

PR-Willow CK 841-2)A



Crows Nest Resources

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P.O. Box 2699, Station M, Calgary, Alberta T2P 2M7 Telex 03-822505 **LIMITED**

March 18, 1985

Ministry of Energy, Mines & Petroleum Resources
617 Government Street
Victoria, B.C.
V8V 1X4

Attention: Mr. P. Hagen, Coal Administrator

Dear Mr. Hagen:

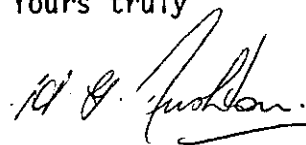
Enclosed please find our report on the Willow Creek project.

This report has been prepared by Mr. B. McKinstry, Staff Geologist, Crows Nest Resources. Mr. McKinstry, M.Sc., graduated in Geology from Carleton University in 1980. Prior to joining Crows Nest Resources Limited in 1981, Mr. McKinstry worked on a number of mineral exploration programs in northern Ontario, Northwest Territories, Manitoba and British Columbia.

Field work was organized and supervised by Mr. A. White, B.Sc., and Mr. D. Fietz, C.E.T, employees of Crows Nest Resources.

In my opinion, the above mentioned personnel are fully qualified by training and experience to have conducted the exploration program and to have prepared this report.

Yours truly



H.G. Rushton
Vice President - Development

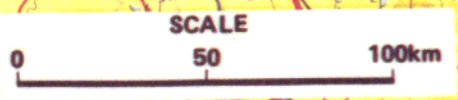
Enclosure

CONFIDENTIAL
GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 691

BRITISH COLUMBIA

ALBERTA



Crows Nest Resources Limited
EXPLORATION

WILLOW CREEK
N.E. BRITISH COLUMBIA
LOCATION MAP

N.T.S. - 930/9

AUTHOR	SCALE AS SHOWN	ENCLOSURE NO.
DATE	REVISED	DRAWING NO. AA-872
To: Accountary		

WILLOW CREEK PROJECT

N.E. B.C.

COAL EXPLORATION, 1984

COAL LICENCES:

COAL GROUP #371 6250, 6255, 6269-6274

PEACE RIVER LAND DISTRICT, NORTHEASTERN

B.C.

B.C. COAL LICENCES HELD BY SHELL CANADA

RESOURCES LIMITED; OPERATED BY CROWS NEST

RESOURCES LIMITED

NATIONAL TOPOGRAPHIC SERIES: 93 0/9 (MOUNT HULCROSS)

LATITUDE AND LONGITUDE:

55° 35' NORTH LATITUDE

122° 10' WEST LONGITUDE

*55° 34'
more middle property
B.D.*

AUTHOR:

B. McKINSTRY

FIELD WORK:

A. WHITE/D. FIETZ

JUNE, 1984

SUBMISSION DATE:

APRIL 23, 1985

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LIST OF ENCLOSURES

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- ENCLOSURE 2 WILLOW CREEK - 1984: LAND DISPOSITION MAP ✓
(1:50,000)
- ENCLOSURE 3 GEOLOGICAL COMPILATION MAP - MOUNT HULCROSS
(1:50,000)
- ENCLOSURE 4 GEOLOGICAL MAP - WILLOW CREEK (1:10,000)
- ENCLOSURE 5 1984 FIELD NOTES CODED TO GEOLOGY MAP LOCATIONS

SUMMARY

The Willow Creek property consists of eight B.C. coal licences within coal group #371.

During June, 1984 reconnaissance-type geological mapping was completed over the licence area.

The purpose was to 'ground-truth' previous work and possibly locate new outcrops. The results have improved the geological base map for the property. Examination of previous drilling information indicates a limited coal potential for the upper section of the Gates member of the Commotion Formation Fort St. John Group. It is recommended that future exploration be conducted in areas having open pit mining potential within the lower section of the Gates. Results of coal analyses indicate the rank for this coal to be medium volatile bituminous.

1.0 INTRODUCTION

The Willow Creek Property held by Shell Canada Resources Limited and operated by Crows Nest Resources Limited (a wholly owned subsidiary) consists of 8 coal licences covering 2344 hectares. It is located approximately 70 km west of Chetwynd along the Lake Hart Highway (#97).

During 1983, a review of pre-existing exploration activities including drilling programs in 1949 and trenching-mapping in 1981 indicated that additional reconnaissance style mapping was warranted to further evaluate the property's potential. The resulting mapping program improved the understanding of structural elements present near wellsite Hunt Sands Sunfalls C-18-G and further delineated geological contacts in the area.

1.1 Coal Land Tenure

Shell Canada Resources holds 8 coal licences (Group #371) covering 2344 hectares of land for the Willow Creek project in the Peace River Land District, Northeastern British Columbia (Appendix 1). The property is operated by Crows Nest Resources Limited, a wholly owned subsidiary of Shell Canada Resources Limited.

The following table entitled "B.C. Coal Licences Tenure Standing" contains details (see Table 1).

TABLE 1

CROWS NEST RESOURCES LIMITED

WILLOW CREEK PROSPECT: GROUP 371

Tenure Status as of May 21, 1985

<u>Licence</u>	<u>Hectares</u>	<u>Term</u>	<u>Base Date</u>	<u>Work Requirements/Credits (per hectare)</u>			
				<u>Previous Credits</u>	<u>+ Current Credits</u>	<u>- Requirements</u>	<u>= Credits Forward</u>
6250	293	5	May 21/80	59.45	10.35	25.00	44.80
6251	293	5	May 21/80	59.45	10.35	25.00	44.80
6269	293	5	May 21/80	59.45	10.35	25.00	44.80
6270	293	5	May 21/80	59.45	10.35	25.00	44.80
6271	293	5	May 21/80	59.45	10.35	25.00	44.80
6272	293	5	May 21/80	59.45	10.35	25.00	44.80
6273	293	5	May 21/80	59.45	10.35	25.00	44.80
6274	293	5	May 21/80	59.45	10.35	25.00	44.80
	<u>2344</u>						

Future Work Requirements

1986	12,188.80
1987	117,200.00
1988	117,200.00
1989	117,200.00

1.2 Location, Geography and Physiography

The Willow Creek property is located south of the Pine River, about 40 kilometers west of Chetwynd and 50 air kilometers southwest of Hudson Hope. The property is centred approximately 55° 35' north latitude and 122° 10' west longitude on NTS Topographic sheet 930/9.

The coal licences are situated along the Willow Creek drainage east of Falls Mountain. The area is characterized by relatively low, rounded northwest-southeast trending ridges and valleys. Elevations in the area range from 670 m at the junction of Willow Creek with Pine River to 1425 m along the ridge top of Falling Mountain.

The area is forested by poplar and some birch in lower elevations; fir or spruce are predominant at higher elevations. In wet areas, willows and devil's club are common. The timberline is approximately 1300 m above sea level.

1.3 Access

The property is accessible by the paved, all weather highway #97 (John Hart Highway) connecting Prince George to Dawson Creek via Chetwynd.

The British Columbia Railway line runs south of the Pine River and connects the project area with the Vancouver and Prince Rupert sea ports. The ports are both about 1200 km from the licence block.

Accessibility is reasonably good via dirt road on the east edge of the licences (since fall 1981 via the 'David Minerals' bridge over the Pine River). While there are a number of washouts along the road, only minimal equipment work would be required to accomodate 4x4 vehicular traffic. However, most of the licences are accessible by helicopter only, with few natural landing sites.

In addition to the transportation facilities available, power sources are present in the form of a Westcoast Transmission Ltd. natural gas pipeline and two major B.C. Hydro transmission lines which parallel the John Hart Highway immediately northwest of the licences.

2.0 EXPLORATION

2.1 Summary of Previous Work

Initial coal exploration in the area was conducted from 1946 to 1951. N.D. McKechnie (1955) carried out geologic mapping and diamond drilling for the coal division of the B.C. Department of Lands and Forests. During this period a total of 39 holes were drilled comprising 7756 meters of core. The proximate analyses of coal intersections were performed by the Department's laboratory. Regional mapping of the area at a scale of 1 inch to 1 mile was completed by Dr. J.E. Hughes of the B.C. Department of Mines and Petroleum Resources in 1960.

In addition, four exploration gas and oil wells were drilled in the vicinity of Willow Creek from 1962 - 1966. They include TGS Sun Falls a-64-B, Hunt Sands Sun Boulder b-74-D, Hunt Sands Sun Falls c-18-G, TGS Falls b-39-G and TGS Falls C-32-F.

Since 1979, Crows Nest Resources has periodically conducted reconnaissance style mapping over the licences.

2.2 Exploration Program: 1984

The purpose of the 1984 exploration program was to verify pre-existing surface mapping results as well as carry out more detailed investigations near surface coal showings. To this end, major drainages, roads and seismic cut lines were revisited on foot, by 4x4 vehicle or on horseback. New information was gained at a more detailed level near the gas exploration well Hunt Sands Sunfalls C-18-G. Notes were recorded at each mapping station (Enclosure 5) and locations recorded on the updated 1:10000 scale geology map of the area (Enclosure 4).

2.3 Exploration Costs 1984

Expenditures of the 1984 geological field program have been detailed in the Application to Extend Term of Licence". During 1984, \$24,269.97 was spent on Willow Creek coal licences.

3.0 GEOLOGY

3.1 Regional Geology (Enclosure 3)

The area under consideration lies within the Rocky Mountain Foothills and trends northwesterly along the front of the Rocky Mountains in Northeastern British Columbia. The strata outcropping in the Pine River Valley area are of Mesozoic age, from Middle Triassic to Upper Cretaceous, and were deposited on the shelf of a miogeosyncline. These formations thin eastwards across the Foothills and into the Plains.

Triassic strata are marine in origin and consist of limestone, calcareous shale, siltstone and sandstone. Jurassic sediments are primarily marine shales. The Lower Cretaceous sediments of sandstones, shales and coal measures marked the end of marine deposition.

The coal bearing beds of Lower Cretaceous age outcrop extensively along the foothills of Alberta and Northeastern British Columbia. These sediments have been assigned to the Blairmore, Bullhead and Fort St. John Groups. During the Columbian Orogeny, the sediments were folded, thrust and uplifted into faulted, elongate, plunging anticlines and synclines.

The intensity of deformation varies from one region to another. The Peace River and Pine River areas are characterized by relatively broad synclines between sharply faulted anticlines. The strata are exposed in a series of folds and thrust belts trending northwest-southeast.

Regional stratigraphic studies have been conducted by the Geological Survey of Canada and published by Stott, 1971 (Figure 2).

Several local stratigraphic and mapping projects have been completed within the area - both by the Geological Survey of Canada and by the British Columbia Ministry of Energy, Mines and Petroleum Resources. These are documented by Hughes (1964, 1967), McLearn and Kindle (1950), McKechnie (1955) and Spivak (1944).

3.2 Local Stratigraphic Descriptions

3.2.1 Bullhead Group

The Bullhead Group contains two formations: A basal conglomerate, the Cadomin Formation and the coal-bearing Gething Formation.

3.2.1.1 Cadomin Formation

The laterally extensive (Peace River to Blairmore, Alberta) Cadomin Formation forms a distinctive marker in lower Cretaceous sediments. In its type region near Cadomin Alberta, it is typically a massive resistant unit of conglomerate. In the Pine River area, however, it is commonly marked by a hard, resistant, coarse-grained to gritty and sometimes conglomeratic, light to medium-grey weathering sandstone. The resistant nature of the Cadomin makes it a good marker for geologic mapping, as it often forms ridges or stands in relief from other strata in the area.

An erosional unconformity at the base of the Cadomin Formation, separates it from the underlying Minnes Group. Although there are local angular relationships with the underlying beds the rocks on either side of the contact are generally structurally concordant (Stott, 1971).

3.2.1.2 Gething Formation

The Lower Cretaceous Gething Formation of the Bullhead Group is underlain by the Cadomin Formation and overlain by the Moosebar Formation. It is comprised of a thick sequence of predominantly non-marine fine-grained sediments and coal. Shales, siltstone, fine-grained sandstones and coal seams are the characteristic lithologies found in the formation.

In the Peace and Pine River areas the Gething Formation is 450 to 550 m thick. The section in the Peace River Canyon as measured by Stott (1969) is 550 m thick.

Numerous coal seams occur within the Gething Formation. Their best development appears to be in the Pine River and Hasler Creek areas. To the northwest and southeast along the foothills coal belt, the seams generally are thinner and more discontinuous. The coal of the Gething Formation seams is reported to be of low to medium volatile bituminous rank with fair to good coking characteristics.

3.2.2 Moosebar Formation

The Gething Formation is conformably overlain by the Moosebar Formation of the Fort. St. John Group.

The predominantly marine sediments consist of dark grey mudstones and shales with minor beds of argillaceous sandstone and ironstone bands. Thin layers of bentonite can occasionally be found.

The upper contact of the Moosebar Formation is gradational from marine shales through a sequence of interbedded shales and sandstones (passage beds) into the basal sandstone member of the Gates Formation. The contact is placed within the passage beds at the base of the first thick succession of sandstone.

The lower contact, with the Gething Formation is abrupt and is easily picked on downhole geophysical logs. The contact is commonly marked by a one to two metre pebble conglomerate or sandstone. It is interpreted as representing the initial deposits of the transgressing Moosebar Sea, marking the end of a prolonged period of alluvial deposition in the area. This pebble conglomerate or pebble sandstone is the equivalent of the Bluesky Formation found in the plains and is therefore commonly called the Bluesky Conglomerate. The five metres above the conglomerate is generally siltier than the main body of the Moosebar and contains a glauconitic zone near the top.

The Moosebar Formation is generally recessive, with outcrops exposed in road cuts and stream and river banks only.

3.3 Project Geology

3.3.1 Stratigraphy

The Willow Creek area is underlain by strata of the Gething and Moosebar Formations. Poor exposure and structural repetition have made complete measurement of the Gething section impossible.

In 1948, N.D. McKechnie conducted an extensive diamond drill exploration program in the Willow Creek area. The program concentrated on the upper section of the Gething Formation on both limbs of the major anticlinal structure (Pine River Anticline), often locating the collar of the borehole in the Moosebar Shales. Results of these investigations reveal limited economic potential for the upper section with only one or two coal seams approaching a thicknesses greater than 1 meter. The upper section consists of a monotonous sequence of shales, siltstones and sandstones. Only a few boreholes investigated the middle section of the Gething (i.e. in the vicinity of DDH-W-29, DDH-W-27, DDH-W-6 and DDH-W-5) Although coal intersections are highly variable, there appears to be a greater potential for thick coal seam development in the middle and lower section of the Gething. The core of the anticline has yet to be drilled and extensive cover limits surface exploration of this area. Thus the middle and lower part of the Gething Formation have yet to be effectively prospected. Investigations in 1984 focused upon surface exposures around the north end of the axis of the Pine River anticline and along the western flank of the structure. Only two seams of coal greater than 1.0 meter were observed.

3.3.2 Structural Geology

Enclosure 4 illustrates the geology of Willow Creek at a scale of 1:10000. The southwest part of the map area is dominated by the Falling Mountain syncline, a broad open structure cored by Gates Formation sediments. N.D. McKechnie, in 1948, intensively prospected the Gething - Moosebar formational contact along the northeast limb of this structure. This northeast limb is truncated by a west dipping thrust fault which trends sub-parallel^a to the fold axis through the central part of the claim licences. Moosebar and Gething sediments are repeated in the footwall of this thrust fault and have been folded into the doubly plunging canoe-shaped Pine River anticline. The northeast limb of this anticline is truncated by an east dipping thrust fault trending parallel to the fold axis. Although east dipping thrusts are relatively rare in northern Rocky Mountain geology, there is considerable evidence for their existence within the Pine Pass property immediately northwest of Willow Creek.

Once again, Gething and Moosebar strata are exposed in the hanging wall of this thrust and constitute the southwest limb of a broad syncline trending northwest-southeast on the northern edge of the coal licences.

The repetition of Gething stratigraphy by thrust faulting increases the potential for economic coal development within the licence block. In addition, data from some of the 1948 drilling activity indicates possible thickening of coal seams associated with folding close to the major thrust faults.

The location of the Willow Creek normal fault is based upon McKechnie's investigations (1955). He estimates a dip slip displacement of approximately 200 m. In contrast to the current geology, McKechnie proposed a total of 11 faults of various orientations. However, it is felt that a lack of seam continuity and difficulty in correlation influenced this fault interpretation. The structural interpretation in this report has been simplified; additional data may require a more complex interpretation in the future.

4.0 COAL QUALITY

Coal quality from drill core analysis of the 1948 program indicates coal rank in the Willow Creek area is medium volatile bituminous, with moderate - low sulphur values. In addition, most seams exhibited coking characteristics. These analytical results appear to represent selective sampling of the dried drill core samples, as the ash content is generally 6 - 10% without the benefit of gravity washing techniques.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Drilling results from the 1948 program indicates that there are limited economic coal occurrences within the upper section of the Gething in the Willow Creek area. Seam continuity and correlation also appear to be inconsistent within this section (McKechnie, 1955 p. 13). As there is little information on coal potential in the middle and lower part of the Gething, it is recommended that further exploration be concentrated where this part of the section occurs close to the surface.

Areas satisfying this condition and exhibiting open-pit mining potential include the west limb of the Pine River anticline and along the west side of the west dipping thrust fault in the central part of the coal licences. It is suggested that the program initially comprise field mapping, backhoe assisted trenching and future drillhole site selection in these areas.

6.0 BIBLIOGRAPHY

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

APPLICATION TO EXTEND TERM OF LICENCE

I, Glenn C. Proudfoot agent for Shell Canada Resources Limited
(Name) (Name)
(same) P.O. Box 100
(Address) (Address)
Calgary, Alberta
Valid FMC No. 207 568

hereby apply to the Minister to extend the term of Coal Licence(s) No(s). 6250, 6251, 6269, 6270, 6271, 6272, 6273 and 6274 (GROUP NO. 371)
for a further period of one year.

2. Property name WILLOW CREEK
3. I am allowing the following Coal Licence(s) No(s). to forfeit
4. I have performed, or caused to be performed, during the period MAY 21, 1984 to MAY 20, 1985, work to the value of at least \$ 24,269.97
on the location of coal licence(s) as follows:

CATEGORY OF WORK	Licence(s) No(s).	Apportioned Cost
Geological mapping	<u>6250, 6251, 6269 - 6274</u>	<u>13,442.47</u>
Surveys: Geophysical
Geochemical
Other
Road construction
Surface work
Underground work
Drilling
Logging, sampling, and testing
Reclamation
Other work (specify)
Off-property costs	<u>10,827.50</u>

5. I wish to apply \$ 24,269.97 of this value of work on Coal Licence(s) No(s). 6250, 6251, 6269, 6270, 6271, 6272, 6273, and 6274
6. I wish to pay cash in lieu of work in the amount of \$ on Coal Licence(s) No(s).
7. The work performed on the location(s) is detailed in the attached report entitled 1984 Geological Assessment Report - Willow Creek

April 23, 1985 [Signature]
(Date) (Signature)
..... Supervisor
(Position)

GEOLOGICAL MAPPING

Yes No

Area (Hectares)

Scale

Duration

Reconnaissance 2772 1:10,000 June 11-18, 1984
Detail: Surface
Underground
Other* (specify)

Total Cost \$ 13,442.47

GEOPHYSICAL/GEOCHEMICAL SURVEYS

Yes No

Method
Grid
Topographic
Other* (specify)

Total Cost \$

ROAD CONSTRUCTION

Yes No

Length Width
On Licence(s) No.(s)
Access to

Total Cost \$

SURFACE WORK

Yes No

Length Width Depth Cost
Trenching
Seam Tracing
Crosscutting
Other* (specify)

Total Cost \$

UNDERGROUND WORK

Yes No

No. of Adits Maximum Length No. of Holes Total Metres Cost
Test Adits
Other workings*

Total Cost \$

DRILLING

Yes No

Hole Size No. of Holes Total Metres Cost
Core: Diamond
Wireline
Rotary: Conventional
Reverse circulation
Other* (specify)
Contractor
Where is the core stored?

Total Cost \$

LOGGING, SAMPLING, AND TESTING

Yes No

Lithology: Drill samples Core samples Bulk samples
Logs: Gamma-neutron Density
Other* (specify)
Testing: Proximate analysis FSI Washability
Carbonization Petrographic Plasticity
Other* (specify)

Total Cost \$

RECLAMATION

Yes No

Details Total Cost \$

OTHER WORK (Specify details)

Yes No

..... Cost
.....
..... Total Cost \$

OFF-PROPERTY COSTS

Yes No

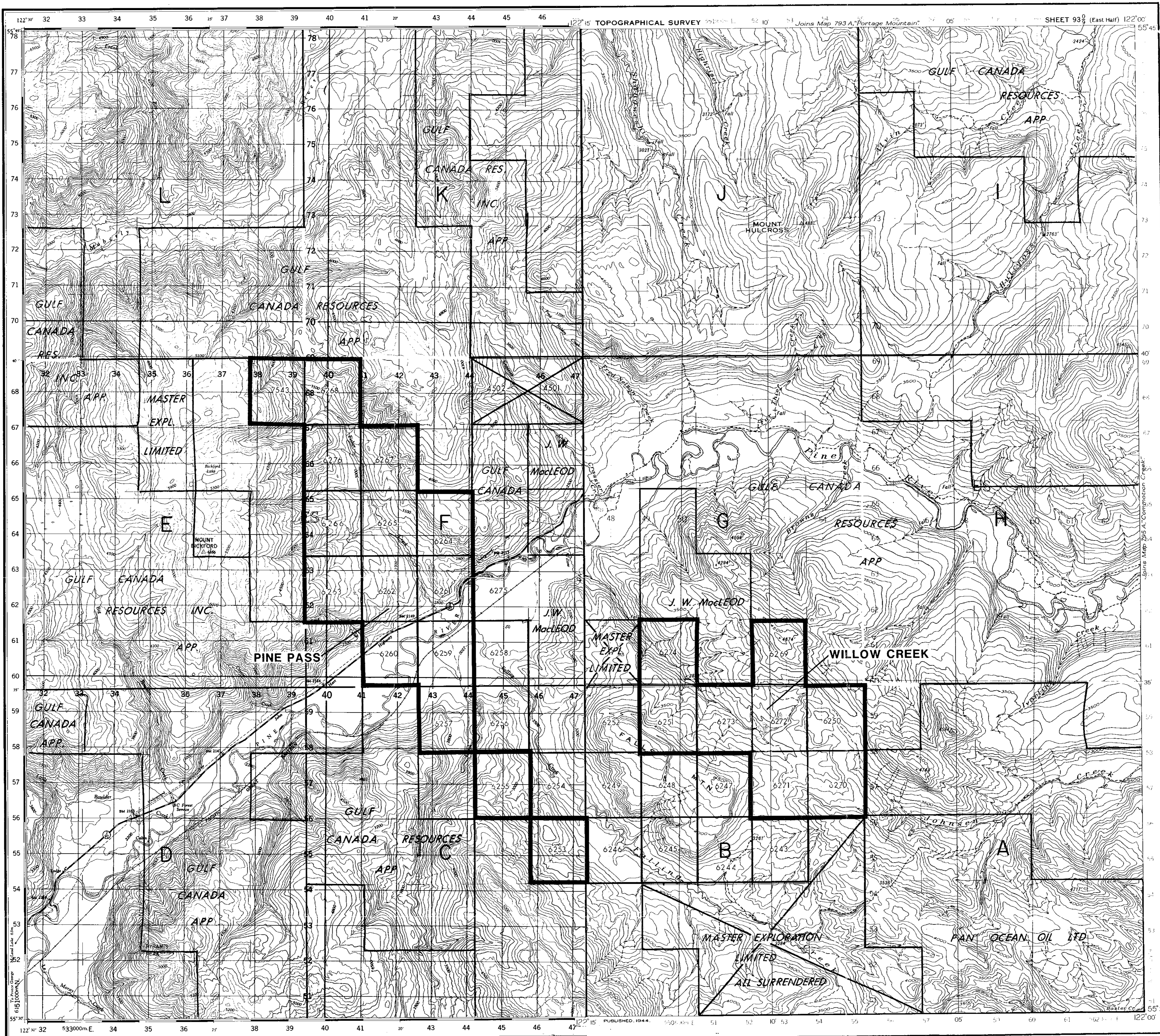
Details Report Generation, Photo Interpretation, Historical Research Total Cost \$ 10,827.50
.....
..... Total Expenditures \$ 24,269.97

April 23, 1985
(Date)

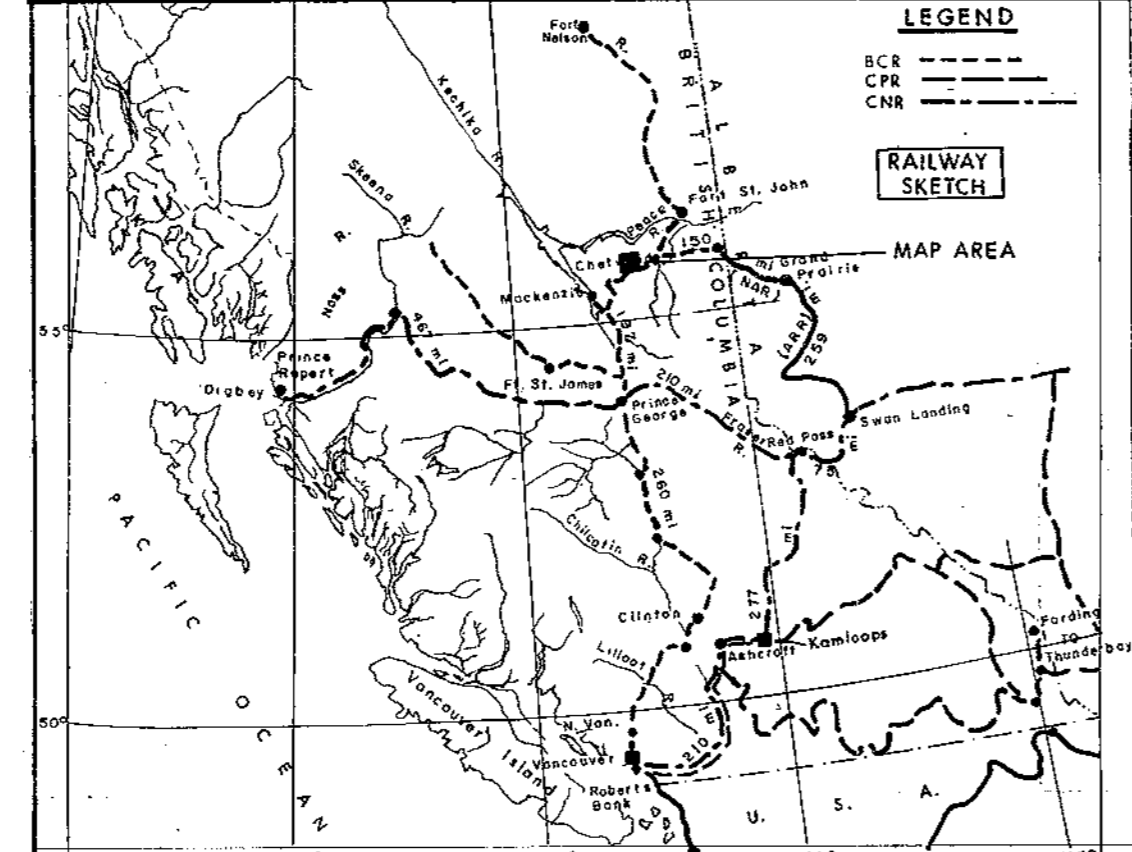
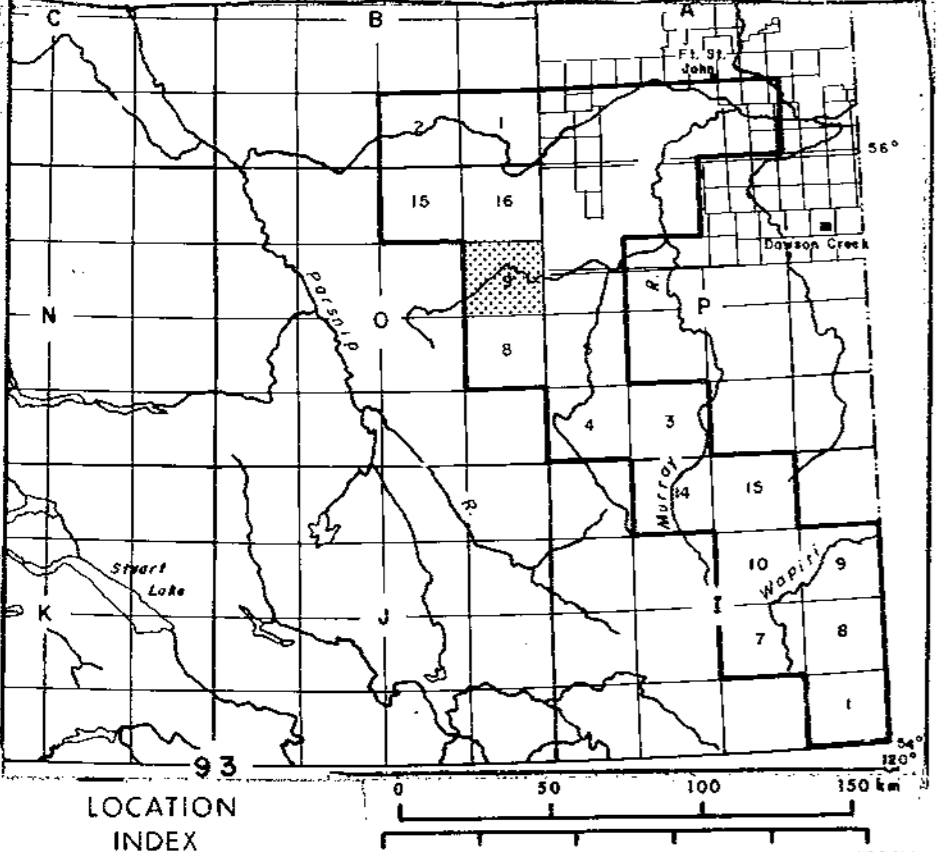
[Signature]
(Signature)

Manager, Geology
(Position)

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



179.98
180.02
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180.90
180.94
180.98
181.02
181.06
181.10



MOUNT HULCROSS
PEACE RIVER DISTRICT
BRITISH COLUMBIA

SCALE 1:50,000
1.25 inches to 1 mile approximately

Approximate magnetic declination, 29°32' East.

Copies may be obtained from the Map Distribution Office, Department of Mines and Technical Surveys, Ottawa.

INDEX TO ADJOINING SHEETS

150° 00'	150° 30'	151° 00'	151° 30'
55° 30'	55° 35'	55° 40'	55° 45'

93% WEST

Crows Nest Resources Limited
EXPLORATION

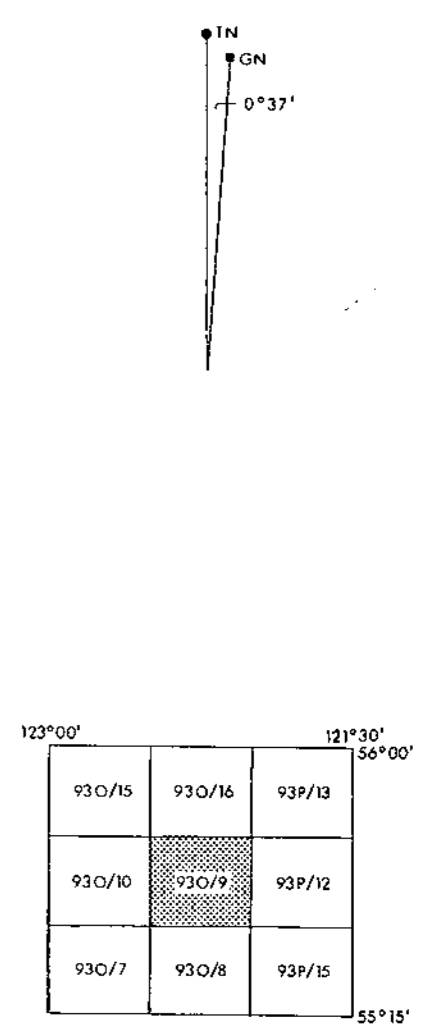
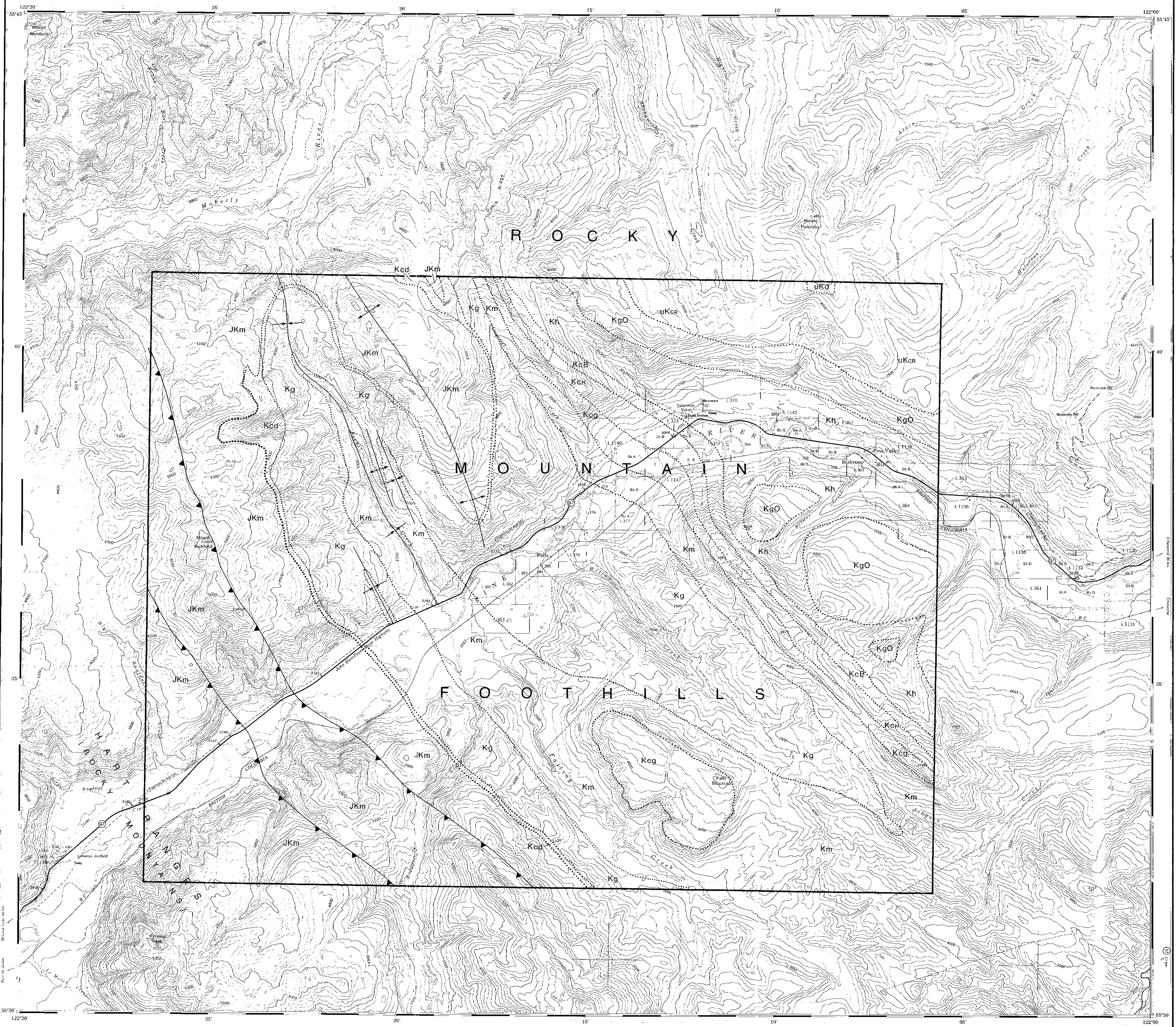
MOUNT HULCROSS
NORTHEASTERN B.C.
PEACE RIVER LAND DISTRICT

691

COAL LAND DISPOSITION MAP

SHELL - CNRL. LICENCES: PINE PASS
NTS 93-0-9 BLK B,C,F,G
MAP 1 of 1

AUTHOR: WHITE/PIETZ	SCALE: 1:50,000	ENCLOSURE No.:
DATE: FEB 1979	REVISED: JULY, 1984	DRAWING No.: RM5H30
To Accompany		



LEGEND

- MESOZOIC
- UPPER CRETACEOUS
- uKd DUNVEGAN FORMATION
 - uKcR CRUISER FORMATION
- LOWER CRETACEOUS
- KgO GODDRICH FORMATION
 - Kh HASLER FORMATION
 - KcB BOULDER CREEK FORMATION
 - KcK HULCROSS FORMATION
 - KcG GATES FORMATION
 - Km MOOSEBAR FORMATION
 - Kg GETHING FORMATION
 - Kcd CADOMIN FORMATION
- JURASSIC/CRETACEOUS
- JKm MINNES GROUP
- THrust FAULT (Teeth in dip direction)
- ANTICLINE
- SYNCLINE
- GEOLOGICAL CONTACT (approximate)

MOUNT HALCROSS
 PEACE RIVER LAND DISTRICT
 BRITISH COLUMBIA
 Scale 1:50 000 Échelle

Information concerning location and precise elevation of bench marks can be obtained by writing to the Geodetic Survey, Survey and Mapping Branch, Ottawa.

On peut obtenir des renseignements sur la localité et l'altitude exacte des repères de nivellement en écrivant au Service des Levés Géodésiques, Division des Levés et de la Cartographie, Ottawa.

CONVERSION SCALE FOR ELEVATIONS

Metres 30 20 10 0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000

Feet 100 50 0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000

ÉCHELLE DE CONVERSION DES ALTITUDES

Mètres 30 20 10 0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000

Pieds 100 50 0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000

COMPTON AIRFIELD 100 FEET
 Localisation et Précision des Repères de Nivellement
 North American Datum 1927
 Transverse Mercator Projection

ÉQUIVALENCE DES COULEURS 100 PIEDS
 Altitudes en mètres
 Système de référence géodésique nord-américain, 1927
 Projection transverse de Mercator

Travaux réalisés par la DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE, MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES. Révisé à la suite de photographies aériennes prises en 1977 et 1978. Verticalité des levés en 1978. Publié en 1981.

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Roads: hard surface, all weather; paved, bitum. const.; unpaved, gravel, dirt, stone, etc.; gravel, bitum. soc.; dirt, stone, etc.

Routes: pavé, bitum. const.; non pavé, gravier, terre, pierre, etc.; gravier, bitum. soc.; terre, pierre, etc.

Contours: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, 5000, 5100, 5200, 5300, 5400, 5500, 5600, 5700, 5800, 5900, 6000, 6100, 6200, 6300, 6400, 6500, 6600, 6700, 6800, 6900, 7000, 7100, 7200, 7300, 7400, 7500, 7600, 7700, 7800, 7900, 8000, 8100, 8200, 8300, 8400, 8500, 8600, 8700, 8800, 8900, 9000, 9100, 9200, 9300, 9400, 9500, 9600, 9700, 9800, 9900, 10000.

Contours: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, 5000, 5100, 5200, 5300, 5400, 5500, 5600, 5700, 5800, 5900, 6000, 6100, 6200, 6300, 6400, 6500, 6600, 6700, 6800, 6900, 7000, 7100, 7200, 7300, 7400, 7500, 7600, 7700, 7800, 7900, 8000, 8100, 8200, 8300, 8400, 8500, 8600, 8700, 8800, 8900, 9000, 9100, 9200, 9300, 9400, 9500, 9600, 9700, 9800, 9900, 10000.

Contours: 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, 5000, 5100, 5200, 5300, 5400, 5500, 5600, 5700, 5800, 5900, 6000, 6100, 6200, 6300, 6400, 6500, 6600, 6700, 6800, 6900, 7000, 7100, 7200, 7300, 7400, 7500, 7600, 7700, 7800, 7900, 8000, 8100, 8200, 8300, 8400, 8500, 8600, 8700, 8800, 8900, 9000, 9100, 9200, 9300, 9400, 9500, 9600, 9700, 9800, 9900, 10000.

FR-Willow Creek (9411)A *2 **691**

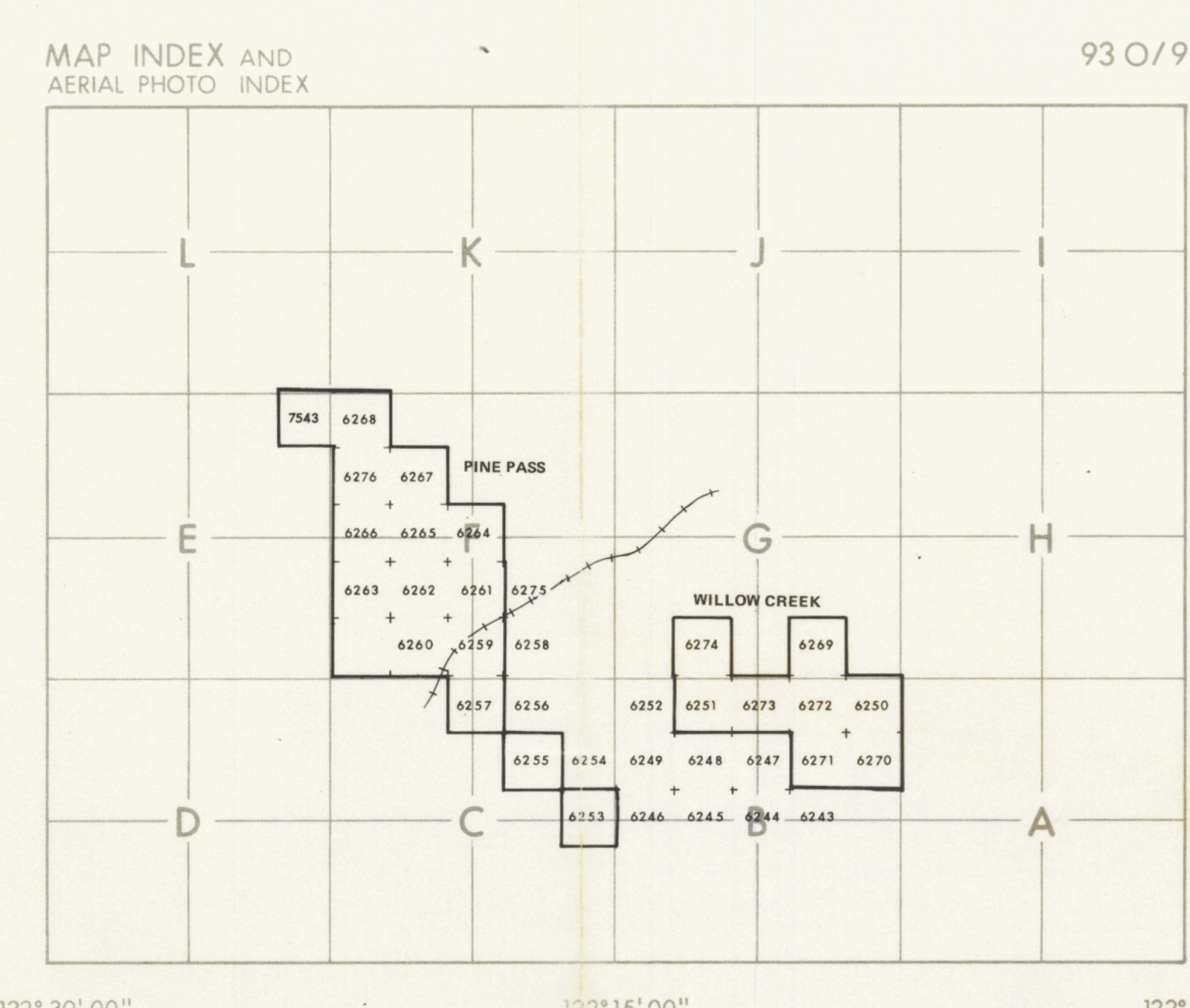
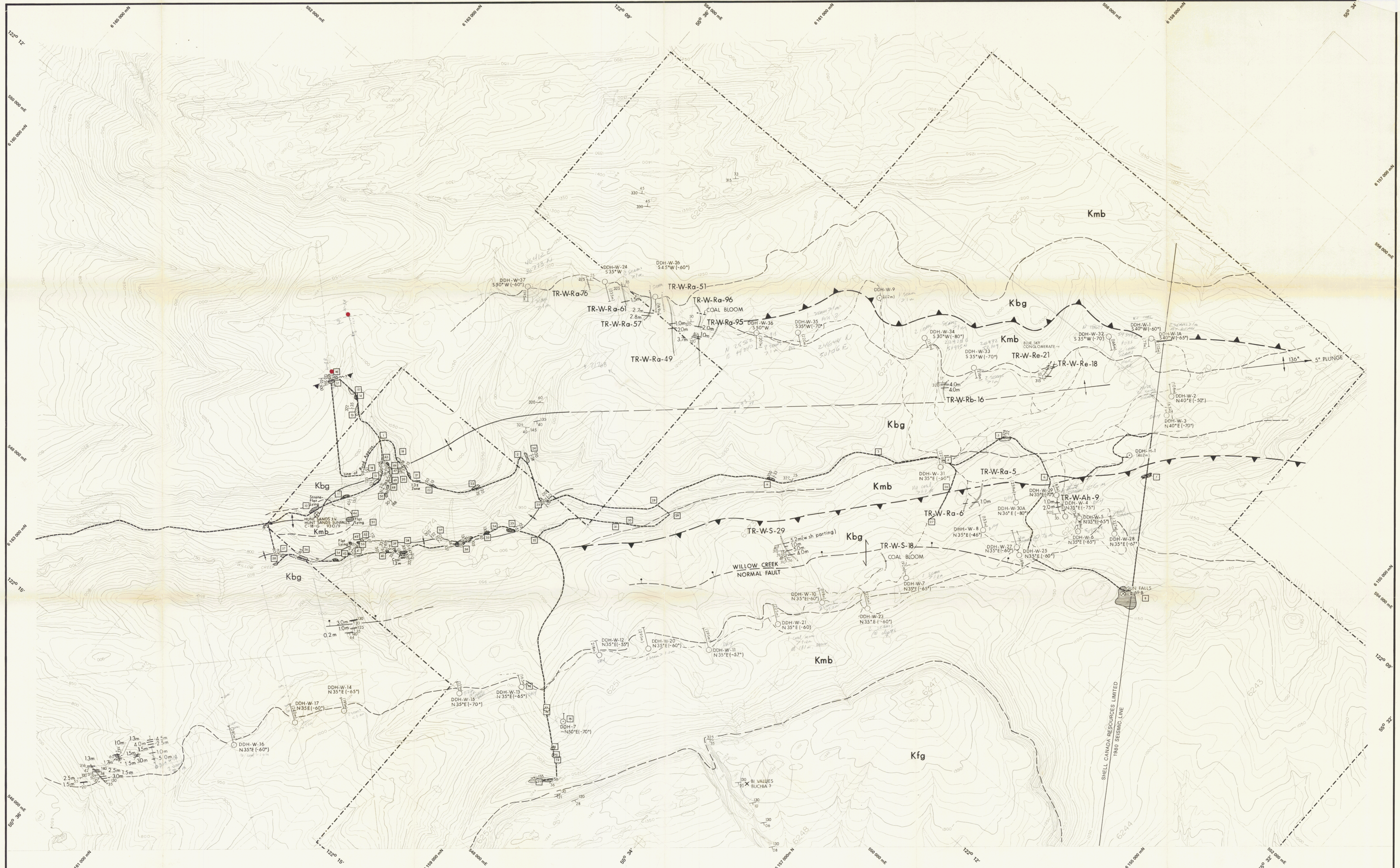
Crows Nest Resources Limited
 EXPLORATION

PINE PASS-WILLOW CREEK
 N.E. B.C.

GEOLOGICAL COMPILATION MAP

NTS-930/9 UTM ZONE 10
 AUTHOR: MGRINSTRY SCALE: 1:50000 DRAWN BY: RGP
 DATE: 93-0/3 REVISED: DRAWING No. PP5U03
 To Accompany

ENCLOSURE 3



137.5°
19' 25"

178 m
10.0 m
7°
4 3125"

GRID NORTH

REFERENCES

MAIN ROAD		RIVER	
BRIDGE, CULVERT		INTERMITTENT STREAM	
TRAIL		LAKE	
LOT LINE		TREES	
CUT LINE		TOWER	
CONTOURS FORMLINES		LICENCE	

SCALE 1:10,000
MAPPING IS BASED ON EXISTING GOVERNMENT CONTROL AND NTS MAP SHEET 93 0/9
FORM LINE INTERVAL: 10 METRES
DATE OF PHOTOGRAPHY: 1978/79
DATE OF MAPPING: 1980
COMPILED BY: AERO GEOMETRICS LTD.

GEOLOGIC LEGEND

1984 DATA POINT	
1984 TRAVERSE	
SANDSTONE	
SILTSTONE	
SHALE	
COAL SEAM / BLOOM	
FORMATION CONTACT	
THRUST FAULT-TEETH INDICATE DIP DIRECTION	
NORMAL FAULT, INDICATES DOWN THROWN BLOCK	
SYNCLINE, DIRECTION OF PLUNGE	
ANTICLINE, DIRECTION OF PLUNGE	
W-SERIES - MCKECHNIE, 1956	
VERTICAL DIAMOND DRILL HOLE	
INCLINED DIAMOND DRILL HOLE	
TRENCHES	
TRACTOR TRAIL	
CNRL LICENSE BOUNDARY	

691

Crows Nest Resources Limited

WILLOW CREEK
N.E. BRITISH COLUMBIA

GEOLOGICAL MAP

NIS 93 0/9		U.T.M. ZONE 10	
AUTHOR: MCKINSTRY	SCALE: 1:10,000	ENCLOSURE No:	
DATE: JUNE 1982	REVISED: 85-01	DRAWING No: PP3U 11	
To Accompany		ENCLOSURE 4	

691

TRAVERSE
REFERENCE NO:

DESCRIPTION

Start reconnaissance of Pine Pass Licences south of Pine River ... at highway turnoff; 1362.1 km.

- 1364.1 railroad crossing
- 1365.0 junction with David Minerals Road/Campsite
- 1367.7 wellsite ... "Hunt Sands J.V. Hunt Sands Sun Falls c-18-G 93-0-9"
- 1368.5 creek crossing 1
- 1369.9 creek crossing 2

1
2

NOTE: Good exposures in road cut at 1367.7-1369.9 ... will map later.

3

Road washed out at creek 3 ... road between 2 and 3 in driveable condition ... at 3 approximately 2' diameter culvert in place (in fair condition); at present, culvert is positioned in mid-air.

4

Road washed out at creek 4 - culverts as above

NOTE: Road repair at 3 and 4 may be difficult ... water flow quite heavy and area to be 'bridged' is approximately 6± metres across.

... On the other side of creek 4, ... there is a small trappers cabin in somewhat less than immaculate condition; ... on the same location ... there are a large number of core boxes (with core); ... judging from the deteriorated condition of the core boxes, it is from the B.C. Dept. of Land & Forests program during the late forties/early fifties.

The core (NQ) is of no use ... it is not possible to identify the core with regard to hole no. and/or depths.

TRAVERSE
REFERENCE NO.

DESCRIPTION

- 5 Outcrop (Gething) on road bed ... Sandstone, fine grained; small scale cross bedding; grey to beige; laminations visible; plant fragments (in rubble); 328°/22°E; iron staining (in rubble).
- 6 Intersection with old access road; walked to DDH-H-1 and up to the seismic line ... no outcrop; elevation at intersection 1160m ASL.

... followed seismic line to wellsite
- 7 Gething siltstone rubble (but very near outcrop).
- 8 Wellsite 'Sun Falls' g-69-B' ... Moosebar Shale (Kmb) rubble over entire wellsite.
- 9 Outcrop in road cut between 2 and 3; Siltstone; 350°/33°E; grey; visible laminations; iron staining; massive; 1015m ASL; outcrop extends approximately 30m± along east edge of road; good cross bedding.
- 10 Elevation 915m ASL; Kmb Shale; dark brown to dark grey; rubbly; friable; flat-lying; iron staining.
- 11 Elevation 940m ASL; Siltstone; 150°/45°W; dark grey, very minor carbonaceous debris throughout; minor iron staining; relatively large scale 'bedding plane' plates/sheets; underlying siltstone, are thin layers of black mudstone

TRAVERSE
REFERENCE NO.

DESCRIPTION

12 Elevation 970m ASL; Sandstone; beige to grey; 135°/53°W; fine grain ... with minor, larger (to 1cm diameter) pebbles; iron staining; fine laminar bedding; rubble to platy; cross bedding indicates 'right side-up'

13 Elevation 1060m ASL; Sandstone; 322°/35°E; fine grained; dark brown to grey; iron staining; laminar bedding

14 Elevation 1063m ASL ... coal bloom in bank

15 Elevation 1070m ASL; Sandstone; 312°/36°E; fine grained; fine laminar bedding; dark grey to brown

16 Elevation 1100m ASL; Sandstone; 135°/55°W; fine grained; hard; blocky; grey to dark brown; coaly/carbonaceous zone at base of interval; cross bedding indicates 'right way-up'

NOTE: At Station 16 ... good exposure of interbedded sandstone/siltstone/mudstone/coal/carbonaceous material, not described in detail; attitude noted in 16 may not be representative

17 At junction (drill site 80-1) have bedding at 300°/30°E ... bedding appears to be rolling and steepening to east ... ?? FAULT ZONE between 16 and 17

18 1025m ASL ... location approx (on a David Minerals exploration Road) ... Coal; approximately 1.5m thick; relatively clean; 315°/15° E; roof is siltstone, dark brown to grey, carbonaceous, friable to rubble ... grades upward (approx. 1m) to a fine grained sandstone ... fine cross bedding indicates 'right way up'

TRAVERSE
REFERENCE NO.

DESCRIPTION

19 1000m ASL; Sandstone; very fine grained; dark grey; weathers tan; massive; thin interbeds of silty (often coaly/carb) mudstone/shale; 010°/22°E; thickness exposed approximately 10m±; rubbly to friable; additional attitude measured (to south) 358°/15°E; calcite crystallization on some surfaces; tabular cross bedding; ... 'coal bloom' on road bed ... thin dirty coaly zone (approx. 0.3m±) beneath the massive sandstone unit

20 Sandstone; medium grained grading downward to a siltstone; dark grey, iron staining 318°/33°E; rubbly

21 1045m ASL; Coal Seam; dirty except for thin vitrinite band at base; ... stratigraphic description:

ROOF	Mudstone
0.20m	Dirty Coal
0.36m	Carbonaceous Shale
0.50m	Coal; clean; soft; bright
0.25m	Coaly/carbonaceous shale
FLOOR	Mudstone

22 1055m ASL; Carbonaceous/coaly shale zone; approximately 40m uproad (ie, to the south) outcrop of Sandstone; fine grained; fine cross bedding; 350°/15°E

23 1005m ASL; Sandstone; very fine grained; clean; hard; dark grey; iron staining; 120°/35W; jointing at
· 250°/75°N
· 330°/77°E

TRAVERSE
REFERENCE NO.

DESCRIPTION

24

Outcrop located in tree cover; Sandstone; medium grained to coarse grained; hard; grey to olive-khaki green weathering; massive; dark grey to black; minor hematite staining in matrix; 120°/28°W

25

980m ASL; 005°/9°E; stratigraphic description from top to bottom

Sandstone; fine grained; cross bedded; grey; ironstone nodules; iron staining;

Shale; black to dark grey; very fissile/friable; minor coaly/carbonaceous debris

additional attitude measured down road (south) ... 010°/15°E

26

. from trappers cabin at 4, tried to follow/find old access road and/or evidence of exploration; heading SE from the main road, came across additional core and core boxes ... elevation 1070m ASL

27

Elevation 1082m ASL ... End of Traverse ... road overgrown; no exposure evident.

28

Traverse downstream from Willow Creek ... walk down to creek from 28; elevation 992m ASL

29

At creek, elevation is 940m ASL; no outcrop but coal float present on creek bed; massive mud slides down stream (tough traversing) to approximately 925m ASL

30

... Coal debris in slide debris at 925m ASL

TRAVERSE
REFERENCE NO.

DESCRIPTION

31

Small creek into Willow Creek at 918m ASL

32

Small creek into Willow Creek at 890m ASL

33

Outcrop at 872m ASL; Siltstone; 123°/55°W;
resistant; dark grey; iron staining; mudstone
underlying

34

Creek into Willow Creek at 862m ASL

35

Outcrop at 860m ASL; 130°/40°W

... stratigraphic description from bottom to
top

SANDSTONE; medium grey; very fine grained;
hard; resistant; weathers grey to ochre to
grey-green

COALY SHALE (0.20m)

CARBONACEOUS SHALE/MUDSTONE; (0.70m)

COAL (0.35m); bright; broken

SILTSTONE; dark grey; weathers tan to beige;
thin interbeds of mudstone; thickness of
exposure 6m±; coalified tree trunks/plant
debris; minor cross bedding indicates 'right
way up'

36

As Above, siltstone continues down stream to
851m ASL; 130°/20°W on E side of Willow Creek;
on west side of Willow Creek, east dipping
strata at 305°/30°E; siltstone as noted in 35;
... slightly down stream but still on west
side of Willow Creek ... 307°/48°E and on east
side of Creek: 095°/15°W

TRAVERSE
REFERENCE NO.

DESCRIPTION

37

Elevation at Creek level 840m ASL; outcrop is located on bench slightly east of creek; 005°/25°E; Mudstone/Siltstone to Sandstone; fine grained; upper part of interval has plant casts; grey; weathers tan and cream; minor carbonaceous/coaly shale at base of interval (thickness less than 0.5m); beneath carb/coaly unit, additional fine grained sandstone/siltstone, outcrop extends to 830m ASL down bench ... 005°/22°E; thin coaly/carbonaceous bands throughout

38

Outcrop at 828m ASL; Coal Seam approximate thickness: 1.2m±; hard; bright to dull; at footwall, 300°/05°E; coal located on east side of creek under approx. 25m± of cover
SAMPLE NO: PP-WC-1.

... good gravel base/bars in Willow Creek ... without too much difficulty, would be able to land a helicopter

NOTE: Station 38, in the future, should be mapped in detail.

39

Outcrop at 822m ASL; Silty Shale; 380°/20°E; dark grey; friable to rubbly; going up stream ... possible fault zone followed by silty shale at 332°/67°E; total exposure 10m± in length; within fault zone (1m±), bedding is vertical ... strata strikes 125°

40

Outcrop at 820m ASL (at creek level); ... outcrop is located East of bench ... and is located in a relative open area with only small poplars and underbrush

Siltstone; dark grey; weathers grey brown; fine-cross bedding indicates 'right way up'; 305°/05°E

TRAVERSE
REFERENCE NO.

DESCRIPTION

- 41 At 797m ASL creek (#1) enters Willow Creek from the East
- 42 796m ASL; seismic line crosses Willow Creek outcrop of Siltstone/Sandstone, fine grained; dark grey, 270°/05°N; weathers off white; approx. 2m± thick and is underlain by silty shale
- 43 832m ASL; Siltstone/Sandstone; fine grained; dark grey; flat-lying
- 44 890m ASL; Kmb shale; flat lying
- 45 975m ASL; Siltstone; dark grey; carbonaceous debris within; weathers grey to off white; 302°/07°E; exposure is located on south side of creek
- 46 972m ASL; Sandstone; fine grained; brown to grey; weathers tan to off-white; 030°/07°E; massive ... 8m± thick; outcrop continues down stream on south side of drainage ...
at 960m ASL: 342°/15°E
at 959m ASL: 016°/08°E
- 47 950m ASL; Sandstone ... as above
- 48 940m ASL; Sandstone; fine grained; dark grey; minor carbonaceous debris; outcrop is located in creek; 160°/51°W; there is a 'roll' in the strata at approximately 3m upstream; 163°/23°W
- 49 950m ASL; Sandstone (as noted in 46) outcrop ends
- 50 932m ASL; Sandstone, as in 48; 188°/30°W

TRAVERSE
REFERENCE NO.

DESCRIPTION

- 51 870m ASL; survey cut line ... trends 140° AZ
- 52 838m ASL (outcrop is located on south side of creek); Sandstone; dark grey; fine to medium grained; 112°/07°S; sandstone is underlain by coal ... bright; broken; thickness uncertain
- 53 828m ASL; located at base of 3m± waterfall; Siltstone; dark grey; weathers off-white to tan; thin mudstone interbeds throughout; approx. 0.20m carbonaceous shale at base; 074°/05°S
- 54 792m ASL; Siltstone/Sandstone as noted in 42; underlain by coaly shale/high ash coal approx 0.70m thick
- 55 797m ASL; initially thought to be outcrop ... sandstone boulder only!
- 56 782m ASL; Sandstone; hard; fine grained; dark grey; weathers grey to ironstain; forms dip slope into creek; 158°/25°W; ... some 5m± down stream strata 'curves' (ie: strike change) ... 165°/25°W
- ... slightly downstream from 56 (no noted elevation change) ... outcrop east of creek bed; Sandstone as noted in 56
- 57 775m ASL; Sandstone; undulating but generally flat-lying; hard; tan to grey; medium grained with pebbles up to 6cm diameter; very poorly sorted matrix; hard ... rock breaks through pebbles rather than through matrix ... slightly downstream (elevation approx 774m± ASL; Sandstone; 305°/06°E; pebble band approx 0.20m thick ... remainder is a medium grained sandstone

TRAVERSE
REFERENCE NO.

DESCRIPTION

- 58 Sandstone outcrop on west side of creek;
770m ASL; flat lying;
- 59 pack trail crosses seismic line at 840m± ASL

... head down seismic line toward Falling
Creek
- 60 823m ASL; Kmb Shale in bank
- 61 790m ASL; 'Outfitters camp'
- 62 739m ASL; Seismic line crosses Falling Creek;
river was too high to cross; outcrop on NE
side of creek bed (slightly down stream) ...
interbedded (from base to upper)
· Mudstone
· Siltstone/Mudstone interbedded; 326°/10°E
· (coarsening to) Sandstone at top of
exposure

NOTE: Total exposure is some 10-15m thick
- 63 865m ASL; Kmb Shale in seismic line cut
- 64 935m ASL; Kmb Shale in seismic line cut
- 65 968m ASL; Kmb Shale in seismic line cut
- 66 975m ASL; Kmb Shale in seismic line cut;
helipad cutout ... clearing shows on topo map
- 67 start traverse at road ... set altimeter at
1015m ASL ... 1035m ASL at creek level;

TRAVERSE
REFERENCE NO.

DESCRIPTION

- 68 Outcrop located (upslope and south of creek) at 1048m ASL; Sandstone; fine grained; 338°/60°E; grey to tan
- ... also appears to be the NE extent of an old road ... bench approximately 4 m± wide and is overgrown with trees;?? ... may be site of TR-W-S-29 ... slightly SE of above, Sandstone; medium grained; hard; massive; NOTE: very similar to sandstone as per 24; 330°/60°E
- 69 ... slightly west of Sandstone in 58 ... Siltstone; tan to ironstain: 150°/30°W; elevation 1050m ASL
- NB: Change in dip!!
- 70 1053m ASL; ... Coal noted in high bank: may be equivalent to noted '5.2m with shale parting'; ... bank is slumped and tree-overgrown
- 71 Start traverse 1280m ASL; ... Kmb Shale outcrop; ... open terrain ... very little vegetation , 135°/17°W
- 72 Headwaters of Creek at 1185m ASL
- 73 1170m ASL; ... Kmb Shale in outcrop; rubbly to fractured; ... uncertain of strike and dip
- 74 1152 ... Kmb Shale; 140°/53°W; slightly silty; dark grey; weathers off-white to dark grey

TRAVERSE
REFERENCE NO.DESCRIPTION75

1118m ASL; old helicopter drill site (remnants of rubber hoses and 5' NQ rods); hole appears to have a dip of 70° at AZ 050°; elevation at permanent datum: 1130m ASL; cut area some 10 years± old (Probably old Esso Resources Drill Hole ... not reported)

76

1095m ASL; confluence of 2 creeks

77

1092m ASL; old McKechnie Trail and/or seismic line crosses creek

79

1090m ASL; ... followed old McKechnie Trail; could not locate old drill hole (DDH-W-13)

32

890m± ASL; confluence with Willow Creek