PR-TREFI 82(1) A

TREFI COAL PROJECT
1982 EXPLORATION PROGRAM
GEOLOGICAL REPORT

C.L.# 5840-44, 5858-67, 5886-5887, 5889, 5923, 5924, 5926, 5931-5933, 5977, 5981, 5984, 5990-5992, 5994-97, 6000-02, 6005-07, 6054-57, 6059-62, 6064-66, 6068-71, 6072-79, 6144-59

GULF CANADA RESOURCES INC.

COAL DIVISION

PREPARED BY

NORWEST RESOURCE CONSULTANTS LTD.

DECEMBER, 1982

PROJECT SUPERVISOR

A.E. BIENIA

Tables from Section 4, parts of Appendix 2, and all of Appendices 3, A, and B of this report contain coal quality data, and remain confidential under the terms of the *Coal Act Regulation*, Section 2(1). They have been removed from the public version.

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/10_251_2004

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES IN TEXT

LIST OF APPENDICES EXTERNAL TO TEXT

1.0 SUMMARY

The Trefi Coal Property consists of 21 709 hectares located south of the Pine River Valley, approximately 30 km southwest of the town of Chetwynd in Northeastern British Columbia. Within the licence boundaries a "resource area" has been identified which contains two coal seams with potential for economic development. The most promising portion of the resource area lies about 20 km south of the main line of the British Columbia Railway which runs along the Pine River Valley.

The 1982 exploration program consisted of completing two rotary drill holes for a total of 347.9 metres of drilling.

No significant structural changes were determined as a result of the 1982 program. The western edge of the property contains strata which dips quite steeply to the east. Depth of cover over the coal measures builds rapidly to the east-northeast. Dips appear to flatten at depth and remain relatively flat in a series of broad folds. These folds terminate along plunge to the southeast and are replaced with a series of smaller tight folds and small scale thrust faults at the southern end of the resource area.

Although no major stratigraphic changes were determined a considerable amount of detail concerning the lateral variations of significant strata was obtained. The resource area is underlain by Lower Cretaceous sediments with the Walton Member of the Commotion Formation containing the Trefi Coal Measures. Two coal seams of potential economic interest are present, the Caron Seam and the Highhat

Seam. An evaluation of the current data indicates that the Caron Seam, which is the thickest seam on the property has a greater lateral extent and thickness than previously indicated. The Highhat Seam is generally thinner and of limited areal extent. Other thin seams are intermittently present but are of no economic interest.

Inferred in-place resources within the Caron and Highhat Seams are as follows:

	Caron	Highhat
0.5 m to 1.5 metres	11 634 000	23 700 000
Greater than 1.5 metres	112 609 000	—
TOTAL	124 243 000	23 700 000

The Trefi coal is low to medium volatile bituminous in rank with relatively high calorific values, low ash, and low sulphur. Metallurgical properties appear marginal. Some select areas may be able to produce an acceptable run of mine product.

At a 1.65 S.G. cut-point the average quality parameters for the Caron Seam are as follows:

(air dried basis)	
Moisture (Residual)	0.43%
Ash	8.38%
Volatile Matter	22.51%
Fixed Carbon	68.68%
Sulphur	0.45%
Calorific Value (MJ/Kg)	32.10

2.0 INTRODUCTION

In 1979 and early 1980 Gulf Canada Resources Inc., under advisement by Dr. J.E. Hughes, acquired 249 coal licences covering 76 313 hectares. These licences were collectively named Trefi and the area referred to as the Trefi Coal Property. Two additional coal licences along the western boundary and six at the southern end were applied for in late 1980 and early 1981. Reconnaissance drilling and mapping completed in 1980 indicated an area of thicker, apparently continuous coal south of the Pine River with relatively thin coals, less than 1.0 metre in thickness occuring north of the Pine River. Consequently, a total of 124 licences, the majority of which lie north of the Pine River were surrendered in mid 1981. The resource area, as indicated by the 1980 and 1981 reports, was considered to contain two potentially mineable coal seams which attain thicknesses of 1.5 to 2.0 metres and named the Caron Seam (upper seam) and the Highhat Seam (lower seam). The resource area is situated south of the Pine River Valley and along the western margin of the property. During September and March of 1982, 48 coal licences to the north and east of the indicated resource area were surrendered. Figure No. 2.1.002 outlines the current leases and indicates those licences that were surrendered during 1982.

A depositional study conducted during the 1982 program indicates a larger resource area than was previously expected. North of the Western Transmission Gas Plant, coal is thin or absent and selected licences should be considered for release, The coal seams are contained in the Walton Member of the Commotion Formation.

Figure No. 2.1.001 illustrates the general Trefi project location.

The 1982 program was designed to further define the mining potential of the Caron Seam with intentions of conducting a depositional analyses of the Trefi deposit.

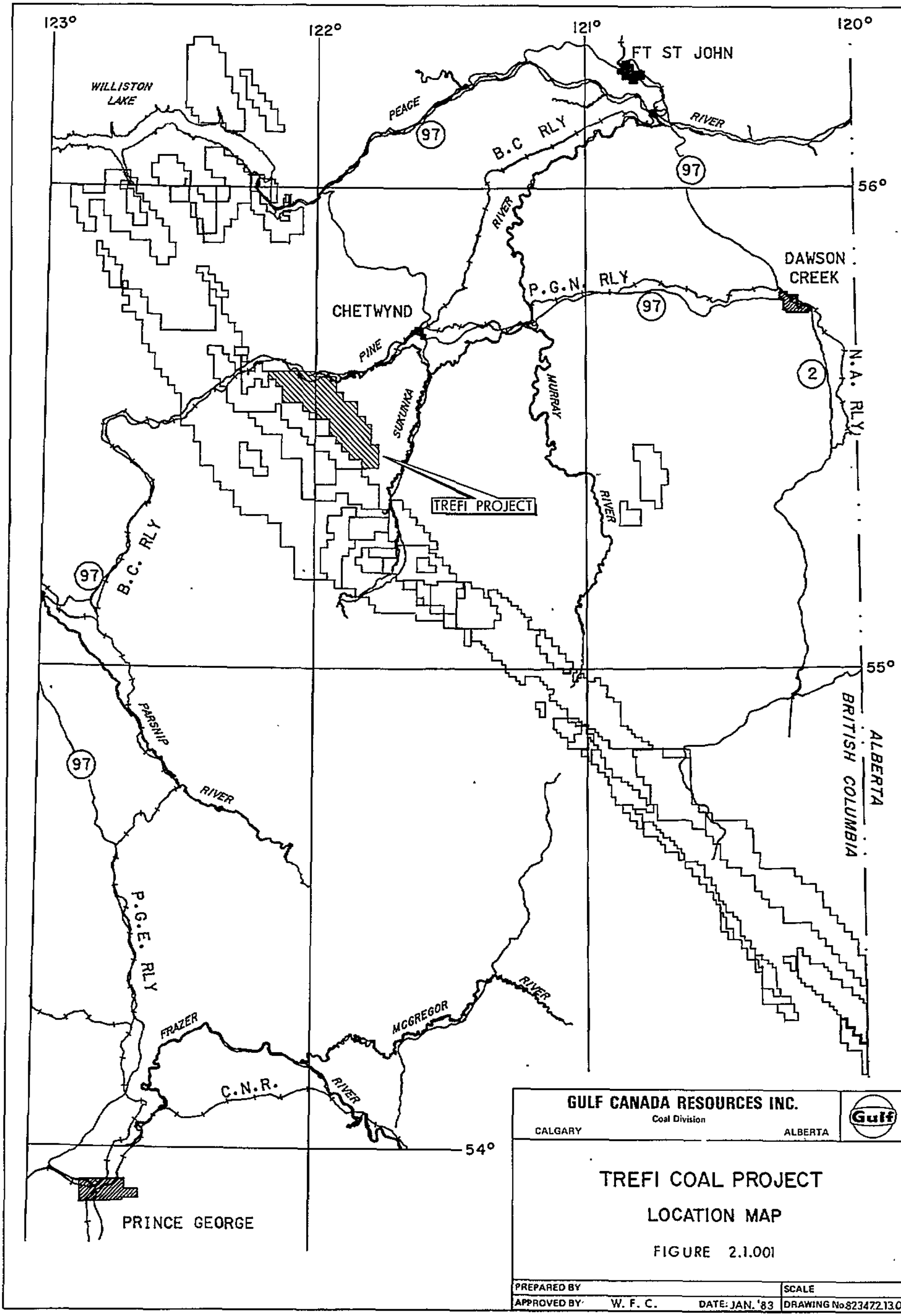
2.1 Location and Access

The Trefi Coal Property is located approximately 30 km southwest of the town of Chetwynd in Northeastern British Columbia at latitude 55° 30' and longitude 121° 50' (Figure No. 2.1.001). The licences currently held by Gulf Canada Resources Inc. are generally located south of the Pine River Valley. The Trefi Coal Property consists of 74 crown coal licences for a total of 21 709 hectares.

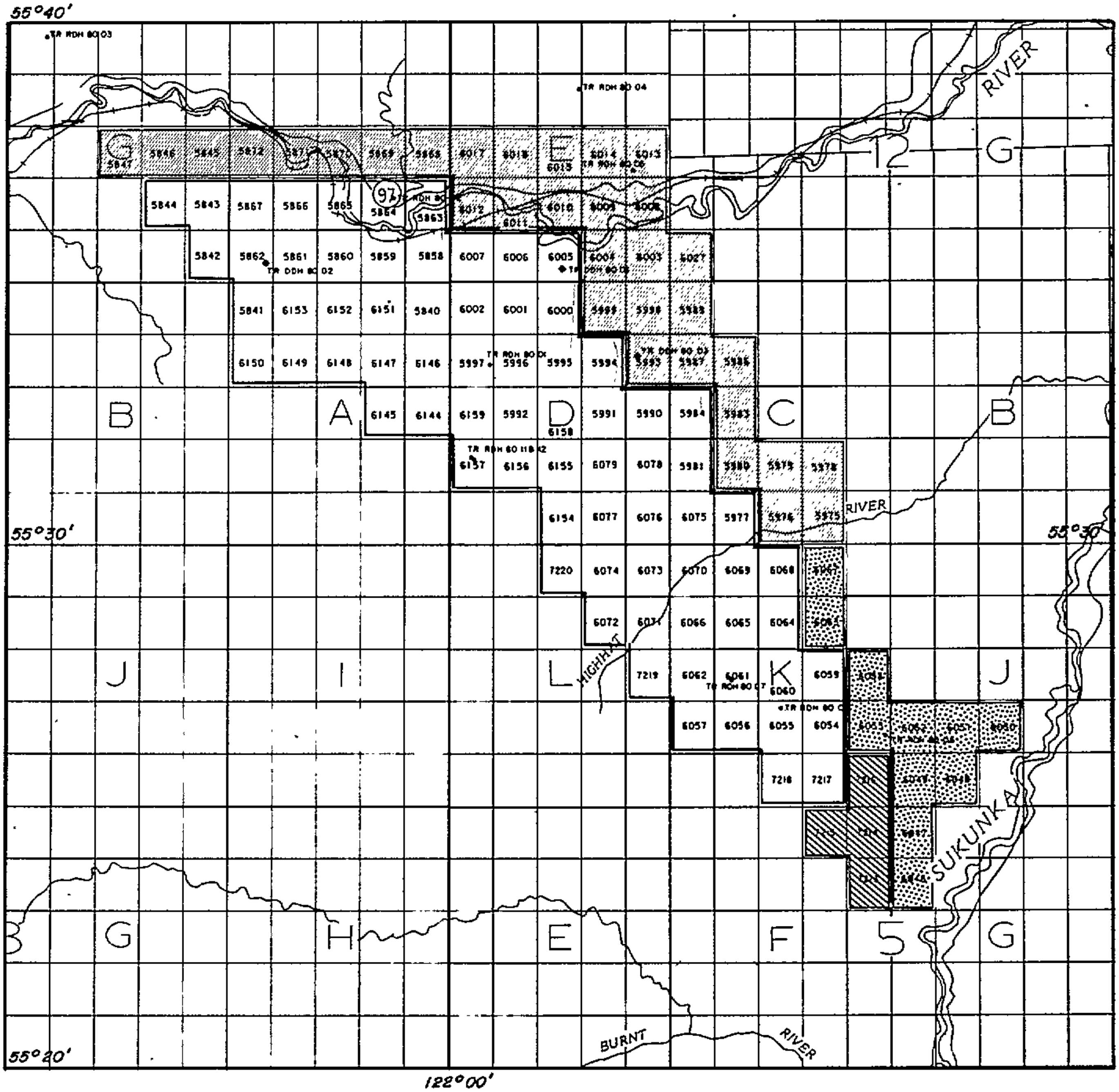
The southern portion of the property is accessible from Chetwynd via the Sukunka River road and an oil and gas exploration access road along Bluff Creek, a distance of about 50 km. The Sukunka River must be forded at approximately kilometre 40. The northern portion of the property is accessible along the Hasler Creek road which leads off the main John Hart Highway about 26 km west of Chetwynd and then along the Westcoast Transmission gas plant access road for a total distance from Chetwynd of about 40 km. There is no surface access into the central portion of the resource area which lies along the Highhat River.

The Westcoast Transmission Grizzly Valley pipeline runs south from the main gas plant just south of the Pine River Valley through the western edge of the resource area.

Some limited access is available along seismic cut lines during the winter season when the low swampy areas are sufficiently frozen.


123°
122°
121°
120°
56°
55°
54°
WILLISTON LAKE
PEACE
RIVER
FT ST JOHN
97
B.C RLY
RIVER
DAWSON CREEK
P.G.N. RLY
CHETWYND
PINE
SUKUNKA
MURRAY
RIVER
2
N.A. RLY
TREFI PROJECT
B.C. RLY
ALBERTA
BRITISH COLUMBIA
PARSNIP
RIVER
P.G.E. RLY
FRAZER
MCGREGOR
RIVER
C.N.R.
RIVER
PRINCE GEORGE
GULF CANADA RESOURCES INC.
Coal Division
CALGARY
ALBERTA
Gulf
TREFI COAL PROJECT
LOCATION MAP
FIGURE 2.1.001
PREPARED BY
SCALE
APPROVED BY W. F. C.
DATE: JAN. '83
DRAWING No 823472.13.0

The main line of the British Columbia Railway runs through the Pine River Valley approximately 20 km north of the southern portion of the resource area.



LEGEND

- SURRENDER - MARCH 1/82
- SURRENDER - MARCH 24/82
- SURRENDER - SEPT. 22/82
- CURRENT LEASES

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

Gulf

TREFI COAL LICENCES 1982

FIGURE 2.1.002

PREPARED BY.	M. J.		SCALE
APPROVED BY:	W.F.C.	DATE: JAN. '82	DRAWING No. 82347.2.14 0

2.2 Physiography

The Trefi Property is located along the eastern fringe of the Rocky Mountains Foothills: Rivers and creeks have cut into relatively flat lying strata leaving deep valleys and flat topped highlands. The principal drainage is the Pine River in the north and the Sukunka River to the east. The Highhat River cuts across the centre of the resource area and flows into the Sukunka River.

The topography of the area varies from 606 metres in the Pine River Valley to 1425 metres in the vicinity of Highhat Mountain. In the resource area the average elevation is about 1242 metres.

Till cover varies over the property, being deeper in creek and river valleys and thin on the highlands. In drill hole DDH-81-102 along the western highlands only 3 metres of gravel was present while in drill hole DDH-81-100 in the Highhat River Valley, 33.5 metres of gravel was intersected.

The area is generally heavily forested with mature stands of pine and spruce and smaller intermittent areas of poplar, willow and shrubs.

2.3 1982 Program Objectives

Gulf Canada Resources Inc.'s 1982 exploration program was designed to further define the depth, thickness, continuity, and quality of the Caron Seam within the southern portion of the indicated resource area.

The program consisted of drilling and coring two rotary drill sites located along existing roadways.

In addition to the drilling, depositional analyses of all data was undertaken to determine trends of elongation within the coal basin. This analysis was conducted using geophysical logs and core data.

2.4 1982 Program; Description of Work

The 1982 field program consisted of completing two rotary drill holes with coring of selected intervals of strata. The operation was conducted during the period of October 25 to November 3, 1982.

Drilling operations were carried out by Alberta Southern Exploration Drilling Ltd. of Calgary, Alberta. An air-rotary Cyclone TH-60 equipped with an Ingersoll-Rand screw type compressor, a hydraulic top head drive and a breakout rotary table was employed on both holes. Surface hole was cased to bedrock. Holes were then completed by drilling ahead with either a 6 inch button tricone or a 6 inch down hole hammer bit. Both holes were cored through the coal zone using a standard 5-1/8 inch O.D. Christensen split-tube core barrel which recovered approximately 3 inch diameter core using a diamond drilling bit. The core recovery was 100% in hole No. 82-100 and 83.5% in RDH-82-101.

The rotary drill holes were geophysically logged using a density, caliper, gammaray neutron, and focused resistivity log suite on a vertical scale of 1:100. An additional expanded scale of 1:40 was obtained through the coal seams using the focused resistivity and density logs. Down hole deviation surveys were run on both holes. All geophysical logging was carried out by Roke Oil Enterprises Ltd. of Calgary, Alberta.

Both holes intersected coal seams of potentially mineable thickness and were therefore cemented for their complete length as required by the Chief Inspector of Mines.

Table 2.4.01 outlines in detail all rotary drilling and coring.

Table 2.4.01

ROTARY DRILLING AND CORING SUMMARY

DATE	HOLE NO.	DAILY DRILLED (metres)	DAILY CORED (metres)	CUMULATIVE (metres)	TOTAL DEPTH (metres)	REMARKS
Oct. 26	RDH - 82 - 100	11.40	0	12.20		Set casing 6.0 m
Oct. 27	RDH - 82 - 100	92.30	9.90	113.60		Coring
Oct. 28	RDH - 82 - 100	8.80	—	122.40	122.40	Move to 82-101 Rig Stuck
Oct. 29						Rig Stuck unable to move
Oct. 30	RDH - 82 - 101	58.00	—	180.40		Set casing 5.0 m
Oct. 31	RDH - 82 - 101	129.63	5.59	315.62		Drilling and Coring
Nov. 1	RDH - 82 - 101	10.49	9.53	335.64		Drilling and Coring
Nov. 2	RDH - 82 - 101	12.26	—	347.90	225.50	Demob. and Cement Holes
		322.88	25.02	347.90		

2.5 Summary of Previous Work

Geological mapping of the Trefi area has been underway for some years by Dr. J.E. Hughes as part of his overall on-going mapping program of the Pine River area. Examination of oil and gas geophysical logs in the area indicated the presence of coal seams of commercial thickness in the Commotion Formation in strata above the coal-bearing Gates Member.

In 1980 a mapping and drilling program was carried out by Gulf Canada Resources Inc. on the Trefi Property which was acquired during 1980. This program covered the area from the Sukunka River in the southeast to Williston Lake in the north. The program was divided into two phases, the first being a helicopter supported diamond drilling operation in which three diamond drill holes were completed for a total of 640 metres of drilling. This drilling program was followed by a rotary drill hole program for an additional 2538 metres.

In conjunction with the drilling programs, a geologic mapping program was carried out over the entire property.

The 1980 program determined that potential coal development of economic interest is confined to the area south of the Pine River.

In 1981 a second exploration program was conducted which consisted of geological mapping and drilling in the resource areas south of the Pine River. Four diamond drill holes were completed for a total depth of 1254 metres along with six rotary holes totalling 1687 metres.

3.0 GEOLOGY

3.1 Regional Geology

The Trefi coal licences are situated in the Outer Foothills Belt of the Rocky Mountains. The area is generally underlain by Lower Cretaceous Bullhead Group and Fort St. John Group strata.

The area lies some distance northeast of the main front of structural disturbance caused by the Rocky Mountain Laramide Orogeny. As such, dips are steeper along the western edge of the licences flattening into broad folds to the east with some minor local faulting. The folds tend to converge and increase in amplitude towards the south. Thrust faulting also occurs more frequently in the south.

3.1.1 Stratigraphy

The stratigaphy of the project area has been discussed in the 1980 and 1981 reports. These reports indicate the presence of coal-bearing strata within the Walton Member of the Commotion Formation (Table 3.1.01). Reclassification of the Gates, Hulcross and Boulder Creek Members to formation status has recently been reported by McLean (GSC; Report No. 80-29). To allow for consistent reference to previous stratagraphic nomenclature, this report will refer to the Walton, Boulder Creek, Hulcross and Gates as being members of the now non-existent Commotion Formation. As defined in these earlier reports, the Walton Member lies conformably on

Table 3.1.01

GENERALIZED STRATIGRAPHIC SECTION

AGE		GROUP	FORMATION		DESCRIPTION
CRETACEOUS	UPPER	FORT ST. JOHN	DUNVEGAN		Sandstone, shale, siltstone, minor conglomerate, few thin coal seams.
CRETACEOUS	UPPER	FORT ST. JOHN	CRUISER		Thickness: 160 - 260 m Claystone, siltstone, minor thin sandstone; marine.
CRETACEOUS	LOWER	FORT ST. JOHN	GOODRICH		Thickness: 170 - 260 m Sandstone, some conglomerate, siltstone, claystone.
CRETACEOUS	LOWER	FORT ST. JOHN	HASLER		Thickness: 210 - 340 m Claystone, siltstone, thin sandstone; marine.
CRETACEOUS	LOWER	FORT ST. JOHN	COMMOTION	WALTON MEMBER	Thickness: 51- 80 m Siltstone, sandstone, claystone, carbonaceous claystone.
CRETACEOUS	LOWER	FORT ST. JOHN	COMMOTION	BOULDER CREEK MEMBER	Thickness: 84 - 109 m Sandstone, conglomerate, siltstone, some claystone.
CRETACEOUS	LOWER	FORT ST. JOHN	COMMOTION	HULCROSS MEMBER	Thickness: 96 - 114 m Siltstone interbedded with claystones; marine.
CRETACEOUS	LOWER	FORT ST. JOHN	COMMOTION	GATES MEMBER	Thickness: 87 - 220 m Sandstone, siltstone, claystone, some conglomerate, COAL.
CRETACEOUS	LOWER	FORT ST. JOHN	MOOSEBAR		Thickness: 400 - 450 m Claystone, siltstone, marine.
CRETACEOUS	LOWER	BULLHEAD	GETHING		Thickness: 490 - 570 m Sandstone, siltstone, claystone, carbonaceous claystone, COAL.

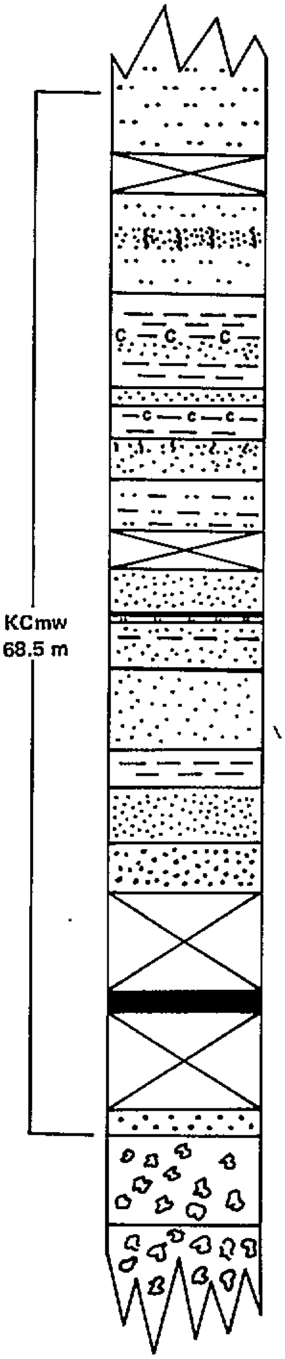
conglomerates which have been assigned to the Boulder Creek Member. The Walton Member is conformably overlain by the Hasler Formation. Three significant coal seams are present within the Walton Member: the Caron, Linklater and Highhat Seams.

Detailed stratigraphic analysis undertaken as a part of the 1982 geologic program re-evaluated member contacts as well as the lateral continuity of stratigraphic units, particularly coal seams. This analysis involved the construction of a detailed correlation diagram (Appendix III) using geophysical logs at a vertical scale of 1:400. A generalization of this diagram is presented as Figure 3.1.103.

In conducting a detailed stratigraphic analysis all logs were reduced to a zero relative dip scale and laterally continuous stratigraphic units were identified which could be used as local datum horizons. Several datum horizons were identified including the tops of marine sandstones in the Boulder Creek Member, as well as coal seams, high natural gamma radiation beds and laterally persistent fluvial sandstone beds in the Walton Member (Appendix III and Figure 3.1.103).

The current evaluation of stratigraphic data has resulted in the redefinition of the base of the Walton Member as the top of the upper most laterally continuous marine sandstone unit. This stratigraphic unit or boundary is

DETAILED STRATIGRAPHY OF WALTON MEMBER



SILTSTONE: LIGHT GREY BROWN, FINELY LAMINATED WITH SOME CONVOLUTE BEDDING OF VERY FINE GRAINED LIGHT GREY SANDSTONE

COVERED INTERVAL

SILTSTONE: MEDIUM GREY, WITH RUSTY ORANGE WEATHERED SURFACE, FINELY LAMINATED WITH COALY ROOTLETS AND SOME INTERBEDDED SANDSTONE: MEDIUM BROWN, VERY FINE GRAINED, WELL SORTED, THINLY BEDDED

ZONE OF INTERBEDDED CLAYSTONE: LIGHT GREY BROWN, SOME CARBONACEOUS CLAYSTONE WITH SOME THIN STRINGER SANDSTONES: BROWN, VERY FINE GRAINED
SANDSTONE: LIGHT BROWN GREY, VERY FINE GRAINED, FINELY LAMINATED, THINLY BEDDED
CLAYSTONE: LIGHT GREY, RECESSIVE, BECOMING CARBONACEOUS NEAR TOP OF UNIT
SANDSTONE: LIGHT GREY, BUFF, VERY FINE GRAINED, MASSIVE, WITH SOME COALY ROOTLETS
CLAYSTONE: BROWN, BUFF, RECESSIVE, SILTY
COAL: BLACK, SHARP UPPER CONTACT, GRADATIONAL LOWER CONTACT IN CARBONACEOUS MUDSTONE

COVERED INTERVAL

COAL: BLACK, SHARP UPPER CONTACT, GRADATIONAL LOWER CONTACT, SOME BRIGHT COAL
SANDSTONE: MEDIUM BROWN, VERY FINE GRAINED, FINELY LAMINATED, THINLY BEDDED
COAL: BLACK, SHARP UPPER CONTACT, GRADATIONAL LOWER CONTACT INTO GREY SILTSTONE
SILTSTONE: GREY BROWN, RECESSIVE
SANDSTONE: GREY/BLACK, VERY FINE GRAINED, FINELY LAMINATED WITH COALY CHIPS
CARBONACEOUS CLAYSTONE: BLACK, VERY COALY IN NATURE
SANDSTONE: MEDIUM GREY/BROWN, FINE GRAINED, WELL SORTED, FINELY LAMINATED, CROSS-BEDDED, THINLY BEDDED
CLAYSTONE: GREY, FISSILE

SANDSTONE: WHITE, GREY, BUFF GRAINS, MEDIUM/FINE GRAINED, MODERATELY WELL SORTED BECOMING CROSS LAMINATED NEAR TOP OF UNIT

SANDSTONE: WHITE, GREY AND BUFF, COARSELY GRAINED TO GRIT, MODERATE SORTING, WELL CEMENTED, MEDIUM/THINLY BEDDED

COVERED INTERVAL

CARBONACEOUS CLAYSTONE AND COAL

COVERED INTERVAL

SANDSTONE: MEDIUM GREY, COARSELY GRAINED, WELL SORTED, WELL CEMENTED, MASSIVE GRIT/PEBBLE CONGLOMERATE WITH WHITE, GREEN AND GREY, ANGULAR CHERT, WELL CEMENTED, MASSIVE

AS MAPPED ALONG THE GETTY RIG ROAD, NORTH OF THE PINE RIVER
SCALE: 1:500
JULY 05/81

GULF CANADA RESOURCES INC.
Coal Division
CALGARY ALBERTA

TREFI COAL PROJECT

DETAILED STRATIGRAPHY

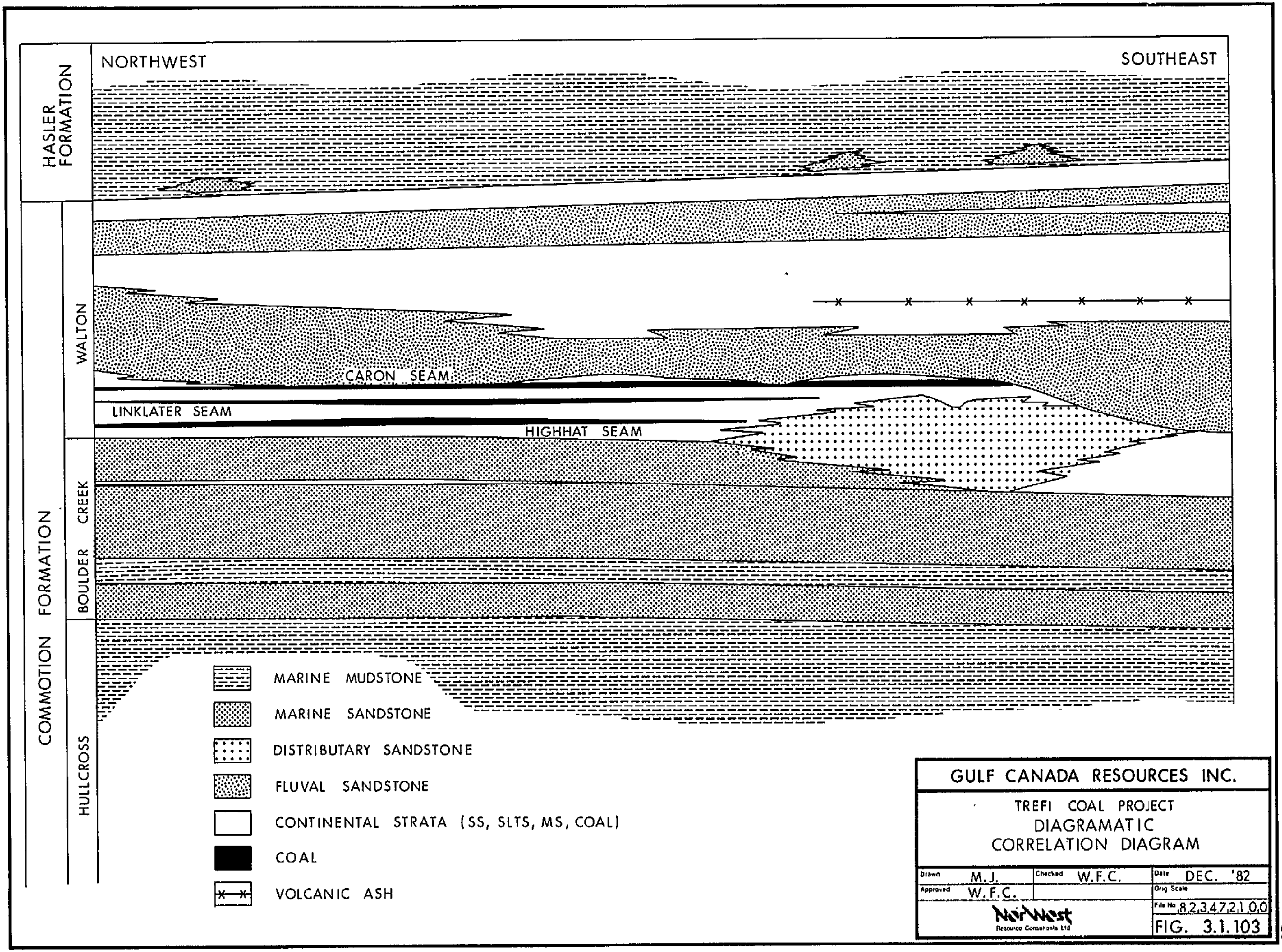
FIGURE 3.1.102

PREPARED BY: KEN SAMSON	SCALE 1 : 500
APPROVED BY: DATE: OCT. / 81	DRAWING No. 82347.2.16

easily recognizable on geophysical logs, traceable in the subsurface, and is laterally continuous over wide areas (Figure 3.1.103).

As is the case with other Cretaceous strata throughout the Western Interior of North America, the boundary between the Walton and Boulder Creek Members rises stratigraphically in a seaward direction and interfingers laterally along shoreline trends. As shown on the correlation diagrams (Appendix III and Figure 3.1.103), the base of the Walton Member rises stratigraphically to the northwest as a third marine sandstone is added to the Boulder Creek Member.

The use of multiple datums including the marine sandstones of the Boulder Creek Member and the massive sandstone which overlies the Caron Seam have been useful in establishing the correlation of individual coal seams. (Appendix III and Figure 3.1.103). This correlation has identified three laterally continuous coal seams and several seams of only local extent. The three laterally continuous coal seams are referred to in ascending stratigraphic order as the Highhat, Linklater, and Caron Seams. Other localized seams in the basal and central portions of the Walton Member have been recognized and have locally been correlated.

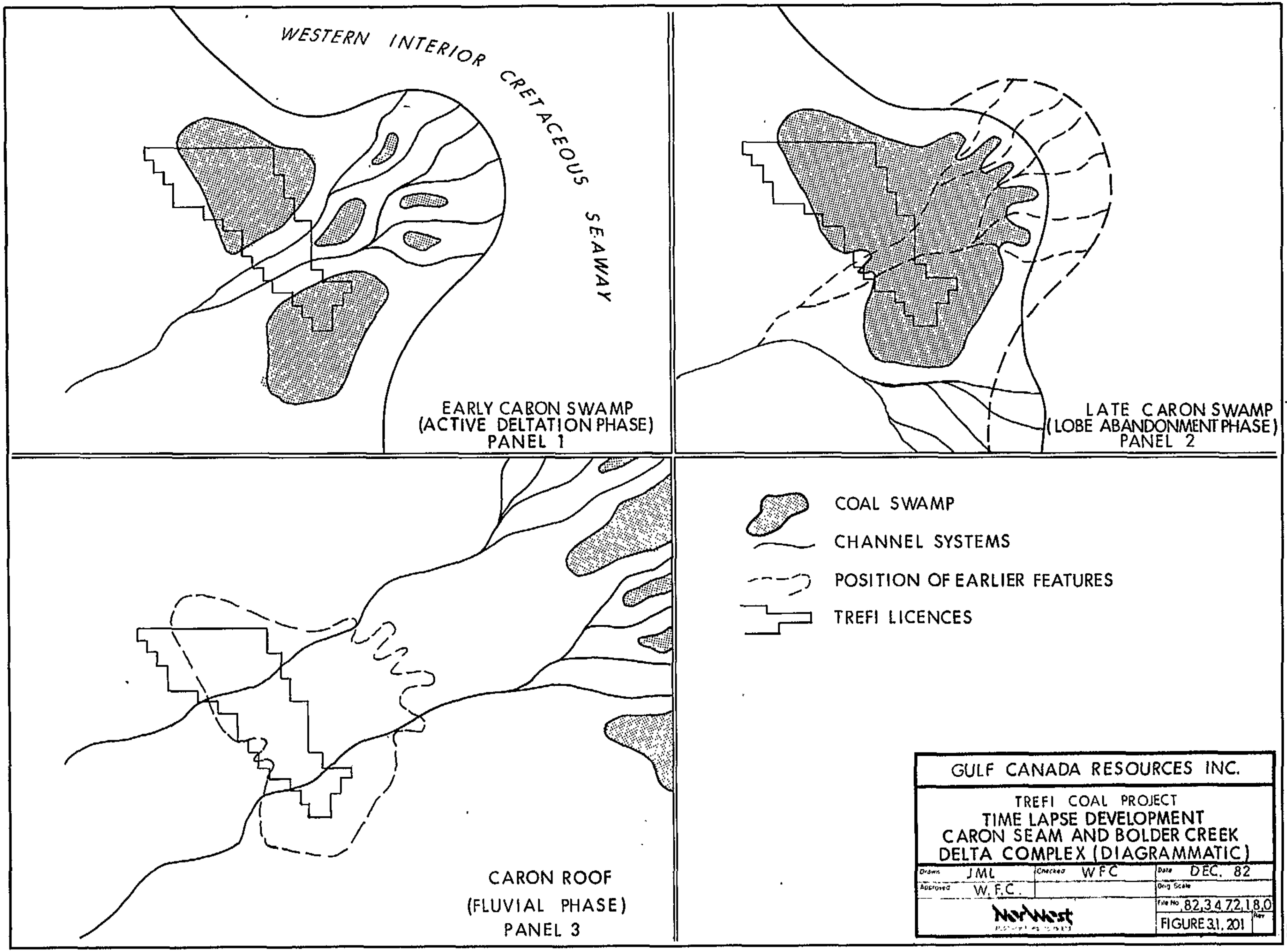


NORTHWEST
SOUTHEAST
HASLER FORMATION
COMMOTION FORMATION
WALTON
BOULDER CREEK
HULLCROSS
CARON SEAM
LINKLATER SEAM
HIGHHAT SEAM
MARINE MUDSTONE
MARINE SANDSTONE
DISTRIBUTARY SANDSTONE
FLUVAL SANDSTONE
CONTINENTAL STRATA (SS, SLTS, MS, COAL)
COAL
VOLCANIC ASH
GULF CANADA RESOURCES INC.
TREFI COAL PROJECT
DIAGRAMATIC
CORRELATION DIAGRAM
Drawn M.J.
Checked W.F.C.
Date DEC. '82
Approved W.F.C.
Orig Scale
File No. 8,2,3,4,7,2,1,0,0
NorWest
Resource Consultants Ltd
FIG. 3.1.103

3.1.2 Depositional Analysis

Two levels of depositional modeling were conducted: regional and detailed. The regional depositional studies are discussed here and the detailed studies will be presented in the discussion for each of the coal seams.

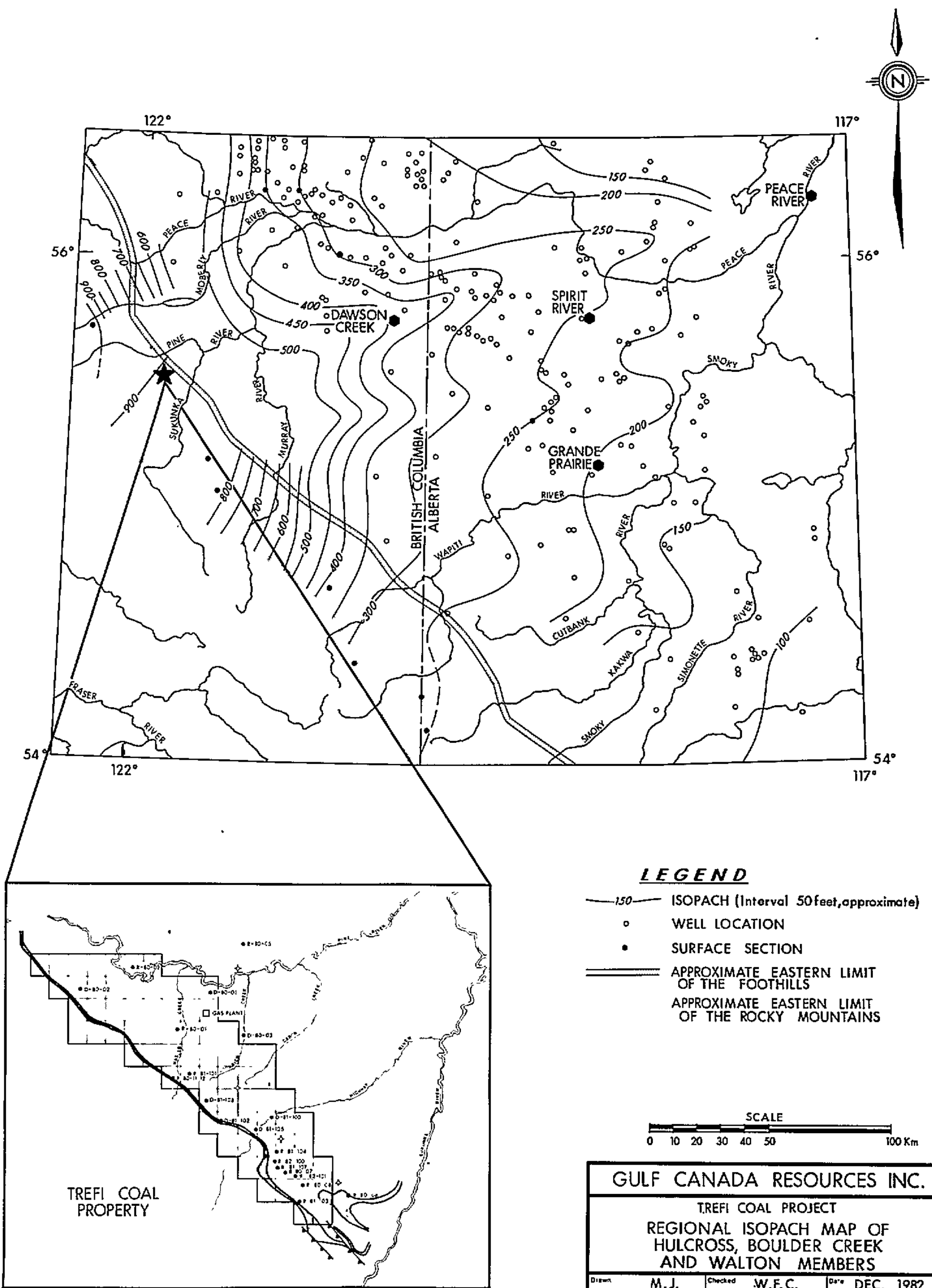
Regional depositional modelling involved the evaluation of the origins of the members of the Commotion Formation and the Hasler Formation. Regional geologic reports (Stott, 1968) and geophysical logs obtained in the project area were utilized in this evaluation. These sources of data indicate that the upper three members of the Commotion Formation were deposited during a progradation of deltaic environments through the project area during Albian times (3.1.201). The marine mudstones which comprise the Hulcross Member were deposited in offshore and prodelta environments seaward of a delta complex located to the west. The progradation of this deltaic complex through the project area resulted in the deposition of the laterally continuous delta front and shoreline marine sandstones which comprise the Boulder Creek Member. Continued progradation of the delatic complex through the project area resulted in the accumulation of the delta plain strata which form the Walton Member. Delta plain strata include distributary and fluvial channel sandstones, marsh mudstones, crevasse splay interbedded sequences and swamp coals.


WESTERN INTERIOR CRETACEOUS SEAWAY
EARLY CARON SWAMP
(ACTIVE DELTATION PHASE)
PANEL 1
LATE CARON SWAMP
(LOBE ABANDONMENT PHASE)
PANEL 2
CARON ROOF
(FLUVIAL PHASE)
PANEL 3
COAL SWAMP
CHANNEL SYSTEMS
POSITION OF EARLIER FEATURES
TREFI LICENCES
GULF CANADA RESOURCES INC.
TREFI COAL PROJECT
TIME LAPSE DEVELOPMENT
CARON SEAM AND BOLDER CREEK
DELTA COMPLEX (DIAGRAMMATIC)
Drawn JML
Checked WFC
Date DEC. 82
Approved W. F.C.
Orig Scale
File No 82,3,4,7,2,1,8,0
NorWest
FIGURE 31, 201

The progradation represented by the upper three members of the Commotion Formation was terminated by a decrease in sediment supply and/or an increase in sea level. The Hasler Formation accumulated during and after the resulting transgression. A few isolated and discontinuous marine sandstone beds at the base of the Hasler Formation accumulated by the contemporaneous erosion of the uppermost strata of the Walton Member during the transgression. The remainder of the Hasler Formation consists of marine-deposited mudstones.

Available data suggests that Laramide thrust faulting and uplift provided a nearby source area for the coarse-grained sandstone and locally conglomeratic strata which is contained within the Boulder Creek and Walton Members. This data indicates that the delta complex may be classified as a fluvial-dominated, lobate system characterized by sinuous distributaries (Galloway, 1975). The regional isopach map of the Hulcross, Boulder Creek, and Walton Members confirms a lobate deltaic shape with a persistent east-northeasterly direction of progradation (Stott, 1968) (Figure 3.1.202). The closely spaced contour lines on this isopach map for the intervals 350 to 800 feet probably indicate the delta front at the maximum extent of progradation.

Coal accumulation in the delta complex occurred in interdistributory lowland swamps between the distributary channels and in lowland swamps on the delta margin (Figure



LEGEND

- ISOPACH (Interval 50 feet, approximate)
- WELL LOCATION
- SURFACE SECTION
- APPROXIMATE EASTERN LIMIT OF THE FOOTHILLS
- APPROXIMATE EASTERN LIMIT OF THE ROCKY MOUNTAINS

SCALE
0 10 20 30 40 50 100 Km

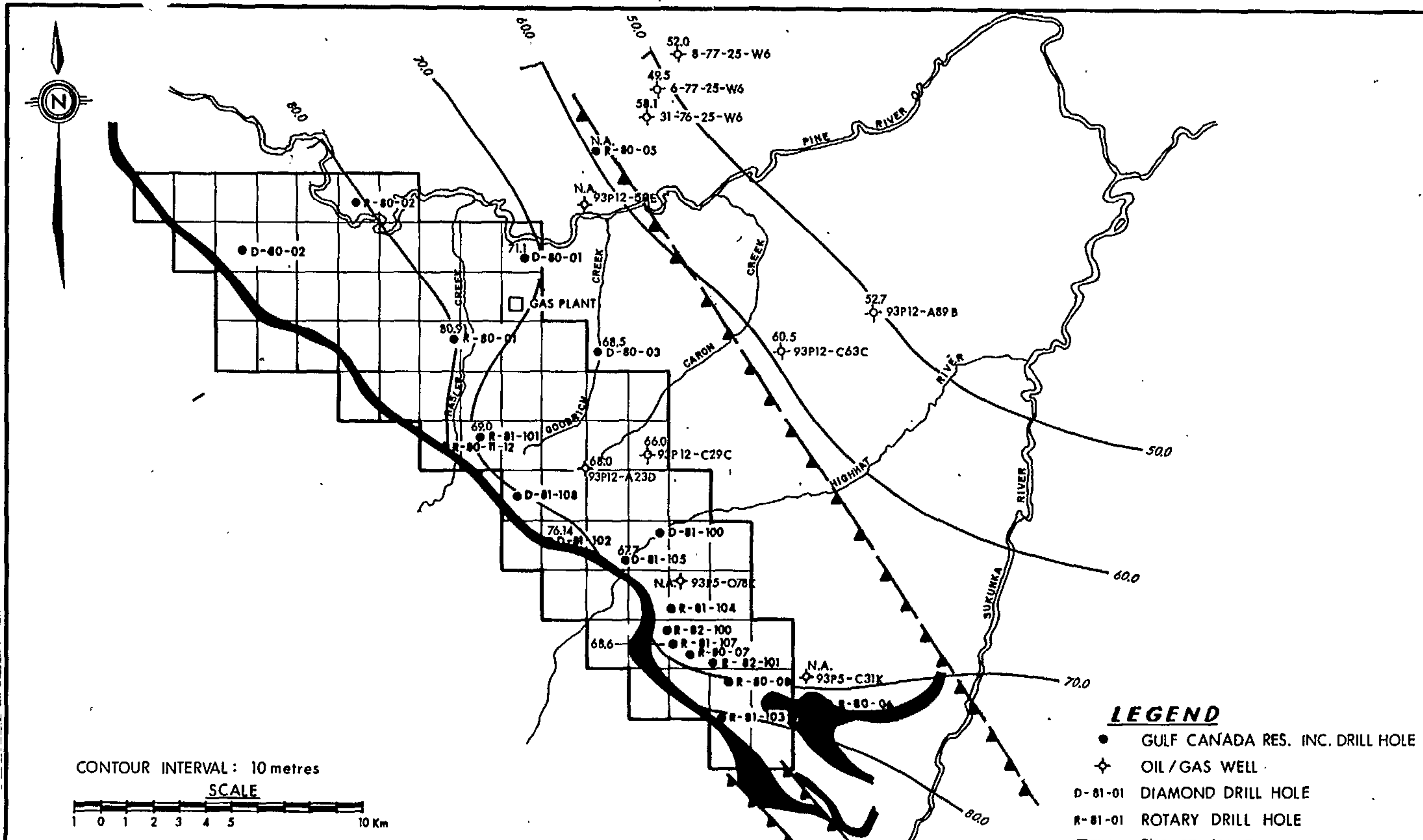
FROM - STOTT (1968)

GULF CANADA RESOURCES INC.

TREFI COAL PROJECT

REGIONAL ISOPACH MAP OF HULCROSS, BOULDER CREEK AND WALTON MEMBERS

Drawn	M.J.	Checked	W.F.C.	Date	DEC. 1982
Approved	W.F.C.			Orig. Scale	BAR
NorWest Resource Consultants Ltd.				File No.	8.2.3.4.7.2.1.1.0
				FIG.	3.1.202



GULF CANADA RESOURCES INC.

TREFI COAL PROJECT

ISOPACH
THICKNESS OF WALTON MEMBER

Drawn M.J.	Checked W.F.C.	Date DEC. '82	
Approved W.F.C.		Orig. Scale 1:200 000	
NorWest Resource Consultants Ltd.		File No. 823472210	
		FIG. 3.1.203	

3.1.201, Panel 1). These swamps were small and relatively discontinuous. Delta lobe abandonment, took place so that the distributary channels abandoned previous courses in favour of shorter, steeper-gradient routes to the sea. Subsequently lowland swamps expanded to cover the entire delta plain as the abandoned lobe subsided (FIgure 3.1.201, Panel 2). If the growth and accumulation of vegetation can keep pace with lobe subsidence, a thick and laterally continuous coal seam can accumulate. Eventually, the progradation of the delta complex will result in the re-establishment of distributaries in the abandoned lobe area and swamp conditions will be terminated (Figure 3.1.201, Panel 2). Channeling in the coal will occur if the subsequent distributary channels are high energy flow systems capable of transporting cobble-sized material.

3.1.3 Structure

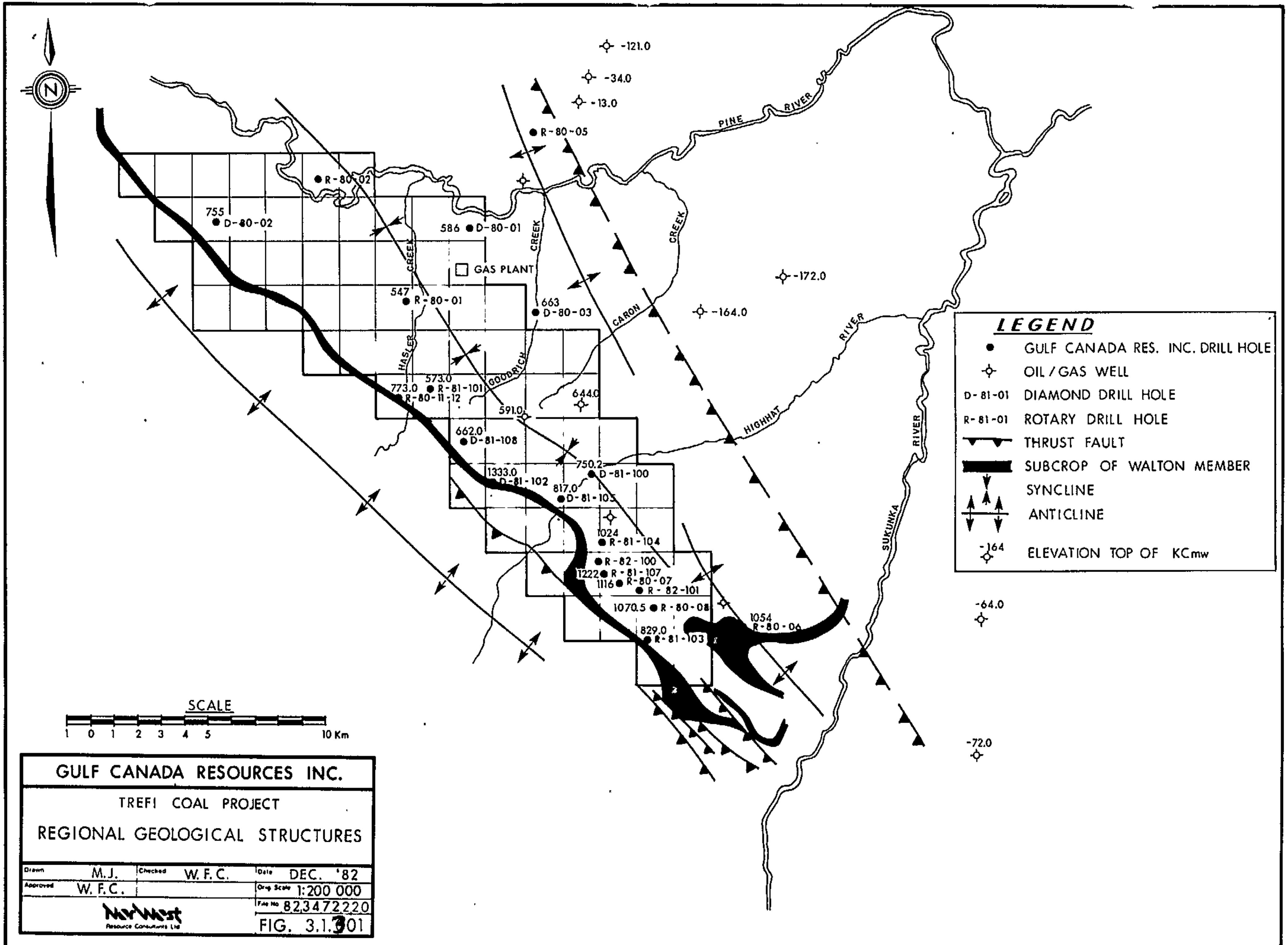
The most intense structural feature affecting the Trefi property is the Pine River Anticline which lies immediately along the western margin of the property. Along the northeast limb of this feature, resistent Boulder Creek Member sandstones and conglomerates outcrop and form northwest-trending ridges. The Walton Member is brought to surface as well, along this limb, but due to the recessive nature of the rocks and cover by surficial material, it is not normally exposed.

The northeast limb of the Pine River Anticline dips rather steeply to the northeast with attitudes ranging from 25° to 45°. At depth along this limb a flexure causes the dips to flatten and eventually dip in the opposite direction following a syncline. The syncline is called the Hulcross Syncline and this structure is generally broad with gentle dips, particularly along the northeast limb. The Hulcross Syncline narrows to the southeast and terminates just north of Highhat Mountain.

To the northeast the Hulcross Syncline is paired with the Commotion Anticline. Dips on the Commotion Anticline are relatively gentle. The Commotion Anticline terminates north of the Highhat Mountain where it converges with the Pine River Anticline. Axial plunge on all folds is towards the southeast.

The Trefi property structure is illustrated in the cross-sections contained in Appendix IV of the 1981 Geological Report and Figure No. 3.1.301.

A fault, named the Highhat Fault, is postulated just west of Highhat Mountain. Poor exposure makes it very difficult to detail this feature with any certainty. Sub-surface investigation will be necessary to positively identify and locate this structure if present.



N
-121.0
-34.0
-13.0
R-80-05
PINE RIVER
R-80-02
755 D-80-02
586 D-80-01
CREEK
CREEK
CREEK
GAS PLANT
547 R-80-01
663 D-80-03
CARON
-172.0
-164.0
RIVER
HASLER
GOODRICH
573.0 R-81-101
773.0 R-80-11-12
591.0
644.0
662.0 D-81-108
HIGHHAT
RIVER
750.2 D-81-100
1333.0 D-81-102
817.0 D-81-105
1024 R-81-104
R-82-100
1222 R-81-107
1116 R-80-07
R-82-101
1070.5 R-80-08
1054 R-80-06
829.0 R-81-103
SUKUNKA
-64.0
-72.0
LEGEND
GULF CANADA RES. INC. DRILL HOLE
OIL / GAS WELL
D-81-01 DIAMOND DRILL HOLE
R-81-01 ROTARY DRILL HOLE
THRUST FAULT
SUBCROP OF WALTON MEMBER
SYNCLINE
ANTICLINE
-164 ELEVATION TOP OF KCmw
SCALE
1 0 1 2 3 4 5 10 Km
GULF CANADA RESOURCES INC.
TREFI COAL PROJECT
REGIONAL GEOLOGICAL STRUCTURES
Drawn M.J.
Checked W.F.C.
Date DEC. '82
Approved W.F.C.
Orig Scale 1:200 000
File No 823472220
NorWest Resource Consultants Ltd
FIG. 3.1.301

South of Highhat Mountain the structure becomes somewhat more complex with fold amplitudes increasing and some thrust faulting taking place. The geological data that is available to date in this area has been generalized and is plotted along with all other Trefi stratigraphic and structural data.

The series of thrust faults shown on the north-east corner of the property are considered to parallel the east edge of Trefi coal property as far south as the Sukunka River. Displacement is considered to be in the order of 800 metres. Lack of detailed mapping has resulted in this feature being positively identified.

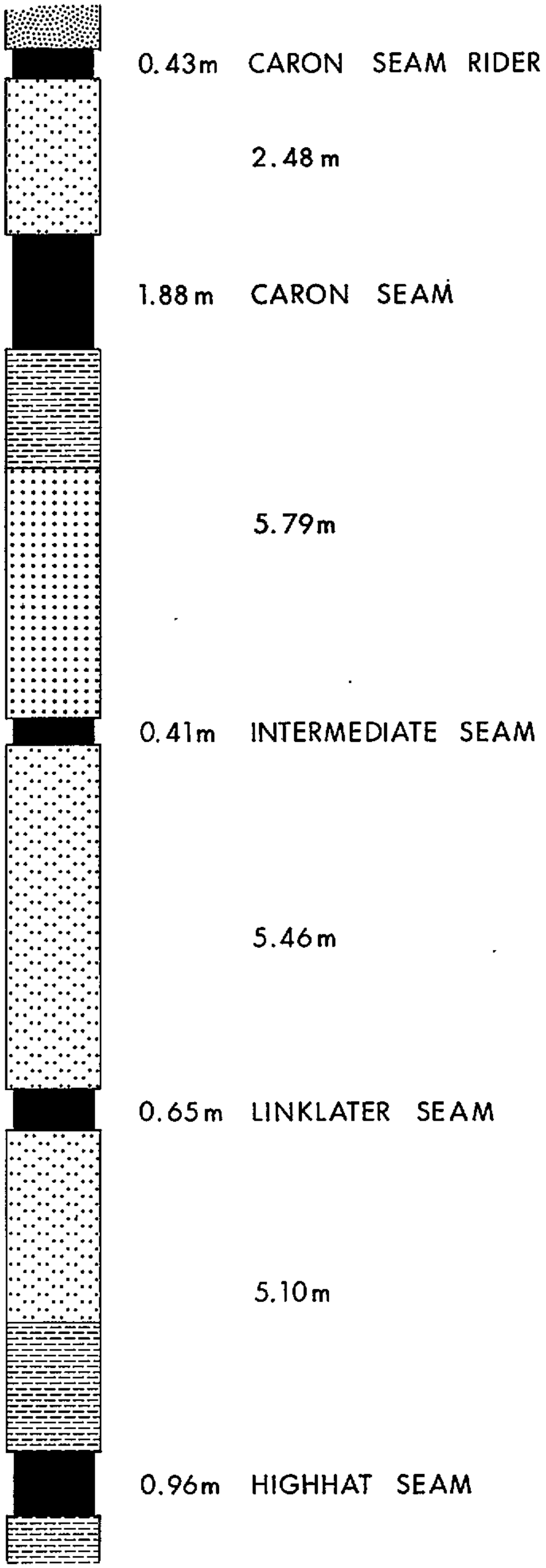
3.2 Coal Seam Stratigraphy

The three drilling programs conducted on the Trefi licences indicate the presence of three seams that are laterally continuous. The seams have been named the Highhat, Linklater and Caron Seams in ascending stratigraphic order.

In evaluating each of the coal seams, it was necessary to conduct a depositional analysis of the strata which encloses the seams in order to predict trends of elongation and thinning. Most of the depositional modelling was applied to the Caron Seam and enclosed strata since this seam has the greatest mining potential.

The strata which lie immediately below coal seams commonly influence the thickness of the coal. Elevated areas of paleotopography cause a reduction in the accumulation of coal. This is particularly the case for coal seams which have their origin in interdistributary lowland swamps that later expanded and coalesced over distributary channels.

Strata which overlie coal seams commonly have the potential for channeling coal seams. This is particularly the case where massive, coarse-grained sandstones which were deposited in high energy flow systems were deposited immediately above coal seams.



GENERALIZED COAL OCCURRENCES
WITHIN WALTON MEMBER

NorWest Resource Consultants Ltd

FIGURE 3.2.100

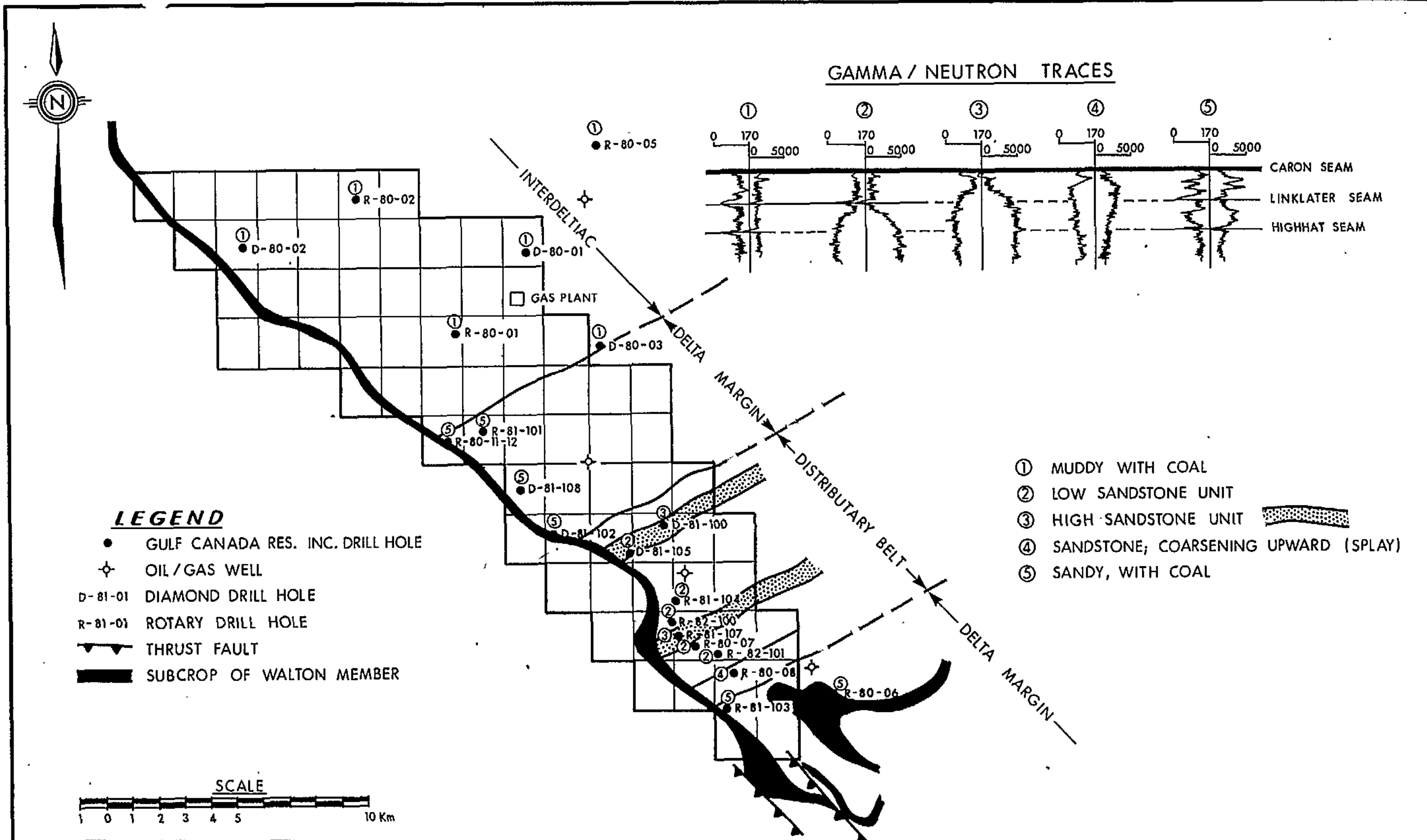
82-347.2.17.0

3.2.1 Caron Seam

The Caron Seam, as named in the 1980 exploration program, is the uppermost of the three laterally continuous seams on the Trefi property. The Caron Seam has the greatest mining potential of all of the seams on the property because of its wide lateral continuity and its thickness which commonly exceeds 1.5 metres and attains a maximum of 4.38 metres.

A depositional analysis of the floor of the Caron Seam indicates the presence of a major distributary channel system which trends east-northeast across the south-central part of the Trefi licences (Figure 3.1.101). The distributary channel system and adjacent environments are recognized by distinctive geophysical log responses (Figure 3.2.101). A differentiation between "high" and "low" distributary channels is made to determine areas where the overlying Caron Seam may be thinner. The topographically higher parts of the abandoned Delta plain will be the last areas covered by the expanding swamps in which the Caron Seam accumulated and, these will be the areas where the Caron Seam may be thinner.

Two "high" channel areas have been identified in the immediate floor of the Caron Seam. The trend of these channels is based on a "best fit" of data between holes which are only locally located to allow a three dimensional



GULF CANADA RESOURCES INC.

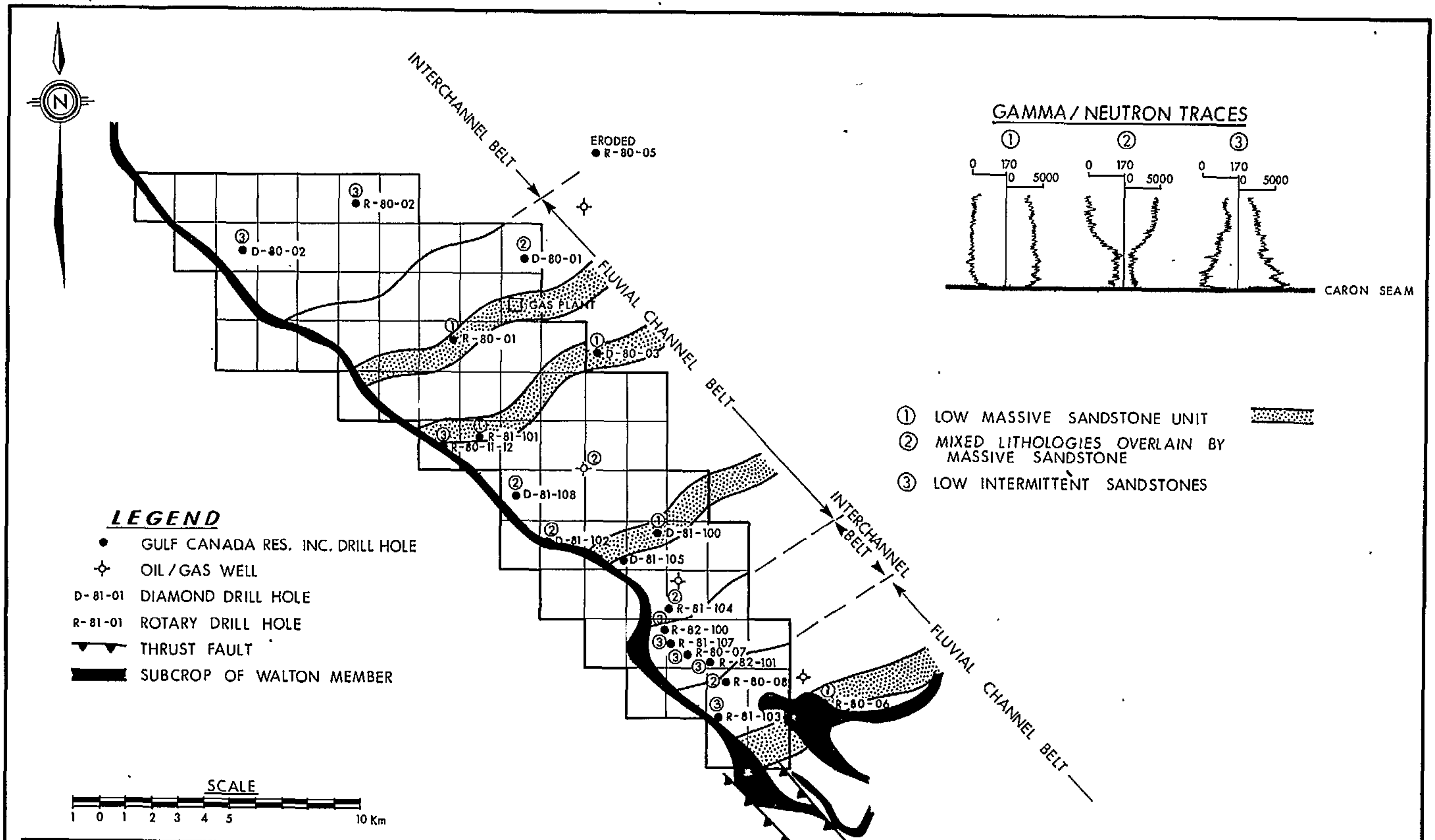
TREFI COAL PROJECT
CARON SEAM; FLOOR STRATA
ISOFACIES MAP

Drawn M. J.	Checked W. F. C.	Date	DEC. '82
Approved W. F. C.		Orig. Scale	1:200 000
NorWest Resource Consultants Ltd		File No.	823472010
			FIG. 3.2.101

analysis. The trend conforms with the elongation shown in the isopach map of the upper three members of the Commotion Formation (Figure 3.1.202). The width of these trends has not been established, but the half kilometre wide zones (Figure 3.2.101) are of the correct order of magnitude.

A depositional analysis of the roof of the Caron Seam indicates the presence of a well-defined fluvial channel system which lies above the Caron Seam (Figures 3.1.102 and 3.2.103). In places this channel system rests immediately on the Caron Seam. This fluvial channel system trends east-northeast and is locally interrupted by interchannel areas. Four "low" channel trends have been identified where the sandstone is in contact with the coal and where scouring of the coal is likely. Comparison of other channel widths indicate that the two northern channels are not a single, wide channel but individual trends instead. Sufficient data are not available to accurately define the widths of these roof channels.

Previous attempts at connecting lines of equal thickness of the Caron Seam have projected the pinchout of the coal to the east, north and south of a lobate-shaped thick pod in the southern part of the Trefi licences. The recent depositional study indicates that the traditional method of constructing isopach lines should not be followed for this deposit since depositional controls from a major influence on trends of elongation, thinning and thickening of coal.

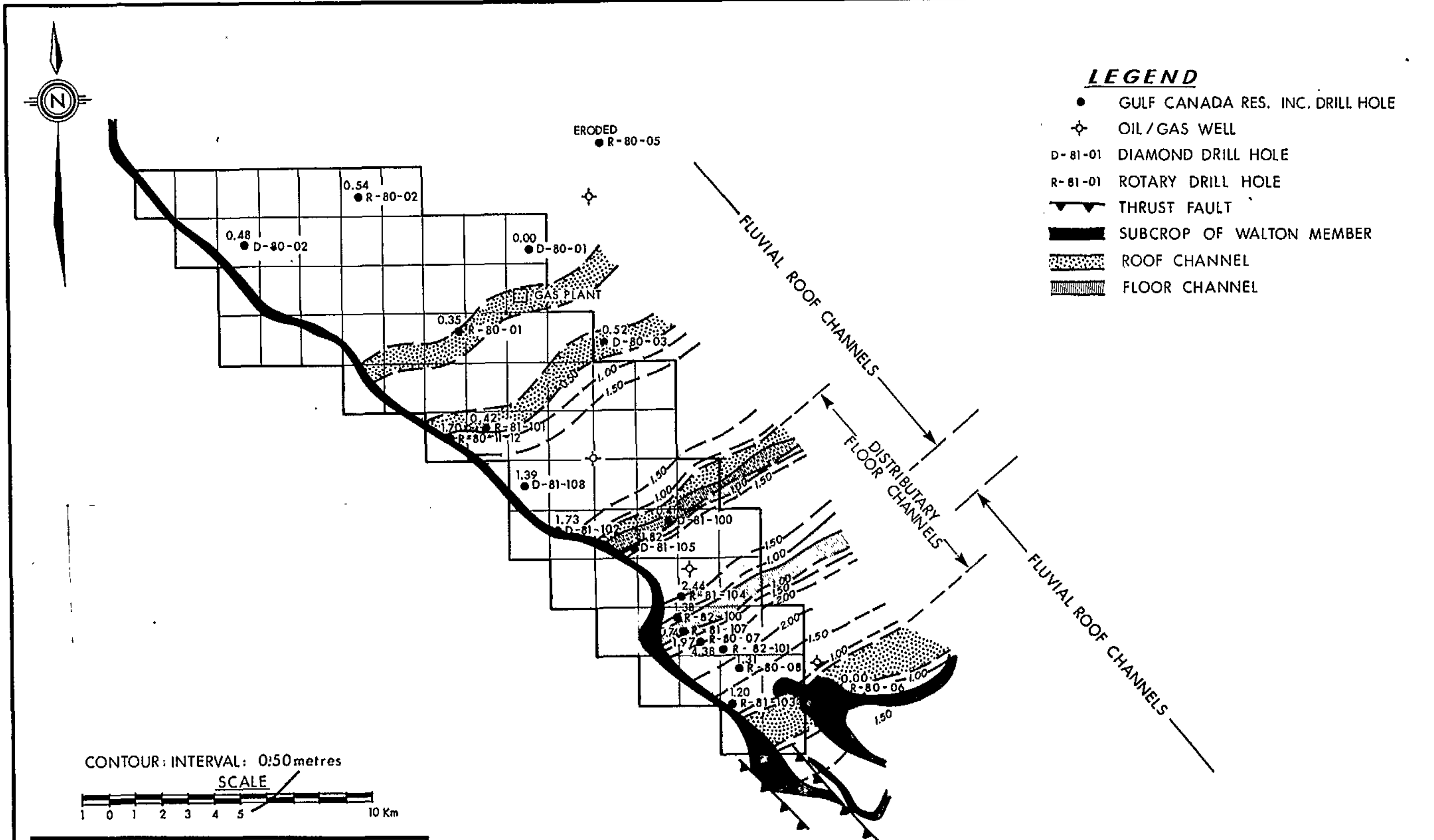


GULF CANADA RESOURCES INC.

TREFI COAL PROJECT

CARON SEAM; ROOF STRATA ISOFACIES MAP

Drawn	M.J.	Checked	W.F.C.	Date	DEC. '82
Approved	W.F.C.			Orig Scale	1:200 000
NorWest Resource Consultants Ltd				File No	823472070
					FIG. 3.2.102



GULF CANADA RESOURCES INC.

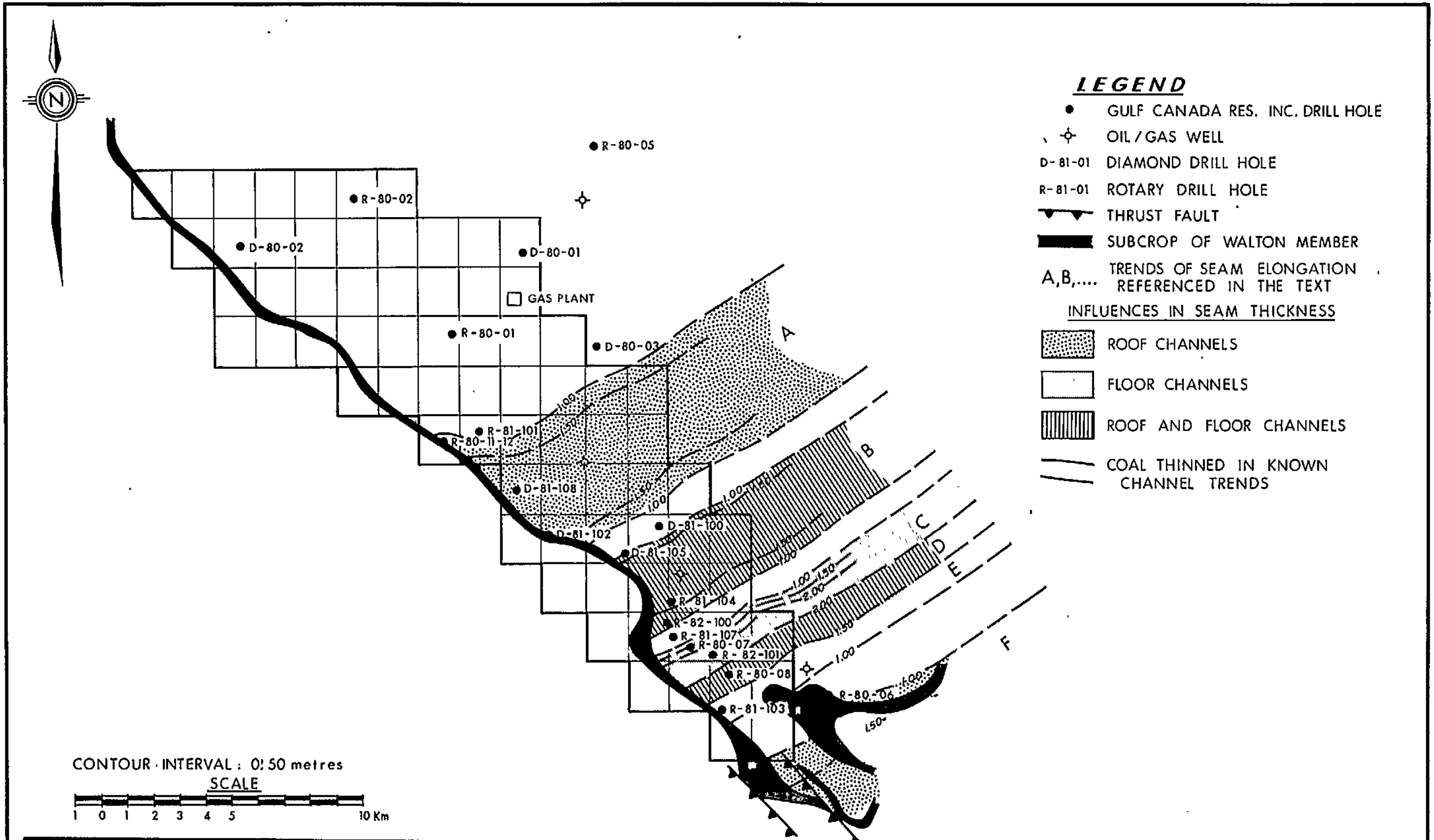
TREFI COAL PROJECT
COAL SEAM ISOPACH MAP AND
DEPOSITIONAL FEATURES – CARON SEAM

Drawn M.J.	Checked W.F.C.	Date DEC. '82
Approved W.F.C.		Orig. Scale 1:200 000
NorWest Resource Consultants Ltd		File No. 823472060
		FIG. 3.2.103

The roof and floor depositional maps must be superimposed over a map showing the thickness of the Caron Seam in order to develop a coal isopach map. Such a map has been contructed and is shown in Figure 3.2.103. In evaluating Caron Seam thickness on this map, it can be noted that all of the thin areas can be explained by roof channels, "high" floor channels, or combinations of both. The thicker seams are in the intervening zones between the channels. The general zones in which roof and floor channels are found has also been shown on Figure 3.2.103. Additional channels may be encountered in these zones as more closely-spaced drill holes are completed.

Isopach lines for the Caron Seam have been drawn to reflect the direction of elongation and general thickness of the seam through the interchannel areas. These isopach values must be thought of in terms of order of magnitude where thicker as well as thinner coals may exist. The extension of the elongated bodies of coal is consistent with local thickness trends of the Walton Member. This suggests that a complete progradation of the coal-bearing portion of the Walton Member occurred in the area.

A more simplified Caron Seam isopach map has been prepared to reflect channels in the roof and floor as well as areas of thinning (Figure 3.2.104). Areas in which the coal seam and enclosing strata characteristics are likely to be similar have been shaded to reflect these similarities. Areas which are unpatterned are areas in which the coal is



GULF CANADA RESOURCES INC.

TREFI COAL PROJECT

COAL SEAM ISOPACH MAP AND THICKNESS TRENDS – CARON SEAM

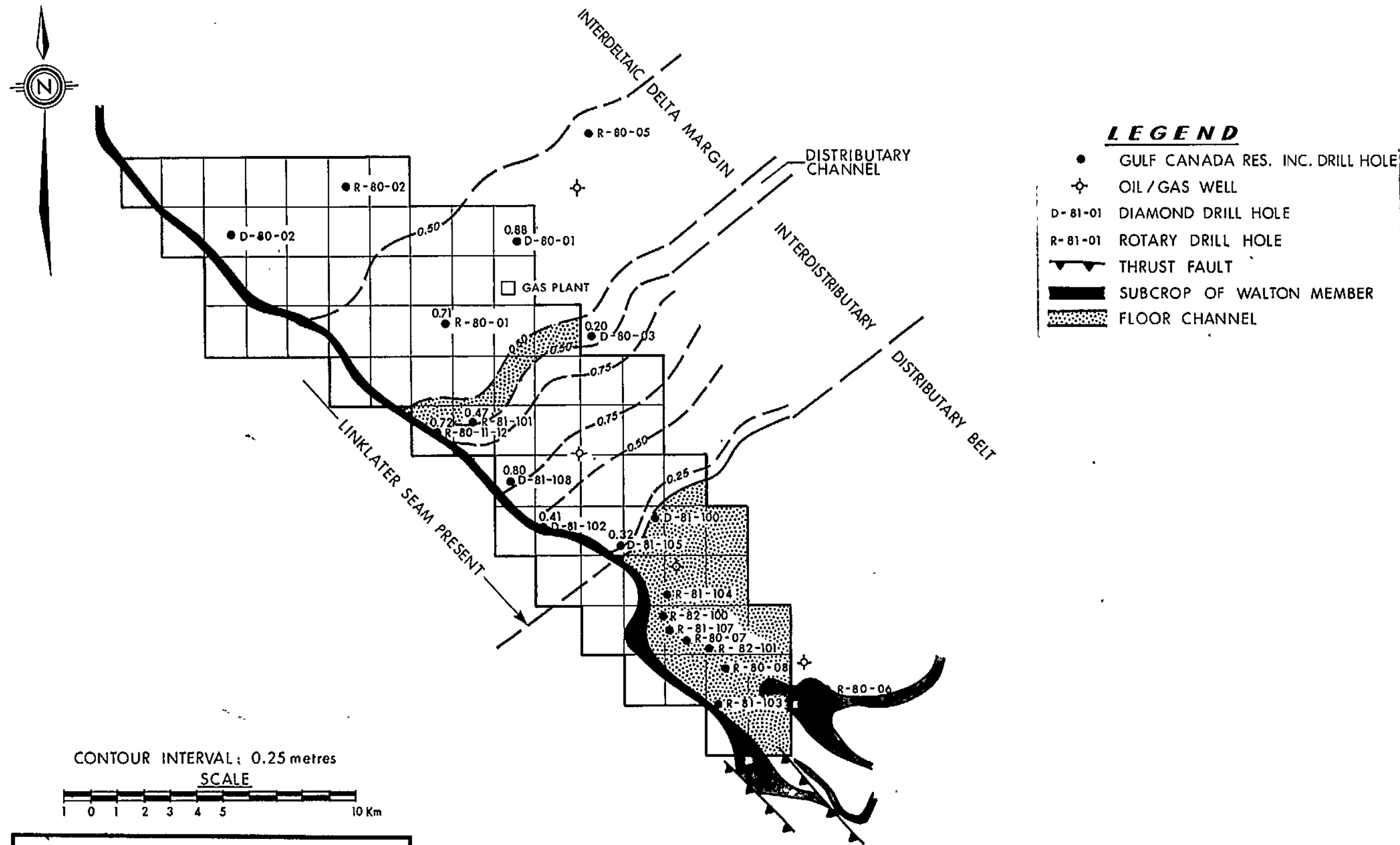
Drawn	M. J.	Checked	W. F. C.	Date	DEC. '82
Approved	W. F. C.			Orig. Scale	1:200 000
NorWest Resource Consultants Ltd				File No.	823472050
				FIG.	3. 2. 104

known to be thinned along a channel trend. Areas A, E and F are all characterized by coal which range from 1.0 to 1.5 metres and where only roof channels may influence seam thicknesses. Area C is the only area in which floor channels may influence seam thicknesses. Seam thicknesses in Area C generally average 1.5 metres and commonly exceed 2.0 metres. Measurement of the Caron Seam at 4.38 metres is found in Area C. Areas B and D are characterized by seams which average 1.5 metres or more and which are influenced by both roof and floor channels.

The coal in Area A will probably be more uniform in thickness and free from rock splits than other areas because of its relative position in the deltaic complex away from distributary clastic influxes. Area C will probably have the thickest coal with the thickness being controlled by channels in the floor. The greatest variability in seam thickness and frequency of rock splits will probably be encountered in Areas B, E, and F because of the delta position relative to clastic influx and channels in the roof and/or floor.

3.2.2 Linklater Seam

The Linklater Seam which is located about 5 metres below the Caron Seam, has not been subjected to the rigorous depositional analysis allowed for the Caron Seam, although depositional trends have been evaluated. This evaluation indicates that the Linklater Seam was deposited contemporaneously with the distributary channels in the southern



GULF CANADA RESOURCES INC.

TREFI COAL PROJECT
COAL SEAM ISOPACH MAP
LINKLATER SEAM

Drawn M.J.	Checked W. F. C.	Date DEC. '82	
Approved W. F. C.		Orig. Scale 1:200 000	
NorWest Resource Consultants Ltd		File No. 823472150	
		FIG. 3.2.201	

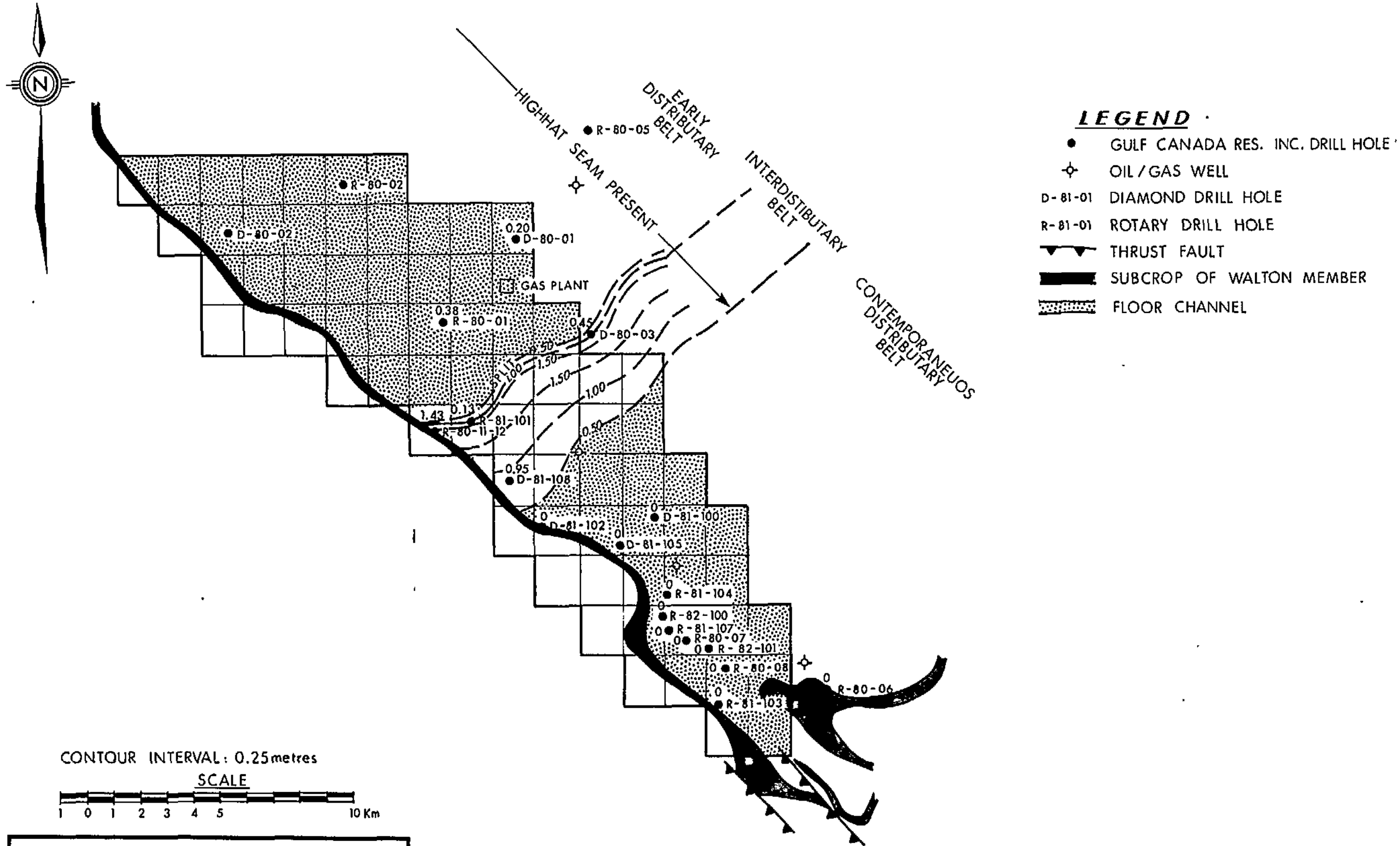
part of the Trefi deposit. The seam pinches out at the same stratigraphic horizon occupied by these channels (Appendix III and Figure 3.1.103).

The seam ranges from 0.5 to 0.75 metres in thickness on the northwestern flank of the delta complex (Figure 3.2.201). The seam generally averages 0.5 metres in thickness in a broad belt which parallels channel orientations except for a band across the centre of the belt where thicknesses of 0.75 metres are present. A single distributary channel in the floor strata disrupts the continuity of the Linklater Seam across the central part of the belt.

A thick coal seam which appears at the approximate stratigraphic level of the Linklater Seam in hole R-82-101 does not correlate with any of the coal seams on the property. Assuming that structural complexities are not involved in this interval of the hole, the presence of the coal seam can be explained by deposition in an abandoned distributary channel. The abnormal thickness of the overlying Caron Seam in this hole may also have been influenced by the presence of this abondoned channel.

3.2.3 Highhat Seam

The Highhat Seam is usually present over the same area as the Linklater Seam (Figure 3.2.301). The depositional environments of this seam and enclosing strata have not been



GULF CANADA RESOURCES INC.			
TREFI COAL PROJECT COAL SEAM ISOPACH MAP HIGHHAT SEAM			
Drawn M.J.	Checked W.F.C.	Date DEC. '82	
Approved W.F.C.		Drg Scale 1:200 000	
NorWest Resource Consultants Ltd		File No 823472040	
		FIG. 3.2.301	

evaluated in detail but available data suggests deposition in an interdistributary or delta margin swamp environment adjacent to the major distributary channels (Appendix III and Figure 3.1.103).

The Highhat Seam pinches out against and interfingers with sandstone of the distributary channel system to the southeast. The seam thickens to the northwest and then abruptly thins and splits where it overlies a previously existing distributary belt (Figure 3.2.301). The belt in which the Highhat Seam attains its greatest thickness is about three kilometres wide; seam thickness ranges from 1.00 to 1.25 metres. No channels have been identified in this zone where thick zones of coal in both the Linklater and Caron Seams occur. This suggests structural and/or sedimentalogical controls on seam accumulation.

Table 3.2.01

COAL SEAM DATA SUMMARY

HOLE NO.	ELEVA-TION (m)	COAL ZONE INTERSECTION (m)	SEAM	APPARENT THK (m)	COAL (m)	ROCK (m)	CORRECTION FACTOR FOR TRUE THICKNESS	TRUE SEAM THICKNESS	TRUE COAL THICKNESS
DDH-80-01	710	165.30 - 165.50	C	0.20	0.20	-	1.00	0.20	0.20
		170.28 - 171.16	N	0.88	0.88	-	-	0.88	0.88
		174.10 - 174.30	L	0.20	0.20	-	-	0.30	0.30
		180.50 - 180.70	H	0.20	0.20	-	-	0.20	0.20
DDH-80-02	926	N.D.E.							
DDH-80-03	808	194.75 - 195.27	C	0.52	0.52	-	1.00	0.52	0.52
		201.1 - 201.30	L	0.20	0.20	-		0.20	0.20
		207.2 - 207.65	H	0.45	0.45	-	-	0.45	0.45
RDH-80-01	775	283.1 - 283.5	C	0.40	0.40	-	0.887	0.35	0.35
		286.14 - 286.94	L	0.80	0.80	-	-	0.71	0.71
		294.65 - 295.08	H	0.43	0.43	-	-	0.38	0.38
RDH-80-02	698	376.73 - 377.60	C	0.87	0.61	0.26	1.00	0.87	0.61
RDH-80-05	733	Eroded							
RDH-80-06	1060	55.0 (Washout)					.641		
RDH-80-07	1250	183.97 - 184.54	CR	0.57	0.57	-	1.00	0.57	0.57
		188.53 - 190.50	C	1.97	1.97	-	-	1.97	1.97
RDH-80-08	1153	145.59 - 146.90	C	1.31	1.31	-	1.00	1.31	1.31
RDH-80-11	832	108.98 - 111.20	C	2.22	1.70	0.52	1.00	2.22	1.70
		116.10 - 116.82	L	0.72	0.72	-	-	0.72	0.72
		122.55 - 124.48	H	1.93	1.93	0.40	-	1.93	1.43
RDH-80-12	832	107.42 - 109.52	C	2.10	1.74	0.36	1.00	2.10	1.74
		114.41 - 115.03	L	0.62	0.62	-	-	0.62	0.62
		120.85 - 122.47	H	1.62	1.62	-	-	1.62	1.62

CR - Caron Rider Seam
C - Caron Seam
N - New Seam
L - Linklater Seam

Table 3.2.01

COAL SEAM DATA SUMMARY (cont'd)

HOLE NO.	ELEVA-TION (m)	COAL ZONE INTERSECTION (m)	SEAM	APPARENT THK (m)	COAL (m)	ROCK (m)	CORRECTION FACTOR FOR TRUE THICKNESS	TRUE SEAM THICKNESS	TRUE COAL THICKNESS
DDH-81-100	923	218.25 - 218.43	CR	0.18	0.18	-	1.00	0.18	0.18
		223.60 - 224.21	C	0.61	0.41	0.20	-	0.61	0.41
		228.84 - 229.13	L	0.29	0.29	-	-	0.29	0.29
DDH-81-102	1380	118.77 - 119.33	CR	0.56	0.56	-	0.713	0.40	0.29
		121.20 - 123.63	C	2.43	2.43	-	-	1.73	1.23
		128.43 - 129.00	N	0.57	0.57	-	-	0.41	0.29
		136.66 - 137.84	L	1.18	1.18	-	-	0.84	0.60
RDH-81-103	1054	303.14 - 305.91	C	1.77	1.77	-	0.676	1.20	1.20
RDH-81-101	887	363.20 - 363.63	C	0.43	0.43	-	0.976	0.42	0.42
		368.51 - 369.20	L	0.71	0.48	0.23	-	0.70	0.47
		377.00 - 377.13	H	0.13	0.13	-	-	0.13	0.13
RDH-81-104	1233	260.82 - 261.34	CR	0.42	0.42	-	1.00	0.42	0.42
		263.28 - 265.72	C	2.44	2.44	-	-	2.44	2.44
RDH-81-105	971	204.48 - 206.85	C	2.37	1.84	0.53	0.878	2.34	1.82
		213.78 - 214.15	L	0.37	0.37	-	-	0.32	0.32
RDH-81-106	1153	144.48 - 145.34	C	0.86	0.86	-	1.00	0.86	0.86
RDH-81-107	1297	120.65 - 121.22	CR	0.57	0.57	-	0.771	0.44	0.44
		130.80 - 131.76	C	0.96	0.96	-	-	0.74	0.74
RDH-81-108	1204	592.80 - 594.50	C	0.42	0.42	-	1.00	0.42	0.42
		601.95 - 602.83	L	0.88	0.88	-	-	0.80	0.80
		608.42 - 609.38	H	0.96	0.96	-	-	0.96	0.95

CR - Caron Rider Seam
C - Caron Seam
N - New Seam
L - Linklater Seam
H - Highhat Seam

Table 3.2.01

COAL SEAM DATA SHEET (cont'd)

HOLE NO.	ELEVA- TION (m)	COAL ZONE INTERSECTION (m)	SEAM	APPARENT THK (m)	COAL (m)	ROCK (m)	CORRECTION FACTOR FOR TRUE THICKNESS	TRUE SEAM THICKNESS	TRUE COAL THICKNESS
RDH-81-1090	1250	184.54 - 184.96	CR	0.42	0.42	-	1.00	0.42	0.42
		187.94 - 190.24	C	2.30	2.30	-	-	2.30	2.30
RDh-82-100	1274.0	108.84 - 109.22	CR	0.38	0.38	-	0.87	0.33	0.38
		111.71 - 113.30	C	1.59	1.59	-	-	1.38	1.38
RDH-82-101	1192.0	203.57 - 204.00	CR	0.43	0.43	-	0.98	0.42	0.42
		207.20 - 212.10	C	4.90	4.47	0.43	(0.661 upper	4.80	4.38
		217.42 - 219.65	H	2.23	1.97	0.26	section of KCmw	2.19	1.93
							131.0 - 182.0 m)		

CR - Caron Rider Seam
C - Caron Seam
N - New Seam
L - Linklater Seam
H - Highhat Seam

TABLE 5.4.01

Summary of Coal Seam Resources (x106 tonnes)

RESOURCE AREA CARON SEAM (m)	SUBECONOMIC RESOURCES	POTENTIALLY MINEABLE RESOURCES	TOTAL RESOURCES
0.5 - 1.5	11.634		11.634
GREATER THAN 1.5		112.609	112.609
Subtotal			124.243
HIGHHAT SEAM			
0.5 - 1.5	23.70		23.70
GREATER THAN 1.5			
Total	35.334	112.609	147.943

4.0 COAL QUALITY

4.1 Sampling

In both rotary drill holes, selected intervals of strata were obtained through coring and cores logged in detail (see core descriptions, Appendix 1). The average core recovery for the two holes was greater than 90%. Determination of coal seam thickness was achieved by following a standard procedure which included measurement of the overall length of recovered core with an estimation of possible core loss and location, detailed visual logging of the coal seam and compilation of the seam section. Comparison between seam core data and density and focused beam resistivity geophysical logs enabled accurate determination of seam thicknesses and location of core losses. Seam profiles were prepared and sample intervals selected based on the distribution of rock bands and percentage of bright bands within the core. All samples were sent to Loring Laboratories Ltd. in Calgary, Alberta for analyses. The remaining roof and floor rock was boxed, labelled and transported to Calgary for further inspection.

Nine samples were collected from the Caron Seam in holes 82-100 and 82-101. One sample representing the Caron Rider Seam was collected from 82-100.

Due to its localized development, the Highhat Seam was not cored.

All coal seams were sampled as outlined in the coal seam data sheets contained in Section 4.2.

4.2 Analyses

Proximate analyses were obtained for ten core intervals that were sampled from holes 82-100 and 82-101. Included in the individual raw coal ply analyses are determinations for calorific value, sulphur and specific gravity. In addition representative ply samples were composited and determinations for the following analyses were made: proximate analyses, calorific value, total sulfur, ultimate analysis, specific gravity, hard grove index, ash fusion, ash analyses, chlorine, phosphorous, equilibrium moisture, and free swelling index. Due to the unusually thick nature of the Caron seam intersected in RDH-82-101, three composite samples were produced: Sample numbers 04413 and 04414 represented the upper and lower portions of the seam (Figure 4.2.003), while composite sample number 04415 represents the full seam section. Sample 04412 represents the entire seam as intersected in RDH-82-100.

Petrographic analysis was conducted on both of the full seam composites for vitrinite and maceral content and the results are contained in Appendix 3 of this text.

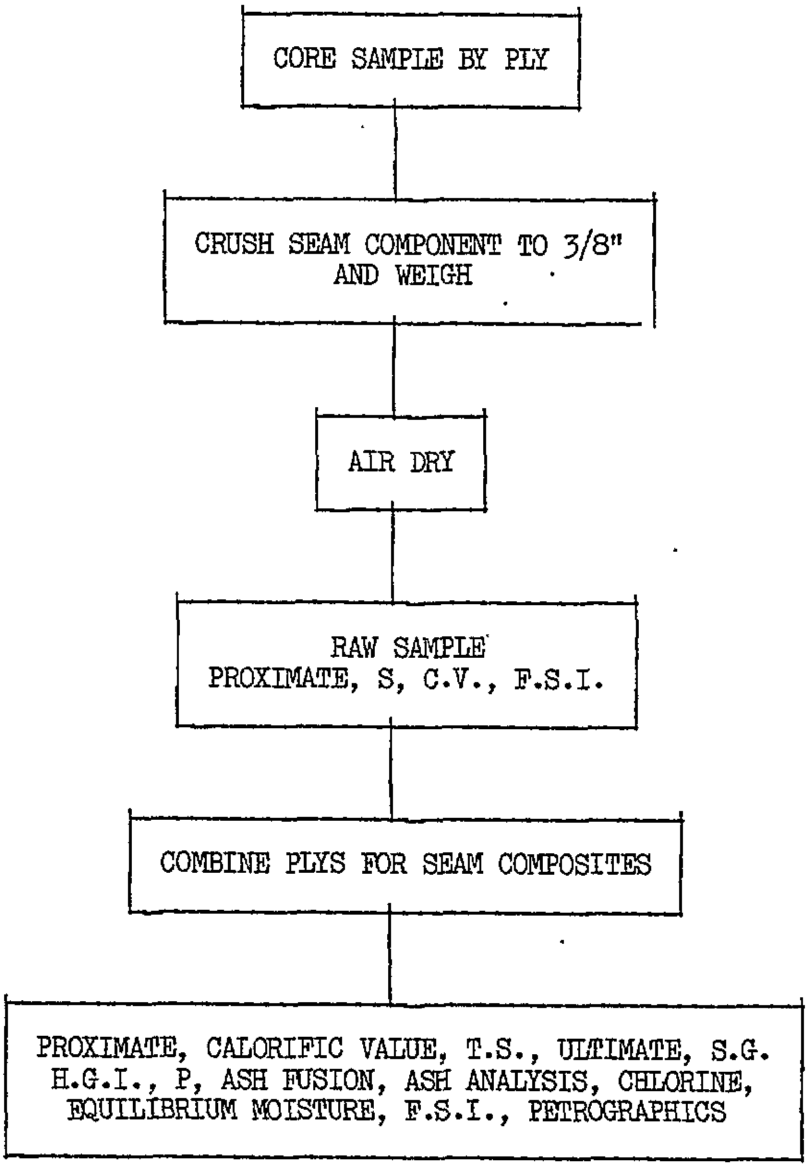
Washability tests were not considered necessary as the raw ash values do not exceed 8%.

A summary of the individual ply analyses carried out on all raw coal samples obtained during the 1980, 1981, and 1982 Trefi Exploration Programs is presented in Table 4.2.01. A summary of the raw coal composites analyses conducted on all Caron Seam samples is outlined in Table 4.2.02. Complete analyses of the 1982 raw coal composites is shown in Table 4.2.03. Table 4.2.04 summarizes the analyses of the 1.65 float product obtained from drill holes DDH-81-105 and DDH-81-108 along with the raw coal analyses of composites having ash values less than 11%. The latter being obtained from drill holes DDH-81-102, RDH-81-109C, RDH-82-100C and RDH-82-101C. A combination of these data is not presented due to the inconsistency of washability data. Values representing the mean of the raw coal analyses compared with the mean of the 1.65 float product indicate only minor differences in coal quality with an increase in the yield.

The information obtained to date on the Trefi Property indicates a trend in the decrease of raw coal ash values to the south. If further investigation confirms this, it is anticipated that a low ash, run of mine coal product can be produced.

Figure 4.2.001

ANALYTICAL FLOW CHART



Tables from Section 4 of this report contain coal quality data, and remain confidential under the terms of the *Coal Act Regulation*, Section 2(1). They have been removed from the public version.

http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/10_251_2004

5.0 RESOURCES

5.1 Description of Resource Areas

In-place resources calculated for the Trefi Coal Property have been based on the Caron and Highhat Seams only. Although other coal seams, such as the Linklater Seam, are found in the area, these resources have not been included in the current resource calculations due to the limited aereal extent of these seams within the property.

Figures 5.1.001 and 5.1.002 illustrate the extent of coal seam development of the Highhat and Caron Seams known as the resource area.

5.2 Method of Resource Calculations

Within the resource areas of the Trefi Property, zones of paleotopographic highs and distributary channels, which affect the coal seam thickness, have been identified. Over 65% of the existing data points for the Caron Seam are located in these zones and therefore should be considered anomolous as they are not representative of typical coal development. As the width of these zones is not accurately defined, resource calculations were made on a mean thickness basis between the 0.5 metre to the 1.5 metre isopach contour and areas greater than 1.5 metres in thickness. These calculations form the in-place resource base of the Trefi Property. Resource calculations have been made for seams that are greater than 1.5 metres in true thickness and these are referred to as the potentially mineable resource base.

Each isopach area was measured and then multiplied by the average seam thickness for the area. A specific gravity of 1.3 g/cc was applied. Resources were calculated to a 600 metre depth of cover only. A substantial resource within the Caron and Highhat Seams lies below that depth.

5.3 Caron Seam Resources

Total in-place resources for the Caron Seam have been calculated to be 124.2 million tonnes. Of this resource base, 112.6 million tonnes is considered to be the potentially mineable resource base (seam greater than 1.5 metres in thickness).

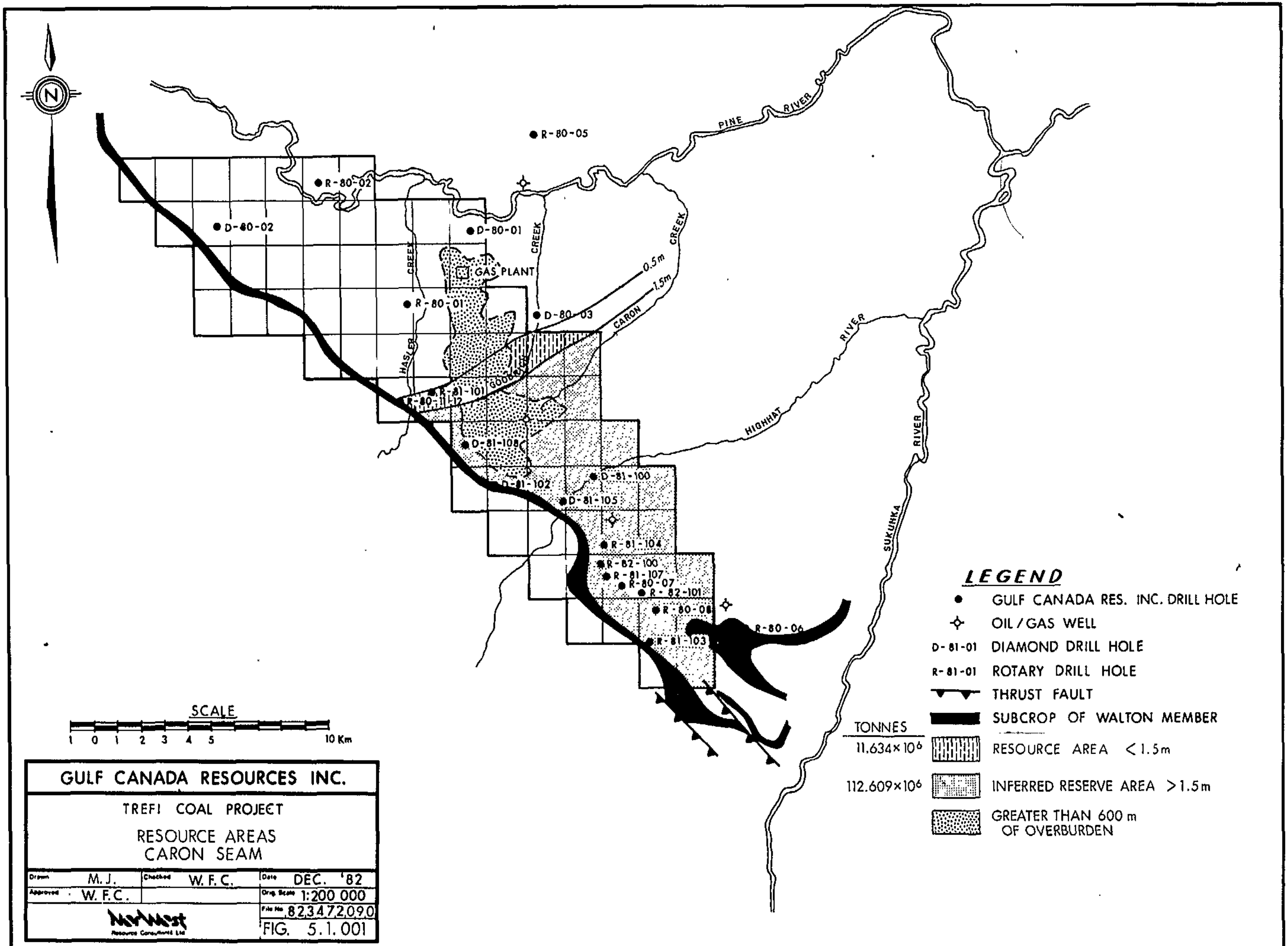
The area of extent of the Caron Seam Resources is shown in Figure 5.1.001.

5.4 Highhat Seam

The Highhat Seam has only limited areal extent on the Trefi Property. All of the Highhat Seam resources are for seam thicknesses of less than 1.5 metres. Total in-place resources for the Highhat Seam to a maximum depth of cover of 600 metres are 23.7 million tonnes. The Highhat Seam has little mining potential because of its limited areal extent and coal thickness.

The area of extent of the Highhat Seam resources is shown in Figure 5.1.002.

A summary of the Trefi Property coal resource base is presented in Table 5.4.01.

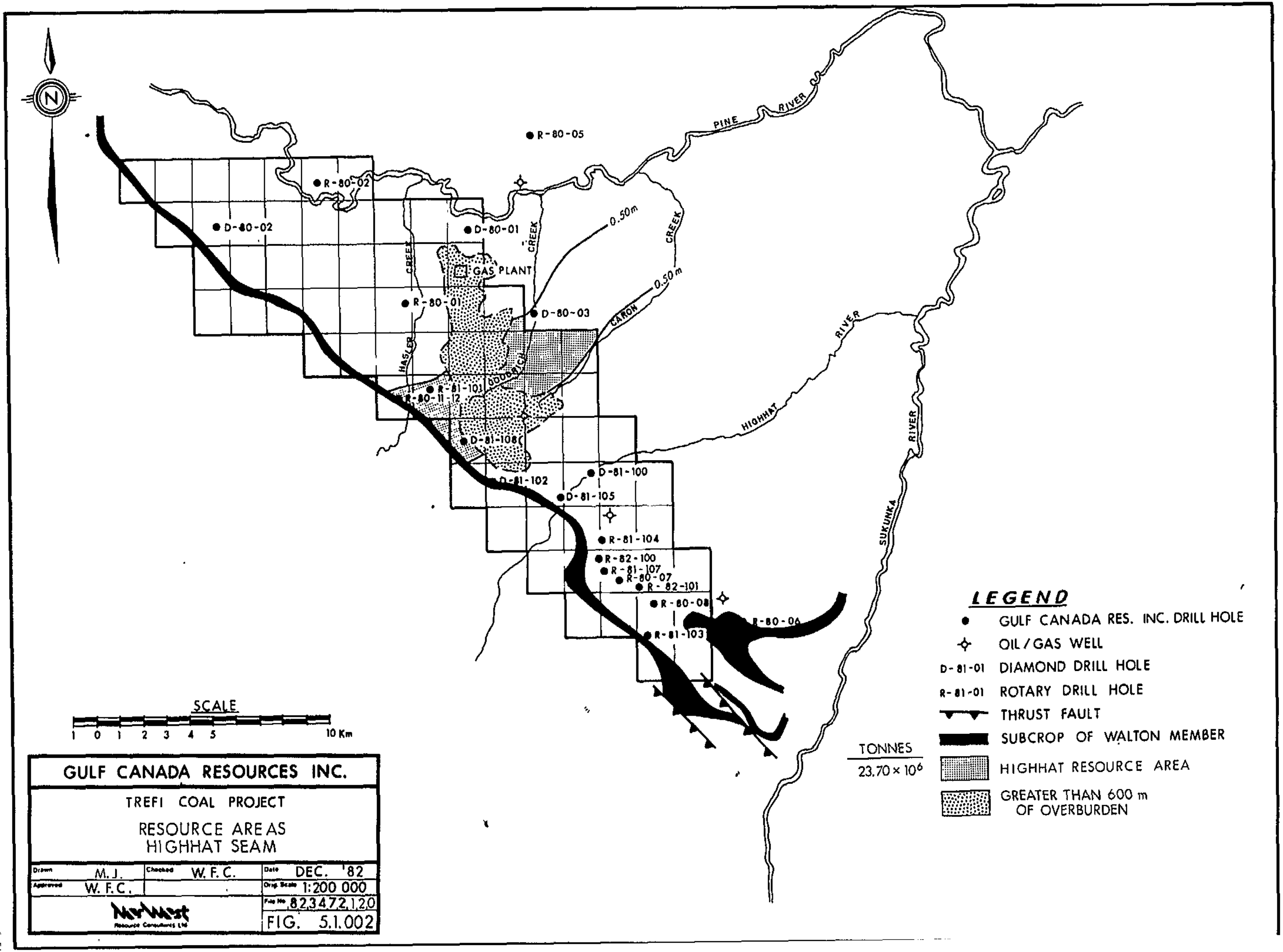


GULF CANADA RESOURCES INC.

TREFI COAL PROJECT

RESOURCE AREAS
CARON SEAM

Drawn M. J.	Checked W. F. C.	Date DEC. '82	
Approved W. F. C.		Orig. Scale 1:200 000	
NorWest Resource Consultants Ltd		File No 823472090	
		FIG. 5.1.001	


N
PINE RIVER
R-80-05
R-80-02
D-80-02
D-80-01
CREEK
CREEK
0.50m
0.50m
GAS PLANT
R-80-01
D-80-03
CARON
HASLER
CREEK
GOODRICH
RIVER
HIGHHAT
RIVER
SUKUNKA
R-81-101
R-80-11-12
D-81-108
D-81-102
D-81-100
D-81-105
R-81-104
R-82-100
R-81-107
R-80-07
R-82-101
R-80-08
R-80-06
R-81-103
LEGEND
GULF CANADA RES. INC. DRILL HOLE
OIL / GAS WELL
D-81-01 DIAMOND DRILL HOLE
R-81-01 ROTARY DRILL HOLE
THRUST FAULT
SUBCROP OF WALTON MEMBER
TONNES
23.70 × 10^6
HIGHHAT RESOURCE AREA
GREATER THAN 600 m OF OVERBURDEN
SCALE
1 0 1 2 3 4 5 10 Km
GULF CANADA RESOURCES INC.
TREFI COAL PROJECT
RESOURCE AREAS
HIGHHAT SEAM
Drawn M.J.
Checked W.F.C.
Date DEC. '82
Approved W.F.C.
Orig. Scale 1:200 000
File No. 823472,120
NorWest Resource Consultants Ltd
FIG. 5.1.002

6.0 CONCLUSIONS AND RECOMMENDATIONS

Depositional modelling techniques have been used in the evaluation of the Trefi deposit resulting in the recognition of channels in the roof and floor of the Caron Seam. This evaluation indicates that thick portions of the Caron Seam, in excess of 1.5 metres, trend over a much wider area than was previously determined; roof channels, high floor channels, or combinations of both affect seam thickness.

The coal seams were deposited in distributary and delta margin swamps which, in the case of the Caron seam, expanded and coalesed into a regional swamp in response to delta lobe abandonment. The distribution and geometry of the Caron Seam is controlled by the environments in which the enclosing strata accumulated.

Although no major depositional analyses was conducted on the underlying Highhat and Linklater seams, it is postulated that these seams were deposited at the same time as the distributary channels in the southern portion of the Trefi deposit. This is indicated by their "pinch out" at the same stratigraphic horizon as that occupied by the channels, resulting in a limited resource potential.

Depositional modelling has also been of value in differentiating between stratigraphic and structural features on geophysical logs. The lateral uniformity of thickness of the Walton Member, based on depositional modelling and correlation, indicates that different dip correction factors should be applied to certain drill holes.

The use of these correction factors implies, therefore, that changes in dip of strata should be made on structure maps.

The lithologic character of roof strata is particularly important in determining mining conditions and strata competence. The laterally continuous sandstone in the roof of the Caron Seam must be considered during underground mine planning because this unit appears to be massive and will affect the caving characteristics of the roof. In those areas where the sandstone is located in the immediate roof, roof stabilities should prove to be good and bolting horizons solid.

Coal quality analyses performed on a number of samples indicate that a medium volatile bituminous thermal coal product can be expected from the Caron seam. Some select areas may be able to produce an acceptable run of mine product such as indicated by the core from RDH-82-101.

In place tonnages for the resource area are inferred due to the limited number of widely scattered data points. The depth of cover over the coal seams accumulates very rapidly to the east-northeast.

Recommended Activities for the Trefi Project
Include the following:

1) Detailed evaluation of oil and gas logs on adjacent lands to the east-northeast for determining thickness trends of the Walton and Boulder Creek Members to help identify delta margins: this activity will improve the confidence level of depositional trends and coal distribution estimates.

2) Outcrop examinations where the sandstones of the Boulder Creek and Walton members outcrop: these examinations should be directed at confirming depositional interpretations, establishing channel geometry and seam thickness trends.

3) Additional exploration to ascertain the trends of elongation predicted by this study: with reference to Figure 3.2.104, holes should be placed in areas of greatest mining potential. Areas A and C should be examined first and at least one hole should be drilled in Area F.

4) Consideration should be given to a program of shallow drilling along the outcrop to detail channel geometry and seam thickness trends.

5) In future drilling programs, drill holes should be completed about 30 metres below the Caron Seam into the marine sandstones of the Boulder Creek Member. This will allow the use of additional horizons to verify correlations and resolve structural uncertainties.

7.0 SELECTED REFERENCES

1. HUGHES 1967 - Geology of the Pine Valley. Mount Wabi to Solitude Mountain, Northeastern British Columbia. B.C. Dept. of Mines and Pet. Res. Bulletin 52.

2. HUGHES 1979 - Peace, Moberly and Pine Areas, Northeast British Columbia; Geology of the Commotion Formation and Coal Prospects. (93-O, 93-P).

3. J.R. McLEAN - Lithostratigraphy of the Lower Cretaceous Coal-Bearing Sequence, Foothills of Alberta, G.S.C. 80-29.

4. STOTT 1968 - Lower Cretaceous Bullhead and Fort. St. John Groups, between Smokey and Peace Rivers, Rocky Mountain Foothills Alberta and British Columbia, Geol. Survey. Canada Bulletin 152.

5. GULF CANADA RESOURCE INC. 1980 - Trefi Coal Project Geological Report.

6. GULF CANADA RESOURCE INC. 1981 - Trefi Coal Project Geological Report.