.4 metres. S.D.S. Drilling Ltd. using a Gardner-Denver 1700 drill completed the hole to 294.1 m.

Adit 13 (Seam 8 Upper) was extended from 31.6 metres to 56.7 metres and bulk sampled (5.0 tonnes).

Adit 14 (Seam 8 Lower and 8 Rider) was extended from 45.1 metres to 50.0 metres and bulk sampled (5.0 tonnes). A 7-metre cross-cut was constructed from the Adit 14 entry to the #8 Rider Seam and a bulk sample taken (5.0 tonnes). A new adit (Adit 19) was driven 35 metres into Seam #7 and a 10 tonne bulk sample was taken. Target Tunneling Ltd. carried out all the underground work.

The four bulk samples were shipped to Birtley Engineering in Calgary for washability tests and beneficiation in their pilot plant. A clean coal sample was then shipped to Ottawa (CANMET) for carbonization tests.

The total cost of the 1980 exploration work was \$386,679. Appendix I contains a copy of the Application to Extend Term of Licence which gives a detailed account of the amount and nature of expenditures applied to Group #263. Appendix 2 contains a detailed account of the expenditures applied to the licences on which the work was actually performed.



#### 4.0 GEOLOGY

The 1979 Horseshoe Ridge Geological Report described the geology of the project both in general and in detail. Part of this report is repeated herein but only to the extent that is required by the B.C. Coal Act Regulations to support any new conclusions or extensions of previous conclusions.

The work done in 1980:

- provided new information concerning the lower west slope (geological mapping).
- confirmed previous knowledge of the geology and reserves (drill hole and roads) and supplemented quality information (1979 drill hole sample analyses and 1980 bulk sample testing).

#### 4.1 Horseshoe Ridge Stratigraphy

The upper part of the Coal Bearing Member of the Kootenay Formation is eroded at Horseshoe Ridge. The Coal Bearing Member is 245 to 400 metres thick and contains at least 10 seams of 45 metres aggregate thickness. The coal bearing strata overlie the Basal Sandstone Member of the Kootenay Formation which is a

distinct mappable rock unit at Horseshoe Ridge. The coal stratigraphy can be described as follows:

- Number 10 Seam lies three metres above the Basal Sandstone. Its thickness varies from 6 metres in the south to 2 metres in the north.
- Interbedded sandstone and shale separate #10 Seam and #9 Seam. Number 9 Seam, where present, averages 2 metres in thickness.
- The stratigraphy between #9 and #8 Seams consists of 100 metres of interbedded sandstones, siltstones and shales. A major sandstone (#9 sandstone) averaging 40 metres in thickness is located mid-section. On surface, this resistant #9 sandstone forms the top of the ridge and in subsurface could be used as the footwall for open pit mineable reserves.
- Number 8 Seam is divided into Upper and Lower units totalling 17 metres of coal in 25 metres of section. The top of 8 Upper Seam has been designated as the datum line for correlation on Horseshoe Ridge.

- Interbedded sandstones, siltstones, and shales separate #8 Seam from #7 Seam. A major sandstone unit (#7 Sandstone) is located mid-section and is 15 to 25 metres thick.
  
- Number 7 Seam is divided into:
  - o 7 Upper Seam .... 6 m thick
  - o 7 Lower Seam .... 3 m thick.

Interbedded siltstones and shales separate the 7 Upper and 7 Lower seams. The #7 Seam totals 9 metres of coal in 20 metres of section.

- Number 6 Seam is separated from #7 Seam by 40 metres of interbedded sandstone, siltstones, and shales. This seam has an average thickness of 4 metres.
  
- Above #6 Seam, four seams greater than 1 metre thick have been encountered. Thus far correlation of these seams has proven difficult due to structural irregularities.

#### 4.2 Horseshoe Ridge Structure

Horseshoe Ridge forms part of the east limb of the Fording River syncline. Locally the ridge is structurally complicated by folding and faulting within an asymmetrical syncline. The west

limb is nearly vertical and the east limb dips 25-70° west forming a dip-slope situation.

On the east limb, coal bearing strata contain high angle thrust faults trending N10°W. Over the extent of the property, these thrusts increase in frequency from south to north. The thrusts sub-parallel bedding resulting in structurally thickened sections of:

- o Basal Sandstone
- o #10 Seam
- o #9 Seam

The west limb is truncated and its remnant has been severely disturbed by the Fording River thrust zone. Evidence of faulting exists throughout the west limb and axis area. Bedding attitudes vary considerably over short distances. Mappable sandstones and coal seams are discontinuous and correlation with the east limb coal bearing section is difficult.

A considerable amount of interpretation will have to be done to tie in the west limb geology with the east. However, it can already be seen that the coal reserve potential of the west limb is extremely limited.

## 5.0 COAL QUALITY

1979 drill hole samples were not analyzed at the time of writing the 1979 Geologic Report, therefore they are included herein. The laboratory analyses sheets for these samples are included in Appendix 3. An average analysis for each seam sampled has been compiled from both rotary cuttings and core samples, using raw coal and clean coal data. Seams having more than one sample have been weighted according to the sample interval to produce a weighted average analyses for the seam in each hole. Tables 2 to 14 contain the weighted averages. The individual seams intersected by either type of hole were then averaged over the property to produce Table 1.

Adit sampling and analyses were done during 1980. FSI and ash values are posted on the Adit Profiles (Enclosures 5, 6, 7) as well as a detailed lithologic description with approximate analyses for #7, #8 Upper, #8 Lower and #8 Rider Seams. Reports of the washability tests performed are included in Appendix 4.

The carbonization test reports have not been received at this time.

The coal making up the Horseshoe Ridge mineable reserves can be ranked as: Medium Volatile Bituminous - metallurgical grade, low sulphur (<0.5%) coal with an average proximate analyses as follows:

Clean Coal, Air Dried Basis

Washed to S.G. 1.5

Moisture	-	0.41%
Ash	-	6.82%
V.M.	-	24.61%
F.C.	-	68.03%
FSI	-	6 1/2

6.0 BIBLIOGRAPHY

Schlender, J. Horseshoe Ridge Coal Project 1979 Geological Report -  
CNRL.

Gilmar, P. Horseshoe Ridge Coal Project 1978 Geological Report -  
CNRL.

Hannah, T. Line Creek Coal Project 1979 Geological Report -  
CNRL.

2/Ne.19

7.0 PROFESSIONAL VERIFICATION OF REPORT

Entitled: Horseshoe Ridge Coal Project  
Kootenay Land District, B.C. 1980  
B. C. Coal Licences  
No. 295, 296, 299, 368, 369, 373

Mr. David L. Handy planned and carried out the 1980 geological field program on Horseshoe Ridge, B.C. Coal Licences held by Shell Canada Resources Ltd. and operated by Crows Nest Resources Ltd. He also prepared this report. Mr. Frank Martonhegyi supervised the activity of this program under the general direction of the undersigned.

Dave Handy Honours B. Sc., graduated in Geology from the University of Waterloo, in 1977. Prior to his graduation Mr. Handy worked as an assistant for two geotechnical companies and after graduation as a geologist for a major exploration company in Saskatchewan. Mr. Handy has worked on several coal properties for Crows Nest Resources Ltd. in British Columbia.

Frank Martonhegyi, M. E., graduated in Mining Geological Engineering from the University of the Heavy Industry, Hungary, in 1962; and received post-graduate training at the University of Saskatchewan, Saskatoon, in 1969-1971. His experience in Western Canadian coal exploration since 1971 includes positions with:

- CanPac Minerals Ltd., Calgary, Alberta
- Shell Canada Resources Ltd., Calgary, Alberta
- Crows Nest Resources Ltd., Calgary, Alberta

His prior experience includes underground coal mining geology, geotechnical engineering and geochemistry in Hungary, Austria and Canada.

He currently holds the position of District Manager, B. C. and other Canadian Coal Projects for Crows Nest Resources Limited.

I consider both the aforementioned geologists to be well qualified to undertake responsibilities they were assigned on this project. I am satisfied that the attached report dated April 30, 1981 has been competently prepared and justly represents the information obtained from this project.



J. J. Crabb, P. Eng.  
Vice-President-Exploration

April 30, 1981







Province of British Columbia  
Ministry of Energy, Mines and Petroleum Resources

APPLICATION TO EXTEND TERM OF LICENCE

I, Bolton Agnew agent for Shell Canada Resources Limited  
(Name) (Name)  
P.O. Box 100  
(Address) (Address)  
Calgary, Alberta, T2P 2H7

Valid FMC No. 207568

hereby apply to the Minister to extend the term of Coal Licence(s) No(s). 295, 296, 299, 300, 302, 303, 368, 369, 370, 373; 10 Licences; 2203 Hectares

for a further period of one year.

2. Property name Horseshoe Ridge and Teepee Mountain, Group #263, Kootenay Land District

3. I am allowing the following Coal Licence(s) No(s). to forfeit N/A

4. I have performed, or caused to be performed, during the period January 30, 1980 to January 31, 1981, work to the value of at least \$ 499,673.90

on the location of coal licence(s) as follows:

CATEGORY OF WORK

	Licence(s) No(s).	Apportioned Cost
Geological mapping	292, 295, 296, 299, 300, 302, 303, 370	\$97,214.77
Surveys: Geophysical		
Geochemical		
Other (Location)	295, 296	12,873.17
Road construction	295, 296, 300, 302, 303, 370	153,176.34
Surface work	295, 296, 302, 303, 370	13,046.00
Underground work	296	79,992.88
Drilling	295, 302, 303	54,717.87
Logging, sampling, and testing	295, 302, 303	45,774.47
Reclamation	295, 296, 302, 303	13,094.15
Other work (specify)		
Off-property costs to date		29,784.25

5. I wish to apply \$ 499,673.90 of this value of work on Coal Licence(s) No(s). 295, 296, 299, 300, 302, 303, 368, 369, 370, 373

6. I wish to pay cash in lieu of work in the amount of \$ N/A on Coal Licence(s) No(s).

7. The work performed on the location(s) is detailed in the attached report entitled Horseshoe Ridge Geological Report '79 was submitted in April 1980, Horseshoe Ridge Geological Report '80 and Teepee Mountain Geological Report '80 will be submitted in 90 days.

1981.01.28  
(Date)

(Signature)

Land Supervisor  
(Position)

**CATEGORY OF WORK**

**GEOLOGICAL MAPPING**

Yes  No

	Area (Hectares)	Scale	Duration
Reconnaissance	3,000	1:5,000	
Detail: Surface	400	1:2,000	283 Man-Days
Underground			
*Other (specify)			
			Total Cost \$ 97,214.77

**GEOPHYSICAL/GEOCHEMICAL SURVEYS**

Yes  No

Method .....

Grid .....

Topographic Location on Surveys .....

\*Other (specify) .....

Total Cost \$ 12,873.17

**ROAD CONSTRUCTION**

Yes  No

Length 6.98 km Width 5 m

On Licence(s) No(s) 295, 296, 302, 303

Access to .....

Total Cost \$ 153,176.34

**SURFACE WORK**

Yes  No

	Length	Width	Depth	Cost
Trenching	1,594.6 m	1 m	2 m	
Seam Tracing				
Crosscutting				
*Other (specify)				
				Total Cost \$ 13,046.00

**UNDERGROUND WORK**

Yes  No

	No. of Adits	Maximum Length	No. of Holes	Total Metres	Cost
Test Adits	3*	64.31 m			
*Other workings					
* One new adit plus two old ones extended					Total Cost \$ 79,992.88

**DRILLING**

Yes  No

	Hole Size	No. of Holes	Total Metres	Cost
Core: Diamond				
Wireline	HQ	1	40.50	10,683.70
Rotary: Conventional	5-1/8"	6 *	594.26	44,034.17
Reverse circulation				
*Other (specify)				
* Cost of two Rotary holes drilled on Freehold land has been deducted				
Contractor Acadia, Nielsen, SDS Drilling Companies				
Where is the core stored? Horseshoe Property				
				Total Cost \$ 54,717.87

**LOGGING, SAMPLING AND TESTING**

Yes  No

Lithology: Drill samples	<input checked="" type="checkbox"/>	Core samples	<input checked="" type="checkbox"/>	Bulk samples	<input checked="" type="checkbox"/>
Logs: Gamma-neutron	<input checked="" type="checkbox"/>	Density	<input checked="" type="checkbox"/>		
*Other (specify) Caliper					
Testing: Proximate analysis	<input checked="" type="checkbox"/>	FSI	<input checked="" type="checkbox"/>	Washability	<input checked="" type="checkbox"/>
Carbonization	<input checked="" type="checkbox"/>	Petrographic	<input checked="" type="checkbox"/>	Plasticity	<input type="checkbox"/>
*Other (specify) .....					
				Total Cost to Date: \$ 45,774.47	

**OTHER WORK (specify details)**

Reclamation (harrowing, fertilizing, seeding) of roads, drill and adit sites

Total Cost \$ 13,094.15

On-property costs 469,889.65

To Date Off-property costs 29,784.25

To Date Total Expenditures \$ 499,673.90

1981.01.28 (Date)

*N. J. Kowalski*  
(Signature)

Manager - Accounting, CNRL  
(Position)

\*A full explanation of other work is to be included.

**HORSESHOE RIDGE PROJECT Part of Group #263**

Application to extend term of licence for the entire group was submitted January 28th, 1981.

**CATEGORY OF WORK**

**GEOLOGICAL MAPPING**

Yes  No

	Area (Hectares)	Scale	Duration
Reconnaissance	2200	1:5000	
Detail: Surface	400	1:2000	197 man-days
Underground			
*Other (specify) .....			
			Total Cost \$ 64,487.50

**GEOPHYSICAL/GEOCHEMICAL SURVEYS**

Yes  No

Method .....

Grid .....

Topographic Location Surveys

\*Other (specify) .....

Total Cost \$ 10,073.17

**ROAD CONSTRUCTION**

Yes  No

Length 5.6 km Width 5 m

On Licence(s) No(s) 295, 296

Access to .....

Total Cost \$ 142,209.58

**SURFACE WORK**

Yes  No

	Length	Width	Depth	Cost
Trenching	519 m	1 m	2 m	
Seam Tracing				
Crosscutting				
*Other (specify) .....				
				Total Cost \$ 5,410.00

**UNDERGROUND WORK**

Yes  No

	No. of Adits	Maximum Length	No. of Holes	Total Metres	Cost
Test Adits	3*	64.31			
*Other workings	1 new adit, 2 old adits extended				
					Total Cost \$ 79,992.88

**DRILLING**

Yes  No

	Hole Size	No. of Holes	Total Metres	Cost
Core: Diamond				
Wireline				
Rotary: Conventional	5 7/8"	1	294.1	
Reverse circulation				
*Other (specify) .....				
Contractor	Nielsen Drilling, SDS Drilling			
Where is the core stored?	.....			
				Total Cost \$ 19,248.50

**LOGGING, SAMPLING AND TESTING**

Yes  No

Lithology: Drill samples	<input checked="" type="checkbox"/>	Core samples	<input type="checkbox"/>	Bulk samples	<input checked="" type="checkbox"/>
Logs: Gamma-neutron	<input checked="" type="checkbox"/>	Density	<input checked="" type="checkbox"/>		
*Other (specify) Caliper					
Testing: Proximate analysis	<input checked="" type="checkbox"/>	FSI	<input checked="" type="checkbox"/>	Washability	<input checked="" type="checkbox"/>
Carbonization	<input checked="" type="checkbox"/>	Petrographic	<input checked="" type="checkbox"/>	Plasticity	<input type="checkbox"/>
*Other (specify) Sulphur, BTU					
					Total Cost \$ 38,149.35

**OTHER WORK (specify details)**

Reclamation .....

Total Cost \$ 1,777.62

On-property costs 361,348.60

Off-property costs 25,330.90

Total Expenditures \$ 386,679.50

Original dated 1981.01.28  
(Date)

ORIGINAL SIGNED BY  
W. S. KOWALSKI  
(Signature)

Manager - Accounting CNRL  
(Position)

\*A full explanation of other work is to be included.

Date: DECEMBER 8, 1980

To: CROWSNEST RESOURCES LIMITED (CNRL)

From: SHELTECH CANADA

Subject: HORSESHOE RIDGE 4051D  
S.E. BRITISH COLUMBIA

All survey control in the Horseshoe Ridge area is based on the Crowsnest Control Network surveyed in the spring of 1980 and using July 14, 1980 results. From this data station 'Sheep' was established by resection using Stations '105', 'Crown', and 'Hump'. Also station 'En Sta' was established from 'Sheep' and tied in through traversing with good precision.

From these control points, 3 adits, 1 drill hole, and 69 traverse points to survey 5.6 km of new road were surveyed.

Conventional survey methods using both a 1" and a 20" theodolite and electronic distance measuring equipment were used to obtain the survey data. Calculations were done using the U.T.M. system with distances being reduced to plane and bearing referenced to 117° W. The results were given to CNRL personnel in both tabular and plan form.

The cost attributed to Horseshoe Ridge was approximately \$9,100.



D. Poulson

BK:sm