CX - Hamilton Lake
83(1)A

CONFIDENTIAL

1983 EXPLORATION WORK

THE GEOLOGY AND COAL RESOURCES OF THE HAMILTON LAKE COAL LICENCES

CUMBERLAND COAL FIELD, NELSON LAND DISTRICT

Lat. 49 deg. 34' TO 49 deg. 36'

Long. 125 deg. 02' TO 125 deg. 05'

EAST CENTRAL VANCOUVER ISLAND

BRITISH COLUMBIA

COAL LICENCE Nos. 7480,7481,7482,7483

NTS Sheet 92 F/11

Prepared For :

WELDWOOD OF CANADA LIMITED

VANCOUVER, BRITISH COLUMBIA

Prepared By :

GARDNER EXPLORATION CONSULTANTS

STEPHEN L. GARDNER, P. GEOL.
NANAIMO, BRITISH COLUMBIA

Date Work Performed :
May 8,9,10 and 18, 1983

SUBMITTED 30-IX-84

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Chapter 1

INTRODUCTION

1.1 LOCATION AND DESCRIPTION OF THE HAMILTON LAKE COAL LICENCES

Coal Licence Numbers 7480, 7481, 7482 and 7483, held by Weldwood of Canada Limited, are located in the Cumberland Coalfield on the east coast of Vancouver Island between Latitude 49 degrees 34 ' to 49 degrees 36' and Longitude 125 degrees 02' to 125 degrees 05'. Weldwood of Canada Limited owns extensive fee-simple coal rights throughout the Cumberland-Comox area. In addition to these large holdings of fee-simple rights, some of the outlying areas of the coalfield are held by Weldwood of Canada Limited under licence from the British Columbia Provincial Government. The Hamilton Lake area, covering the aforementioned coal licences, is one of these areas.

The present coal licences were once part of the the Esquimalt and Nanaimo Railway Land Grant and were held fee simple by Weldwood of Canada Limited after its purchase of Canadian Collieries in 1964. In 1973 Weldwood cut down on the size of its coal holdings within the Railway Belt. The Hamilton Lake area was surrendered to the Crown. After further evaluations, the company decided to reacquire the area, which necessitated applications for licence. The Hamilton Lake coal licences, issued on October 1, 1982, form a contiguous block of licences covering approximately 1091 hectares. They lie in the Nelson Land District, approximately 6.5 km due southwest of the village of Cumberland. Access to the area is via 12 km of good gravelled logging road owned and maintained by Pacific Forest Products Ltd.. This logging road joins the Royston-Cumberland highway approximately 3 km northeast of Cumberland. The total road to the old Union Bay shipping wharf is 23 kilometres.

1.1.1 Physiography

The Hamilton Lake Coal Licences cover a high plateau area that overlooks the broad Comox Valley. The towns of Courtenay, Comox and the Comox airport are all visible in the distance to the northeast. The topography on this plateau ranges from 400 to 650 metres above sea level. The plateau is one of a number of low ridges that form the foothills along the east side of the Beaufort Mountains.

The northern part of the licence area covers part of the Cumberland waterworks district. Hamilton Lake, which is the highest dammed lake in the water supply, directly abuts the coal measures on the north end of the licence area. In keeping with previous studies on the Hamilton Lake licences, this northern part of the licence area is termed Block 'A'.

Drainage in the middle and south end of the licence area occurs in deep, steep-sided valleys. The Trent River is the major drainage in this part of the licence area. Between the Trent River and Idle Creek to the south, a small area of sedimentary deposition occurs. This is termed the Block 'B' area. All of the current year's exploration work is confined to this Block 'B' area.

1.1.2 Description of Previous Work

The coal seams at Hamilton Lake were known about for many years but the relatively inaccessible nature of the area during the mining period and the generally dirty characteristics of the coal at outcrop deterred development.

As part of an on-going program of evaluation and assessment of its holdings, Weldwood of Canada Limited constructed a bulk sample adit in the coal measures near the edge of Hamilton Lake in 1976. A 20 ton bulk sample was extracted and shipped to Birtley Engineering in Calgary for float-sink and washability testing.

As a follow-up to this work, a number of exploratory drillholes were completed in 1978 in order to determine the size and extent of the coal reserve. These holes confirmed the presence of a number of coal seams in the Block 'A' area north of the Trent River, and the Block 'B' area, south of the Trent River. The scattered nature of the drillholes allowed preliminary reserve estimates to be made for each of the two areas, however it was recognized that more work was required in order to establish the

boundaries of each deposit and determine the geology with respect to the coal measures.

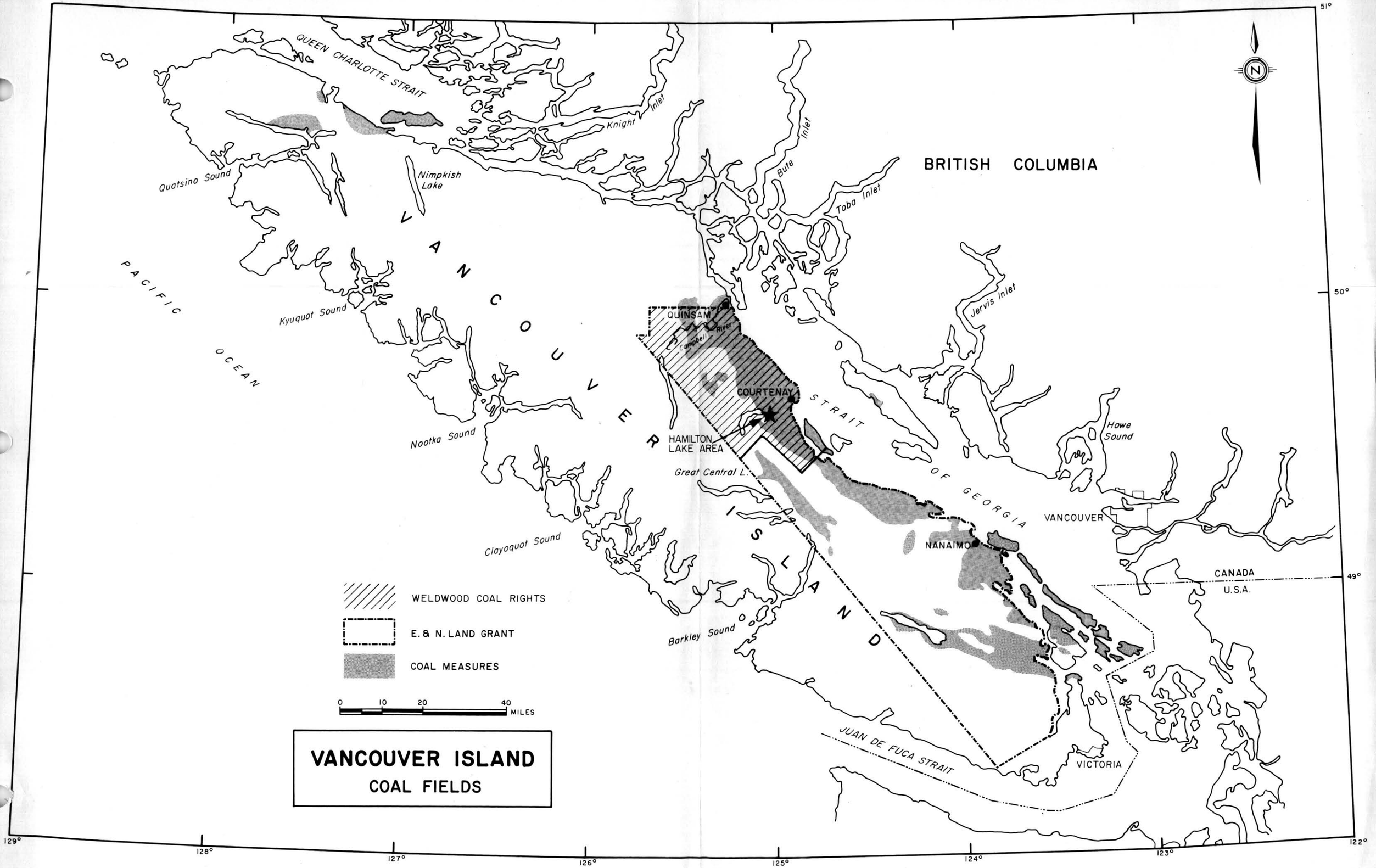
1.1.3 Description of Present Work

The present program of work consisted of field mapping over licence numbers 7480, 7481, 7482 and 7483 on a scale of 1 : 7,500. The mapping was aimed at locating coal outcrops of seams which were intersected during the 1978 drilling, sampling any exposures which could be located, determining the sedimentary-volcanic contact in order to define the total possible area of coal deposition, and identifying any structures such as faults or volcanic dykes which could affect the quality and mineability of the coal seams. The mapping covered approximately 800 ha. The remainder of the licence area which was not mapped is interpreted to contain no sedimentary deposits from air photo interpretations. This area is on the northeast side of the coal licences.

1.1.4 Cost Summary

The following details costs of this program :

ON-PROPERTY COSTS	
Field mapping	$ 1,746.16
OFF-PROPERTY COSTS	
Laboratory Analytical Work	$ 163.00
Maps, Printing, Xeroxing	$ 21.90
Report binders, supplies, etc.....	$ 37.63
Drafting and Photoreproduction ...	$ 1,175.25
Data Interpretation & Reporting ..	$ 2,800.00
TOTAL	$ 5,943.94



VANCOUVER ISLAND
COAL FIELDS

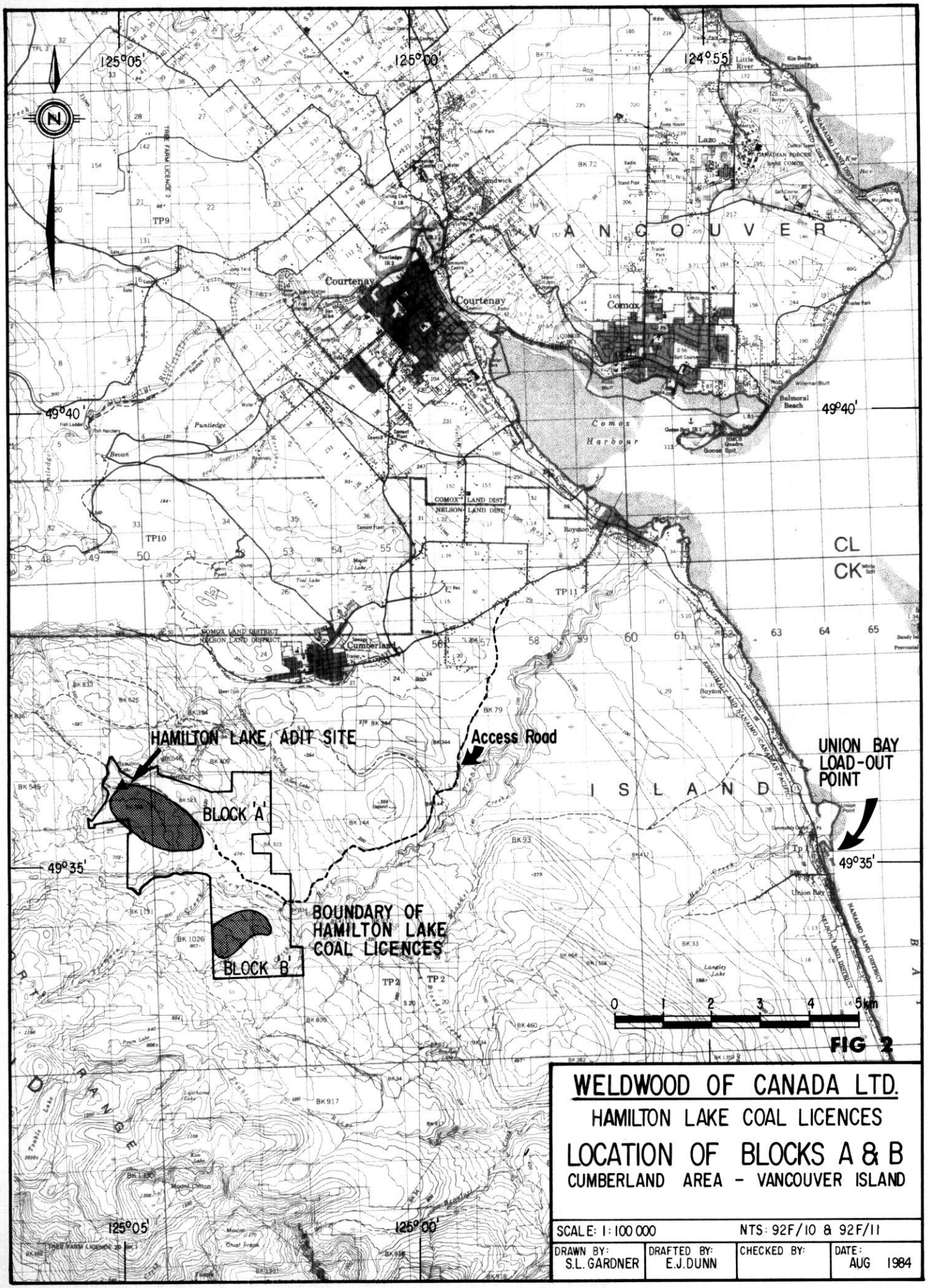


FIG 2

WELDWOOD OF CANADA LTD.

HAMILTON LAKE COAL LICENCES

LOCATION OF BLOCKS A & B

CUMBERLAND AREA - VANCOUVER ISLAND

SCALE: 1:100 000		NTS: 92F/10 & 92F/11	
DRAWN BY: S.L. GARDNER	DRAFTED BY: E.J. DUNN	CHECKED BY:	DATE: AUG 1984

1.2 Physiography

The Hamilton Lake coal licences cover a high plateau area that overlooks the broad Comox valley. The towns of Courtenay, Comox and the Comox airport are all visible in the distance to the northeast. The topography on this plateau ranges from 400 to 650 meters above sea level.

The northern part of the licence area covers part of the Cumberland waterworks district. Hamilton Lake, which is the fourth and highest dammed lake in the water supply, directly abuts the coal measures on the north end of the licence area.

Drainage in the middle and south end of the licence area occurs in deep, steep-sided valleys. The Trent River is the major drainage in this part of the licence block.

1.3 Description of Previous Work

The coal seams at Hamilton Lake were known about for many years during the previous mining era but the relatively inaccessible nature of the area and the generally dirty characteristics of the coal at outcrop deterred development.

As part of an on-going program of evaluation and assessment of the various Weldwood of Canada holdings, the company constructed a bulk sample adit in the coal measures near the edge of Hamilton Lake in 1976. A 20 ton sample was extracted and shipped to Birtley Engineering in Calgary for float-sink and bulk washability testing.

As a follow-up to this work, a number of exploratory drillholes were completed in 1978 in order to determine the size and extent of the coal reserve. These holes confirmed the presence of a number of coal seams in two separate localities, termed Block "A" and Block "B". This terminology will continue to be employed in future and present work. Block "A", which is the largest block of coal reserves, is located on the north end of the licences, directly abutting Hamilton Lake. Block "B" is located in the centre of the licence area. It is separated from Block "A" by the valley of the Trent River. Figure 1 illustrates the location of the two blocks with respect to each other.

1.4 Scope of Present Work

As a follow-up to the 1978 drilling, the present work combines the results of the drilling with surface mapping in order to determine the validity of the 1978 projections with respect to coal reserve boundaries and possibilities for expanding these boundaries.

The most important aspect of the present work is the recommendations and detailed layout of further exploration and evaluation of the licence area. The aim of this further planned work is to provide a sufficient enough data base for the generation of a technical feasibility study.

SECTION 2

2.0 SUMMARY AND CONCLUSIONS

The Hamilton Lake Coal Licences, located approximately 6.5 kilometers southwest of the village of Cumberland (23 road kilometers from the Union Bay shipping point), contain between 6.4 and 9.1 million metric tons of in-situ geologic coal reserves. These reserves are distributed between two separate sedimentary areas - Block "A" and Block "B" (see Appendix Map A). Block "A", which is located on the north end of the licences near Hamilton Lake, is the largest area and contains over 6 million metric tons. Block "B", which is located south and east of Block "A" across the Trent River valley, may contain as much as 2.6 million metric tons. While some level of confidence is possible in making reserve projections for Block "A", the scarcity of present information on Block "B" precludes a comfortable projection of in-situ reserves. Recoverable or saleable coal reserve projections can not be estimated for either block until further drilling and coring work is completed.

While coal quality information is limited to the extreme north end of Block "A", the coal exhibits good coking characteristics in this area, but its relatively high sulphur content would necessitate its use as a blending product. The limited quality data from Block "B", consisting of one outcrop sample, indicates that the coal is lower in sulphur in this area and possesses no coking qualities.

Future evaluation and development of the Hamilton Lake coal licences should progress in three phases:

Phase II - Limited drill and core program - Block "B" (Cost approximately $75,000).

Phase III - Detailed drill and core program - Block "A" (Cost approximately $175,000).

These three phases would provide enough information to complete an initial feasibility study of the area, similar to that recently completed by Brinco Mining Ltd. for the Quinsam Property.

At this early stage of evaluation of the Hamilton Lake Coal Licences, it is the author's opinion that, in consideration of Weldwood of Canada's other coal holdings in the Comox-Cumberland field, the Hamilton Lake Licences could be profitably mined. It is important, however., to consider this coal reserve in context within a broader scheme of development for the entire area.

SECTION 3

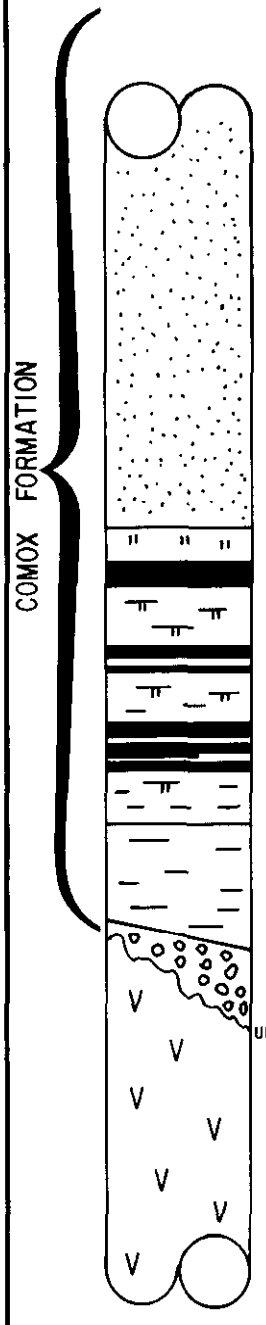
3.0 GEOLOGY

3.1.0 Regional Stratigraphy and Structure

Basaltic lavas of the Triassic Karmutsen Formation form the basement rock upon which younger sediments containing the coal measures were deposited. The Karmutsen Formation is a volcanic series of flow and pillow lavas thousands of meters in thickness, forming the backbone of Vancouver Island. The pillowy nature of some outcrop exposures of Karmutsen basalt indicates that in certain areas the lava was extruded in a submarine environment. After the tectonic island-building process was complete, emergence and uplift caused an erosional period during which the volcanic surface was exposed to the elements. A conglomeratic facies accumulated in topographically low areas and valley bottoms. This basal conglomerate facies, composed almost entirely of sub-rounded to angular pebbles and cobbles of basalt of major cycles deposition which continued to the end and chart, is important in that it signifies the beginning of Cretaceous time. Two of these cycles of deposition contain the important coal seams of the Comox and Nanaimo coalfields.

The Comox Formation, which is the oldest formational unit of the Nanaimo Series, is Upper Cretaceous in age and rests unconformably on the irregular paleotopographic surface of older Karmutsen Formation basalts in the Cumberland area. It consists of shale and mudstone beds, coal seams and massive sandstones. The sandstones make up the majority of the total stratigraphic section of the Comox Formation and are commonly medium to coarse grained and gritty, buff and pinkish weathering, massive beds of arkosic sandstone. In general, these sandstones become more dominant in the upper stratigraphic sections of the Comox Formation.

The structure of the Cumberland area consists of sedimentary blocks separated by major normal faults that strike in a general northwest to southeast orientation. Secondary transverse faults striking southwest to northeast also occur. Because of its proximity to the tectonic centre of the Beaufort Range to the west, the area is rather heavily faulted and many of the sedimentary areas such as the Hamilton Lake area are completely isolated as a result of tectonic uplift and later erosion. In general, the sedimentary formations dip at angles of 6 to 16 degrees to the northeast. However, near fault zones and areas of intense structural disturbance, dips can be steeper.



EROSIONAL SURFACE

0 - 30m SANDSTONE UNIT: Massive, thick-bedded medium to coarse - grained sandstone.

15 - 30m COAL MEASURES: Mudstone and shale containing three main coal zones.

0 - 10m SHALE UNIT: Concentrically weathering silty shale.

0 - 10m BENSON MEMBER (Late Cretaceous): Basal conglomerate.

unconformity

+ 1000m KARMUTSEN FORMATION (Triassic): Flow basalts and pillow lavas.

FIG 2

WELDWOOD OF CANADA LTD.

HAMILTON LAKE COAL LICENCES

GENERALIZED STRATIGRAPHIC COLUMN

DRAWN BY:	DRAFTED BY:	CHECKED BY:	DATE:
S.L. GARDNER	E.J. DUNN		JUNE 1983

3.1.1 Structure -Block "A"

The Block "A" area is a fault-bound wedge of Comox deposition which is in direct contact with Karmutsen basalts on all sides. An uplifted volcanic block separates it from the Block "B" area to the south.

In general, the structure over the coal reserve of Block "A" appears to be relatively uniform with no major faulting evident. The sediments appear to dip uniformly to the northeast at angles of approximately 10 degrees, but becoming steeper on the flanks. Some change of dip is indicated at the east end of the block, where dips change to due north at a shallow 6 degrees.

At the northwest end of the block near Hamilton Lake a fault contact exposes the coal measures, which in this location occur approximately 10 stratigraphic meters above the volcanic basement rock. A small displacement normal fault with an indicated vertical displacement of .3 meters is exposed on the outcrop face. Other small slippages such as this one probably exist. They are a result of latent stress relief and are more likely to occur on the flanks of the sedimentary block.

3.1.2 Structure - Block "B"

No major fault features are evident in the exposed sediments on Block "B". The sedimentary area dips to the north and north-north-east at angles of 8 to 22 degrees, with the steepest dips occurring on the flanks of the block near the volcanic contact.

One important observation which may affect the structure of the Block "B" area in localized situations is the presence of a volcanic dyke cutting through the sedimentary sequence on the south side of the Trent River valley approximately 200 meters west of the western boundary of the licence area (see Appendix Map A). This dyke has a vertical orientation and strikes at 25 degrees west of north. It consists of two sections, each of 3.5 meters in thickness, separated by a covered interval of 3 meters. It is composed of very fine grained intrusive volcanic rock which has incorporated pieces of sediment and plant meterial. It weathers orange and rusty pink and has a vdggy appearance (see Plates XI and XII). This existence of this volcanic dyke in direct contact with the coal measures may disrupt the structure. The occurrence of other similar volcanic intrusions which are not exposed is a distinct possibility.

NORTHWEST

SOUTHEAST

HOLE HL-78-3
K.B. Elevation 575m

HOLE HL-78-4
K.B. Elevation 584 m

HOLE HL-78-8
K.B. Elevation 530m (corrected)

HOLE HL-78-7
K.B. Elevation 485m

HOLE HL-78-17
K.B. Elevation 457m
(no geophysical log)

HOLE HL-78-15
K.B. Elevation 445m

Datum : Upper Coal Seam

glacial till

volcanic bedrock

Karmutsen Formation
Basalts

Datum: Upper Coal Seam

T.D. 75ft

Triassic Volcanics
(Pre - Cretaceous)

Trent River

Horizontal Scale 1:5000
Vertical Scale 1:480
Datum : Upper Coal Seam

FIG 3

WELDWOOD OF CANADA LTD.
HAMILTON LAKE COAL LICENCES
LONGITUDINAL SECTION
RESERVE BLOCKS A & B

DRAWN BY:	DRAFTED BY:	CHECKED BY:	DATE:
S.L. GARDNER	E.J. DUNN		JUNE 1983

3.2.0 GEOLOGY OF THE COAL MEASURES

Figure 3 illustrates a longitudinal cross-section across Blocks "A" and "B" in a northwest to southeast orientation. The section shows that the coal seams found in Blocks "A" and "B" are correlative but the two blocks are separated by an uplifted section of volcanic basement rock.

3.2.1 Description of the Coal Measures - Block "A"

In the northern part of Block "A", Hole 78-03 identifies three major coal zones. The gross thickness of these zones varies from 1.5 meters for the upper zone to approximately 3.0 meters for the lower zone. The lower zone is characterized by a parting almost one meter in thickness.

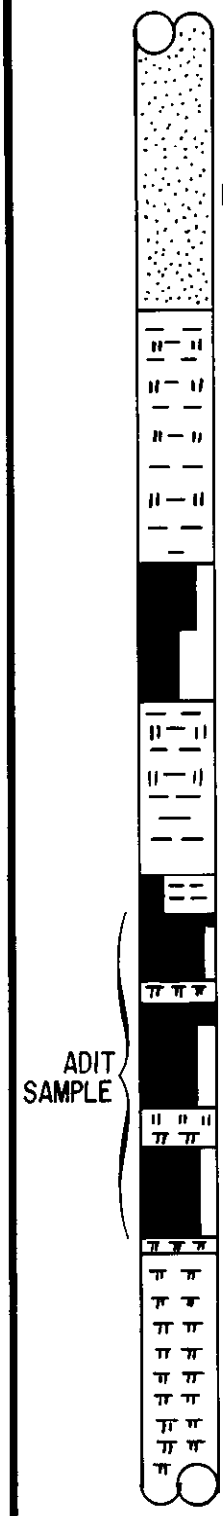
These three major zones splay apart in a south-easterly direction. While the upper two zones retain their character over much of the Block "A" area, the lowermost seam exhibits a remarkable variance. This is a function of the proximity and irregularity of the volcanic basement topography.

The entire sequence is indicative of coal seam generation in an alluvial plan or deltaic environment, which is constantly changing and does not allow thick, clean coal seams to generate.

The coal seams in Block "A" are contained in a variable sequence of silty mudstones and shales with occasional sandstone channels. The shales exhibit a rusty concentric weathering on outcrop and are dark grey on unweathered surfaces (see Plate IV). The sandstones are typically thin bedded, medium to coarse grained and exhibit cross-bedding. Some sandstone exposures show large concentrations of worm burrows, indicating a brackish water or near shore marine environment (see Plates VII and VIII).

Directly above the uppermost coal seam, the lithology changes to a massive competent sandstone unit, labelled F in Figure 3. This sandstone is coarse to medium grained, greyish brown weathering to buff and arkosic. The sandstone has essentially prevented the softer coal measures below it from being completely eroded away.

Figure 4 illustrates the section of coal measures exposed in outcrop at the edge of Hamilton Lake in which the 1976 bulk sample was removed. The letters at the left of the column indicate the stratigraphic correlation to the geophysical logs in Figure 3. From the description of this exposure, it is evident that the bulk sample was removed from the middle coal seam. The upper coal seam is exposed 1.39 meters above the roof of the adit, although it appears thinner and dirtier than in the geophysical log of corehole HL-78-03 which is located approximately 400 meters to the southeast of the adit site. The lowermost seam is not exposed at the adit location.



	MEASURED INTERVALS	LITHOLOGIC DESCRIPTION	
	covered		
F	+1.83 m	SANDSTONE:	Buff to light grey; weathering orange; becoming thinly bedded at base with coaly and carbonaceous laminae; medium grained.
	1.65m	SHALE:	Dark grey; silty; fissile; some vertical fracturing; concentrically weathered near base.
E	0.91 m	COAL:	Blocky and hard; dirty and boney sections throughout; streaks brown; becoming harder and dirtier near base.
	1.14 m	SHALE:	Dark grey weathering to grey and buff; some thin coal lenses; silty
	0.25 m	SHALE:	Dark grey to black; fissle; abundant coal laminae throughout
	0.43 m	COAL:	Blocky; hard but somewhat dirty; bright and dull banded
	0.15 m	MUDSTONE:	Dark grey weathering to buff and orange; hard.
D	0.69 m	COAL:	Hard; blocky with dull and bright sections; boney and dirty throughout.
	0.25 m	MUDSTONE:	Dark brown; silty at top; concrectionary lenses near base.
	0.58 m	COAL:	Hard; dull with some bright sections; streaks brown; dirtier near base.
	0.08 m	MUDSTONE:	Light grey to cream; fairly soft; irregular thickness.
	1.50 m	MUDSTONE:	Dark grey weathering to reddish and light grey; large concretionary layer near top - smaller ironstone concretions throughout.
	covered		
TOTAL SECTION	9.46m		

FIG 4

WELDWOOD OF CANADA LTD.

HAMILTON LAKE COAL LICENCES

OUTCROP EXPOSURE
BULK SAMPLE SITE
BLOCK 'A'

DRAWN BY:	DRAFTED BY:	CHECKED BY:	DATE:
S.L.GARDNER	E.J. DUNN		JUNE 1983

3.2.2 Description of the Coal Measures - Block "B"

Section 12+00 in Appendix I illustrates the coal measures as defined by the 1978 drilling in Block "B". The sequence of coal deposition on Block "B" is initiated by the middle coal seam occurring within 25 stratigraphic meters of the volcanic basement in the case of Hole HL-78-15. This coal seam is the most well-developed in the series on Block "B" and is shown in both holes HL-78-15 and HL-78-11 as between 1.6 and 1.7 meters in total thickness, including one major shale parting up to .3 meters and one minor parting up to .2 meters thick. This coal seam was located in outcrop exposure approximately 15 meters east of hole HL-78-15. Figure 5 details the measured exposure in outcrop. This seam was channel sampled for quality analysis.

A second seam occurs approximately 1.5 meters above the middle seam in HL-78-15. Its thickness is 1.2 meters, including a seam occurs in HL-78-15 approximately 2.4 meters above the second seam. Its thickness is approximately .5 meters and it is visible in an outcrop exposure, however its outcrop thickness was indeterminate. The total aggregate coal thickness, including partings, of the coal measures in Hole HL-78-15 is 3.35 meters, 2.55 meters of this aggregate thickness could be classed as clean coal. The stratigraphic separation between the uppermost and lowermost coal seams in Hole HL-78-15 is 5.2 meters. This stratigraphic separation increases to the south to 16.9 meters in Hole HL-78-11, which is located approximately 450 meters due south of HL-78-15. A marked change in coal seam generation is evident over this distance. The general characteristics of the lowermost coal seam remain the same. The uppermost coal seam increases to approximately .61 meters. The middle coal seam has split apart into 5 separate stringers all between .3 and .6 meters in thickness. These stringers are all separated by approximately 1.5 meters of shale formation.

With only two drillholes intersecting the coal measures on Block "B" and only limited surface exposures, it is difficult to reach a firm conclusion on the nature of coal seam generation in this area. The previous 1978 report speculated that the splitting apart of the seams is a result of structural stress, however the current field work indicates that depositional factors may be the underlying cause of the variation in seam characteristics, in particular the middle seam. Additional drilling and coring work is required before a definitive assessment of coal seam characteristics and calculation of reserves can be undertaken.

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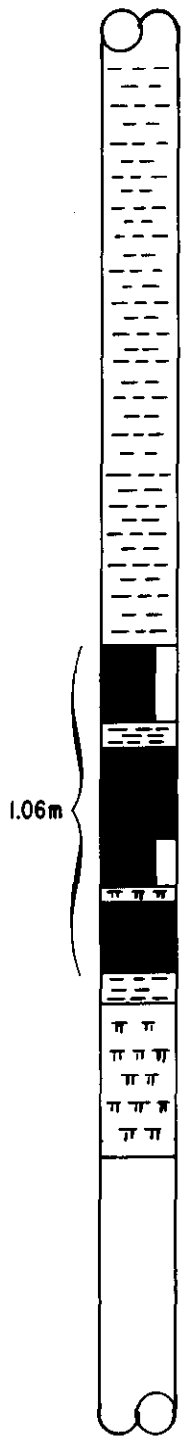


MEASURED INTERVALS	LITHOLOGIC	DESCRIPTION
> 2.00 m	SHALE:	Medium to dark grey; fissle; easily erodable; weathers to rusty orange; some coaly lenses up to 0.10m. thick.
0.25 m	COAL:	Generally dirty but some bright, blocky sections.
0.08 m	SHALE:	Medium grey to dark grey; carbonaceous, thickness variable.
0.30 m	COAL:	Bright, blocky and clean.
0.15 m	COAL:	Dull and boney throughout with some blocky lenses.
0.05 m	MUDSTONE:	Medium grey; soft.
0.23 m	COAL:	Bright and blocky but some dull banding; highly weathered.
0.10 m	SHALE:	Dark grey to black; carbonaceous; some fissility.
> 0.50 m	MUDSTONE:	Medium grey, weathering to rust; some coaly lenses up to 7cm; root imprints.
covered interval		

FIG 5

NOTE: Section through the lowermost coal seam as measured and sampled in outcrop.

WELDWOOD OF CANADA LTD.

HAMILTON LAKE COAL LICENCES

STRATIGRAPHIC SECTION BLOCK 'B'

DRAWN BY:	DRAFTED BY:	CHECKED BY:	DATE:
S.L.GARDNER	E.J. DUNN		JUNE 1983

3.3.0 Surficial Geology

Both the Block "A" and "B" areas have been subjected to considerable glacial scour, as they are topographically high. On the tops of the plateau areas, striations and grooves created by the movement of ice in an east-north-easterly direction area visible (see Plate III). Exposures of Comox formation sandstones are common and in general only a slight covering of glacial till up to 1 meter in thickness is present.

On the flanks of the plateau areas, glacial deposition is the factor controlling the topography and accumulations of till up to 30 meters thick are present in valleys and draws. Most of the sedimentary - volcanic contact areas are masked by moderate thicknesses of glacial till averaging 5 to 10 meters thick.

The till is typically a sandy or silty clay material containing a large amount of pebbles, cobbles and boulders. It is grey in colour and weathers to orange and brown.

The upper .5 meters of till which has been exposed to the elements and plant life has incorporated the vegetal matter to form a humic or organic layer which nurtures tree and understory growth quite readily.

SECTION 4

4.0 COAL QUALITY

Coal quality information on the Hamilton Lake Coal Licences is limited to 3 data points:

a) the outcrop at the edge of Hamilton Lake at the northwest end of Block "A", where a bulk sample was extracted from the middle seam in 1976.

b) a corehole (Hole HL-78-03) located approximately 225 meters to the south and east of the bulk sample site.

c) a channel sample from an outcrop of the middle coal seam taken during the recent field work from the northeast end of Block "B".

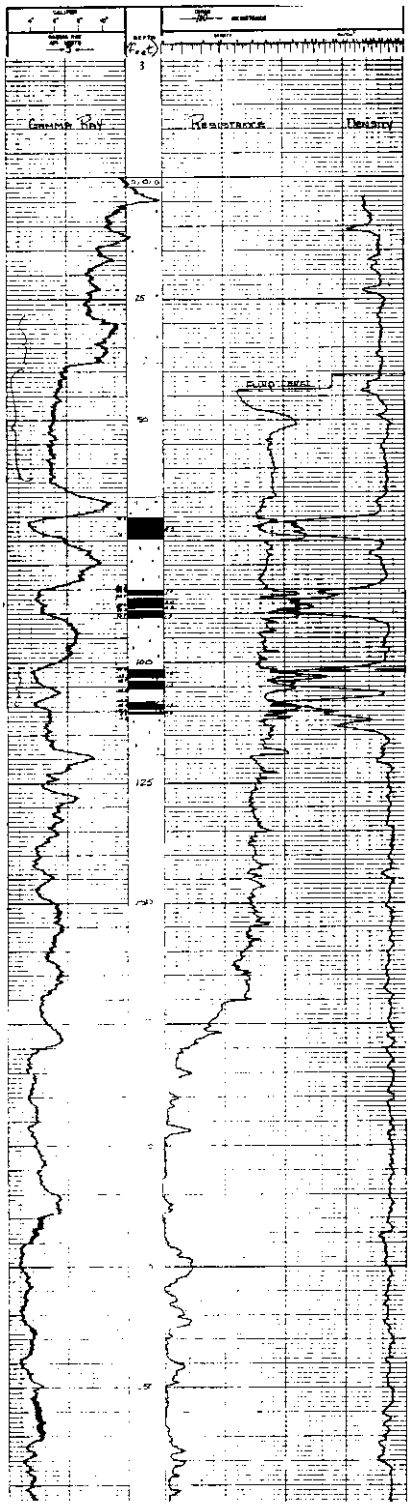
The following excerpt from a report on the bulk sample washability tests conducted by Birtley Engineering of Calgary gives an indication of general coal quality for the Hamilton Lake area:

> "The clean coal, which places in the high volatile Bituminous "A" classification, exhibits good coking characteristics with an F.S.I. of 8 1/2 comparing with a G. Factor of 1.068 of the Ruhr Dilatometer test. The sulphur content of the coal is rather high at 1.5%."

Figure 6 illustrates the geophysical log of corehole HL-78-03. Head assays of the raw coal samples are detailed on the log. These are taken from the analytical data contained in the 1978 report. The ash contents do not necessarily reflect the gross seam section as shown on the log, as some partings were removed prior to analysis.

Table I ← confidential summarizes the coal quality data of the recent outcrop sample taken in the Block "B" area. The most outstanding difference is that no coking qualities are evident from this sample, as compared to the good coking characteristics of the bulk sample and the drill core samples. It is possible that the weathered nature of the coal on outcrop does not reflect true coking characteristics.

HL - 78 - 03



RAW COAL ANALYTICAL DATA

Moisture	Ash	Volatile Matter	Fixed Carbon	Sulphur	Calorific Value (Btu/lb)	Free Swelling Index
0.45%	20.5%	31.5%	47.6%	2.40%	11,690	7.0
0.40%	23.6%	30.9%	45.1%	1.57%	11,254	6.5
0.46%	27.4%	27.2%	44.9%	0.90%	10,166	5.5

FIG 6

*NOTE: Ash content does not reflect the gross seam section, as some partings were removed prior to analytical work.

WELDWOOD OF CANADA LTD.

HAMILTON LAKE COAL LICENCES

RAW COAL QUALITY (AIR - DRIED BASIS)* BLOCK 'A'

DRAWN BY:	DRAFTED BY:	CHECKED BY:	DATE:
S.L.GARDNER	E.J.DUNN		JUNE 1983

Corehole HL-78-03 shows that the sulphur content varies by seam: the upper seam is highest in sulphur content at 2.4%, the middle seam is somewhat lower in sulphur at 1.6% and the lowest seam is lowest in sulphur at .9%. This is the case in a number of other areas on Vancouver Island.

While the existing quality information gives some indication of trends in coal quality for the Hamilton Lake area, the absence of quality data over the majority of the area precludes any comfortable predictions of product coal quality. However, the author feels that any coal produced from the Hamilton Lake coal licences would be necessarily a blending coal because of relatively high sulphur contents (an average sulphur content of 1.5% could be expected). The coal will be most likely metallurgical grade but suitable for use as a thermal product in such facilities as cement plants, provided it was blended correctly with low sulphur, low F.S.I. coal from other areas.

SECTION 5

5.0 COAL RESERVES

5.1 In-Situ Coal Reserves - Block "A"

Table II tabulates aggregate seam thicknesses for each of the drillholes located in Block "A". Because these holes are relatively evenly spaced over the block, a rough average aggregate coal thickness for the area can be calculated:

HOLE NO.	AGGREGATE SEAM THICKNESS* (m)	
HL-78-13	2.3	
HL-78-03	4.2	
HL-78-09	2.7	Raw average = 3.4 m.
HL-78-04	2.2	(11.2 ft)
HL-78-19	3.4	
HL-78-08	4.9	
HL-78-07	4.2	

* Does not include individual seams less than .3 meters in thickness.

Table II: Aggregate Coal Thicknesses, 1978 drilling, Block "A"

The calculation of in-situ reserves for Block "A" was accomplished by employing a planimeter to calculate the total area in Block "A" underlain by coal measures. The projected outcrop line of the upper coal seam as shown on Appendix Map A was used as a boundary on the southern edge of the block. The other boundaries are fairly well-defined by drilling. Using the following assumptions, a total in-situ reserve figure was calculated for the planimetered area of the coal reserve block:

a) assume a Relative Density of raw coal in place of 1.5 gm/cc.
b) assume an average dip on the coal measure of 10 degrees.
c) assume an average aggregate in-situ coal thickness of 11.2 ft. (3.4 m.) (see Table II).
d) assume 1852.17 short tons of coal per foot per acre (at a 10 degree average dip).

Therefore:

1852.17 tons/ft. x 11.2 ft. = 20,744.3 short tons/acre

20,744.3 short tons/acre x 341 acres (area calculated by planimeter)

= 7,073,808 short tons

or approximately 6.43 million metric tons

This compares with the calculated reserve of 8.54 million metric tons contained in the 1978 report.

5.2 In-Situ Coal Reserves - "Block B"

With only two of the five 1978 drillholes intersecting economically recoverable coal and virtually no surface coal exposures on the west side of Block "B", it is not possible to arrive at a reasonable estimate of in-situ coal reserves. The 1978 report estimates 2.64 million metric tons (2.9 million short tons), however this assumes a radius of investigation of the available drill data of up to 700 meters. Considering the variation of the coal intervals between Holes HL-78-11 and HL-78-15, this may not be a safe assumption. In consideration of the shortage of drill data and current field evaluations, the author recommends a limited drill and core program in Block "B" in order to provide information that would allow a safe estimate of in-situ coal reserves to be made.

SECTION 6

6.0 CONCLUSIONS AND RECOMMENDATIONS

Hamilton Lake Coal Licence Numbers 7480, 7481, 7482 and 7483 contain a potentially economic in-situ coal reserve of between 6.43 and 9.07 million metric tons, contained in two areas termed Blocks "A" and "B". These reserves have been delineated as a result of recent surface mapping and previous drilling conducted by Weldwood of Canada Limited. The variation in both thickness and quality of the coal seams indicated by this preliminary work makes additional more detailed work a necessity before a reasonable economic evaluation can be undertaken. This additional work can be sub-divided into three phases:

Phase I - Technical Preparation: Prior to the undertaking of detailed field work, a proper base map must be produced.

Phase 2 - A Limited Drill and Core Program on Block "B": This limited program is essential in the evaluation of both coal quality and reserves in Block "B". Upon completion of this program, the Block "B" area would be explored to a slightly better degree than is presently in place on Block "A".

Phase 3 - A Detailed Drill and Core Program on Block "A": This detailed program would escalate the degree of exploration on the Block "A" area to be level that would permit an initial engineering feasibility study.

6.1.0 Phase 1 - Technical Preparation

Recent field mapping has isolated some possible discrepancies in the surveying of the previous drillholes. It has also shown the present map, which is simply a 1:7500 scale map enlarged from a 1:15,840 scale hand-drawn topographic map, to be unreliable in terms of topographic control and the location of existing roads and trails. Prior to the undertaking of any additional field work, a proper base map must be produced. The map should provide accurate enough topographic control for Phase 2 and 3 of future exploration. The author recommends a base map to be constructed on a 1:5,000 scale with 2.5 meter topographic control.

Any of the larger survey companies can undertake this work.

- Total cost to prepare surface topographic map from existing air photo control at a scale of 1:5,000 on 2.5 meter contour intervals - $3,500.00.

6.2.0 Phase 2 - Block "B" Drilling and Coring

A limited drill and core program is essential in the evaluation of both coal quality and reserves in Block "B". While it is essential, it can represent a degree of flexibility when considering the time frame for development of the entire licence area: this limited drill program can be undertaken separately or in tandem with the Phase 3 program for Block "A" as outlined below. If Weldwood management elects to evaluate the entire area rapidly and with some urgency, Phase 2 and Phase 3 programs can be co-ordinated as one. Alternately, if Weldwood management would prefer to take a slower stance toward development, the limited program of Phase 2 allows evaluation to proceed more slowly while still meeting all work commitments necessary to keep the exploration licences in good standing.

Table III summarizes the limited drill and core program for Block "B" that constitutes Phase 2 of the proposed plan of exploration and development. The location of these holes is detailed on Appendix Map A. These initial ten holes are spaced on a modified grid pattern of approximately 150 meter spacing. All holes are located on existing access so that no land clearing or tree cutting is required. This spacing will allow in-situ coal reserves to be calculated with confidence and should define the limit of economic coal occurrence in the area. Two cored holes will provide a reasonable indication of coal quality.

DRILLHOLE # (seq. order)	GRID LINE	LOCATION Lt. or Rt. of B/L	DRILLED meters	CORED meters	TOT. PROJ. DEPTH meters
1	13 + 50	585 m.Lt.	50	-	50
2	10 + 20	435 m.Lt.	40	-	40
3	9 + 20	660 m.Lt.	30	-	30
4	11 + 60	475 m.Lt.	15	20	35
5	15 + 00	720 m.Lt.	40	-	40
6	16 + 50	900 m.Lt.	40	-	40
7	13 + 50	1035 m.Lt.	50	-	50
8	15 + 00	1090 m.Lt.	30	-	30
9	18 + 00	700 m.Lt.	40	-	40
10	16 + 20	500 m.Lt	10	10	20
		TOTALS	345	30	375

TABLE III: Phase 2 - Block "B" Drilling and Coring.

Using recent costs associated with drilling and coring on the Quinsam Property in 1982, the following table estimates cost for this program:

TABLE IV - Summary of Projected Costs, Drilling Proposal, Hamilton Lake, Block "B" (Phase 2).

ON-PROPERTY COSTS

Surveying	5,000.00
Mobilization-Demobilization	3,500.00
Drilling	17,000.00
Coring, including equipment rental	3,500.00
Geophysical Logging	3,500.00
Bits and Downhole Consumables	2,500.00
Fuel	1,200.00
Cat Support	2,000.00
Reclamation	2,000.00
Meals and Accommodation	1,500.00
Supervision, includes vehicle	3,200.00
sub-total	45,900.00
+ 15% Contingency Factor	6,895.00
TOTAL	52,795.00

OFF-PROPERTY COSTS

Planning and permitting	2,000.00
Laboratory Analytical Work	10,000.00
Final Reporting	8,000.00
TOTAL	20,000.00

GRAND TOTAL, PROJECTED COSTS = 72,795.00
say 73,000.00

This expenditure could be applied against the work commitment for entire Hamilton Lake Licence Area, including Blocks "A" and "B".

The total expenditures outlined in Phase 1 and Phase 2 of the proposal would keep the entire licence area in good standing for the next three years, with approximately $27,000 in additional credit for year 4.

6.3.0 Phase 3 - Detailed Drilling and Coring, Block "A"

Phase 3 should consist of grid pattern drilling and coring as indicated on the cross-sections in Appendix I and on Appendix Map A. The initiation of a grid pattern drill program is contingent of the construction on a baseline which is usually parallel to formation strike. A recommended baseline, with cross-sections drawn every 300 meters through the Block "A" area, is illustrated in Appendix I. This Phase 3 program encompasses holes drilled on a 300 meter spacing across the area of Block "A", with a number of coreholes spaced down the length of the block so as to give a reasonably spaced coverage for the establishment of a coal quality data base.

The completion of this proposed Phase 3 program would result in providing enough background geological and coal quality data to allow an initial feasibility study to be undertaken. This feasibility study would provide the following:

a) in-situ raw and recoverable coal reserves.
b) basic raw coal quality and anticipated product quality.
c) the type of mining method best suited to this deposit.
d) operating cost projections.
e) capital cost projections.
f) a preliminary mining schedule.
g) an assessment of the viability and profitability of the proposed development.
h) recommendations for future work i.e. more detailed drilling and coring on a tighter grid.

The Phase 3 detailed drilling program is summarized in Table V below:

DRILLHOLE # (seq. order)	GRID LINE	LOCATION Lt. or Rt. of B/L	DRILLED meters	CORED meters	TOT. PROJ. DEPTH meters
1	48+00	190 m.Lt.	35	-	35
2	48+00	600 m.Lt.	50	-	50
3	48+00	1200 m.Lt.	45	-	45
4c	48+00	900 m.Lt.	30	20	50
5	45+00	300 m.Lt.	50	-	50
6	45+00	900 m.Lt.	40	-	40
7c	45+00	600 m.Lt.	25	20	45
8	45+00	1440 m.Lt.	100	-	100
9	42+00	150 m.Lt.	60	-	60
10	42+00	600 m.Lt.	45	-	45
11c	42+00	300 m.Lt.	30	30	60
12	39+00	150 m.Lt.	65	-	65
13	39+00	545 m.Lt.	40	-	40
14	39+00	900 m.Lt.	125	-	125
15	39+00	1200 m.Lt.	100	-	100
16c	39+00	300 m.Lt.	20	30	50
17	36+00	Baseline	85	-	85
18	36+00	425 m.Lt.	45	-	45
19c	36+00	150 m.Lt.	30	35	65
20	33+00	150 m.Lt.	50	-	50
21c	33+00	280 m.Lt.	15	20	35
22c	33+00	Baseline	30	30	60
23	30+00	Baseline	55	-	55
24c	30+00	115 m.Rt.	25	25	50
25	30+00	200 m.Rt.	50	-	50
26	28+65	60 m.Rt.	50	-	50
27	30+00	225 m.Lt.	65	-	65
28	27+45	40 m.Rt.	65	-	65
		TOTALS	1425	210	1635

TABLE V: Phase 3 - Block "A" detailed drilling and coring.

Although detailed costs for the Phase 3 program have not been worked out, an estimated cost for Phase 3 work, not including the technical feasibility is $175,000.00

In summary, the author recommends the expenditure of approximately $250,000.00 in on-going exploration work on the Hamilton Lake Coal Licences over the next three to six years. The logical and orderly sequence of exploration work as planned in this report should allow Weldwood management a degree of flexibility as to the pace of development of these licences, while at the same time meeting all the necessary work commitments in order to keep the property in good standing.

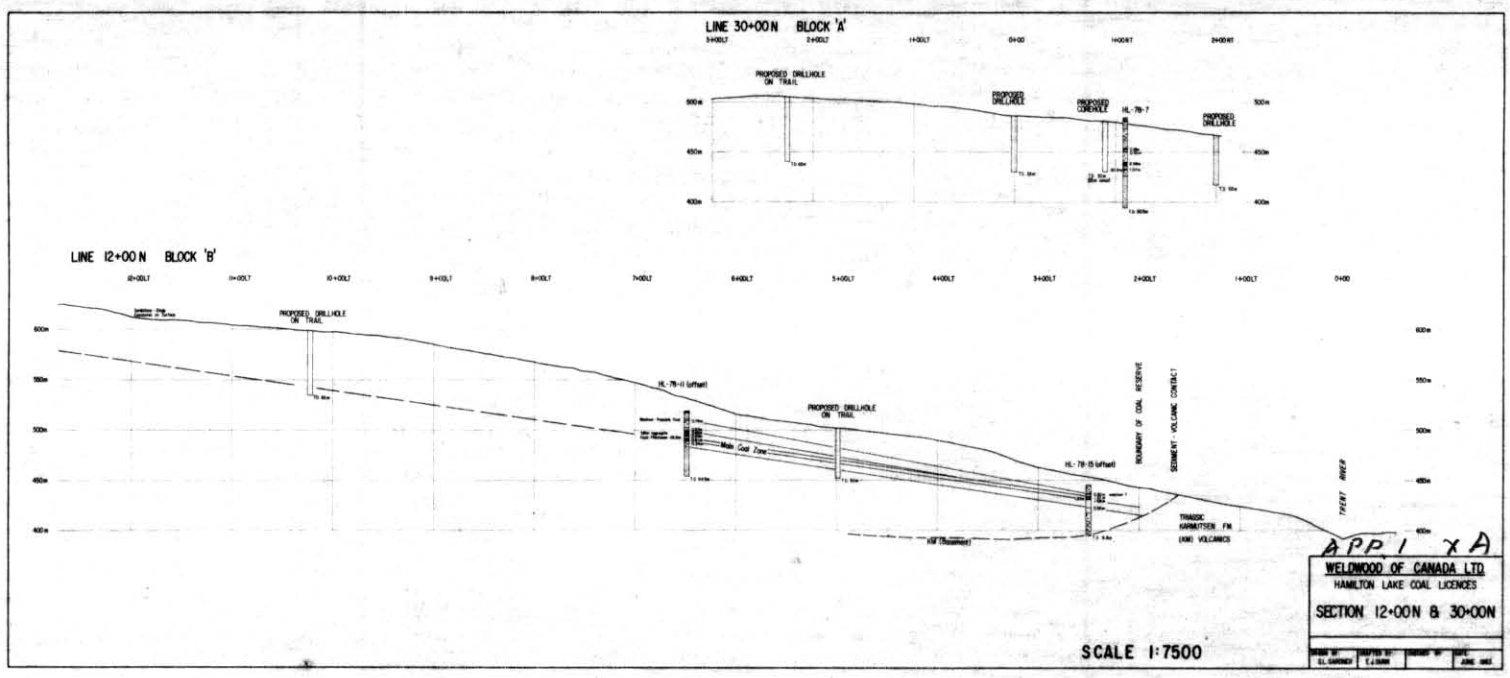
The author also recommends discussions with the Coal Administrator, B.C. Department of Energy, Mines and Petroleum Resources to determine whether a reduction of the existing licence area is possible. In certain instances the Administrator may allow physiographic boundaries to replace existing legal surveys on Vancouver Island, especially where large timber licences are the only existing survey control, which is the case in the Hamilton Lake area. Work to date shows clearly that a good portion of the existing licence area definitely has no potential for containing coal measures (see Map A, Appendix I). This volcanic terrain should be surrendered to the Crown, if possible. The surrender of all or some of these areas could result in a substantial reduction of annual licence rentals and would allow work credits to be applied against a smaller area.

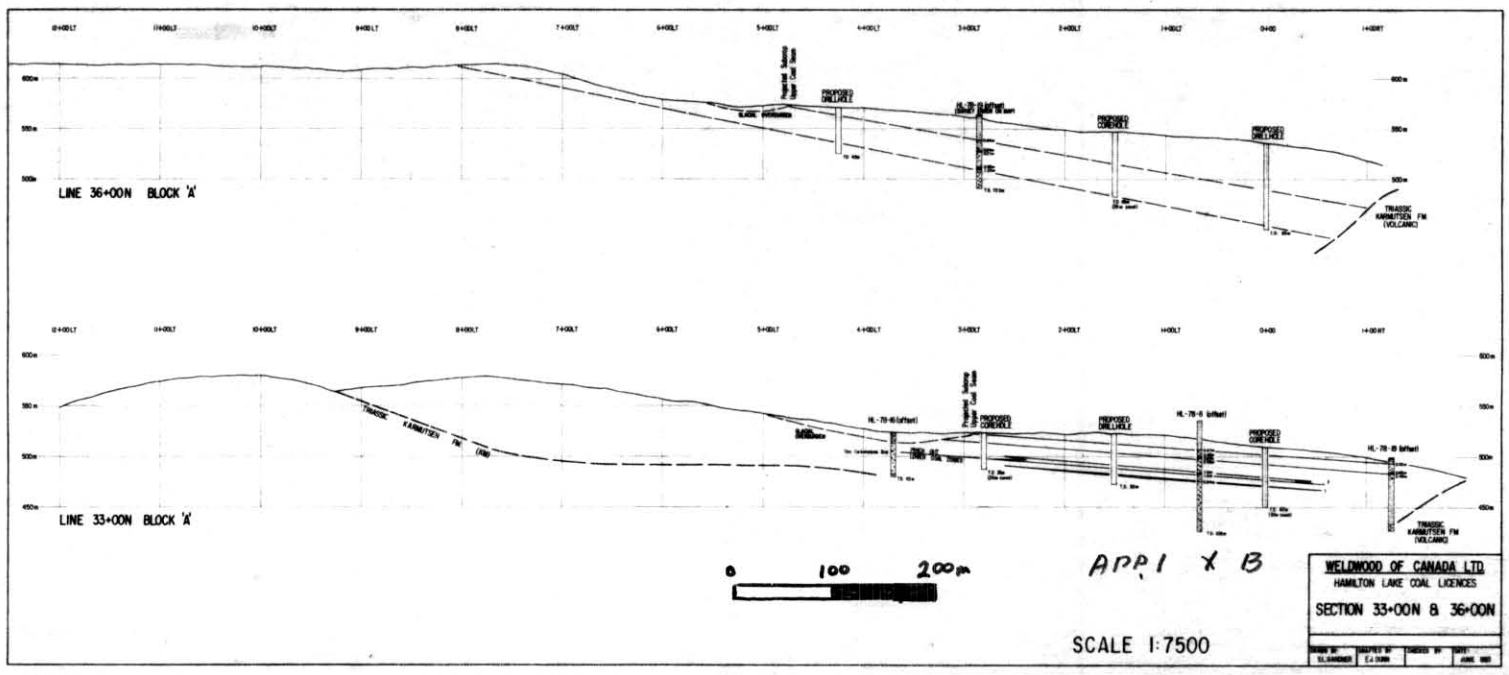
References

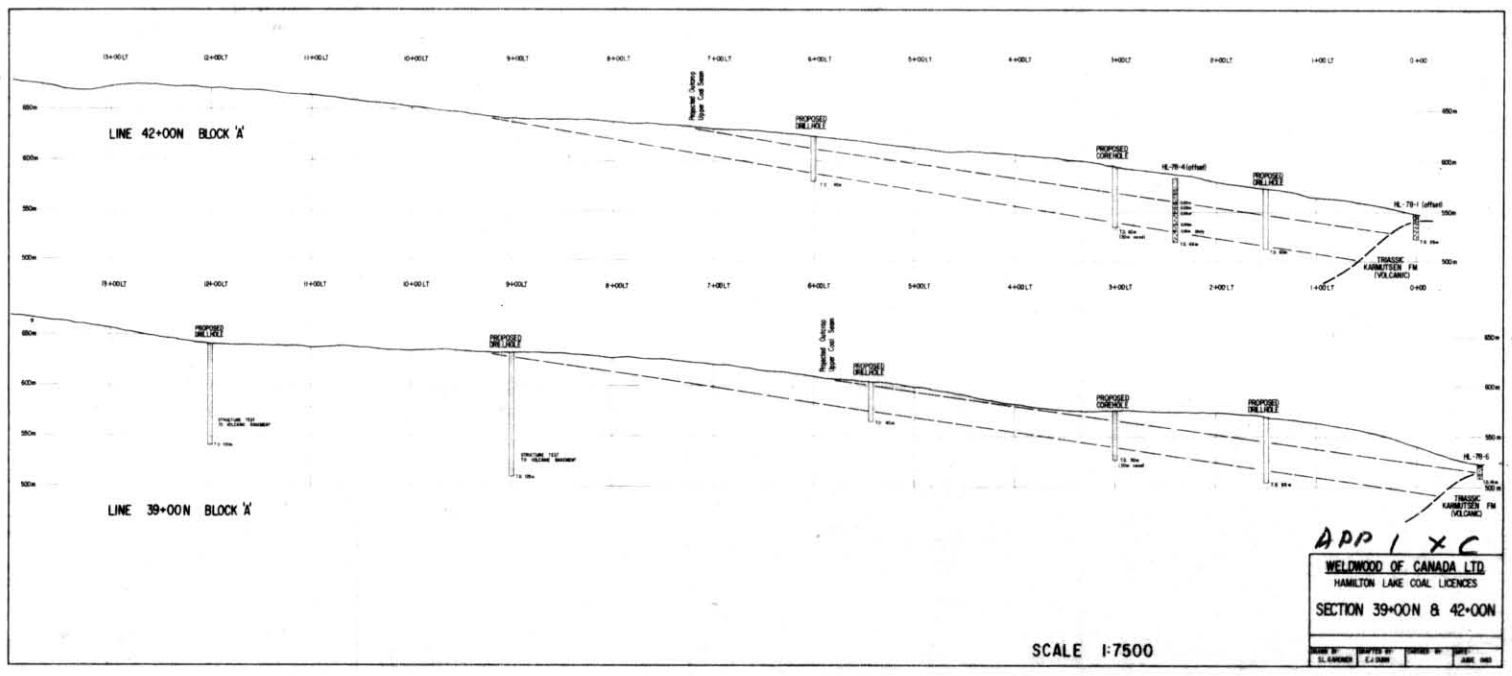
1. The Hamilton Lake Coal Licences
   (1978 Exploration Work)
   By M.P. Curcio, Weldwood of Canada Ltd.
   October 1978

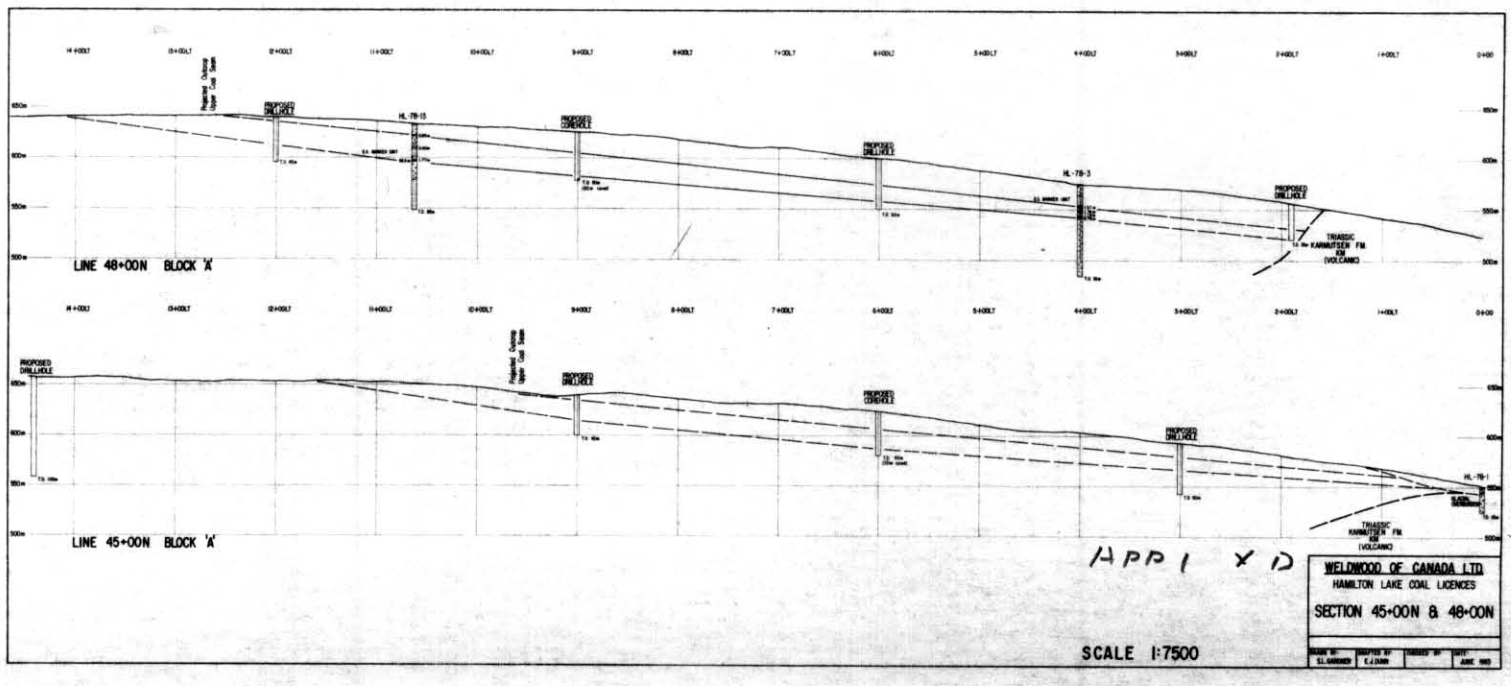
2. Hamilton Lake Bulk Sample Work
   (Report and Summary of Analytical Data)
   by Birthley Engineering Ltd. (Calgary, Alberta)
   February 1977

APPENDIX I

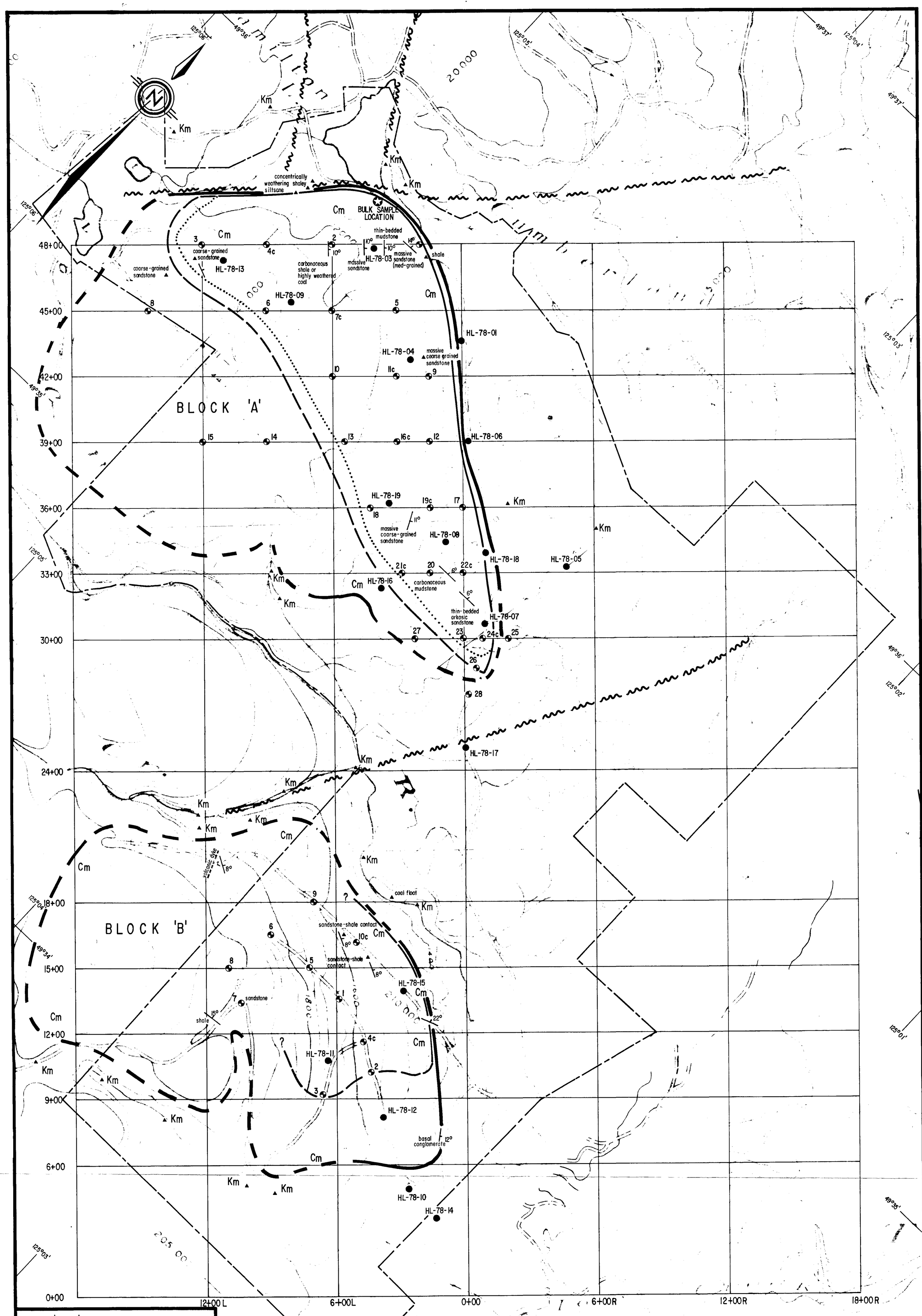








CX- Hamilton Lake 83L 2*(A #1)



Legend

- Borehole Location (Existing, Proposed)
- 4c Corehole
- Sediment - Volcanic Contact, Defined
- Sediment - Volcanic Contact, Extrapolated
- 15° Strike & Dip
- Volcanic Dyke
- Boundary of Economic Coal Reserves, Defined
- Boundary of Economic Coal Reserves, Extrapolated
- Coal Outcrop
- Intraformational Contact, Sandstone - Shale OR OUTCROP
- Km Karmutsen Formation, Triassic (Volcanic Basement)
- Cm Comox Formation, Late Cretaceous, (Coal-Bearing Sediments)
- Fault Structure
- Approximate Boundary of Hamilton Lake Coal Licences
- Projected Subcrop - Outcrop Line - Upper Coal Seam

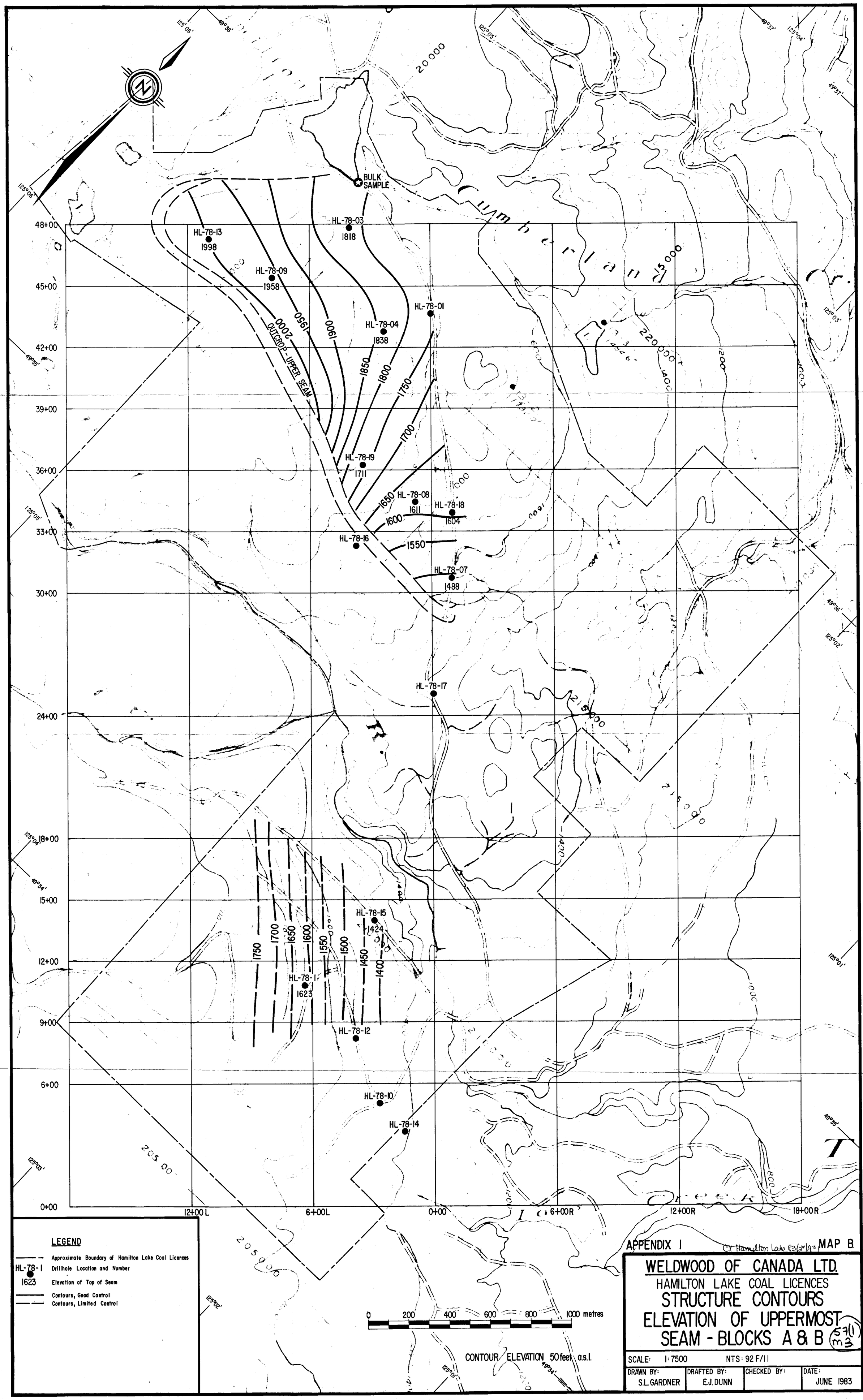
APPENDIX I (Ex-Hamilton Lake 83(2)A #1) MAP A

WELDWOOD OF CANADA LTD.

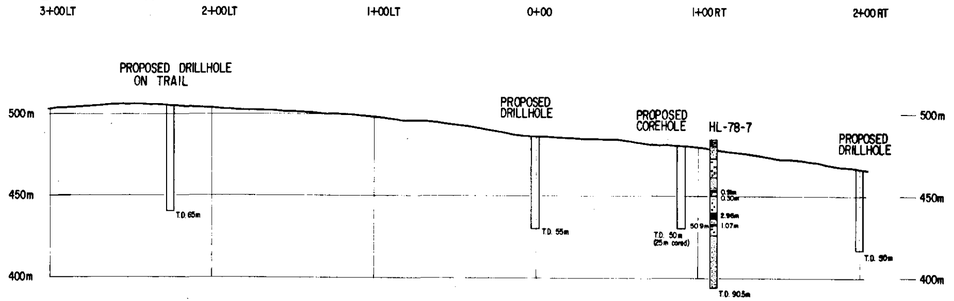
HAMILTON LAKE COAL LICENCES

SURFACE GEOLOGY 57(1) m2

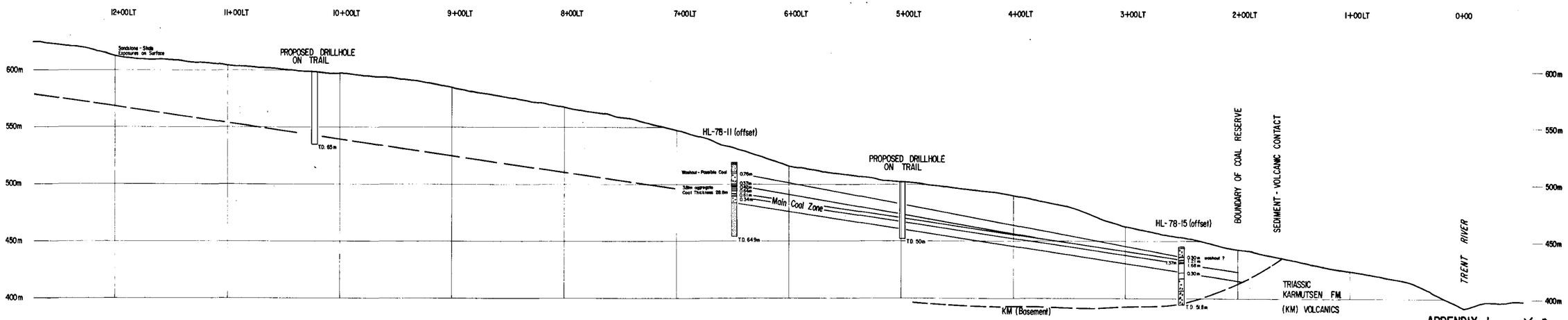
SCALE: 1:7500	NTS: 92F/11		
DRAWN BY: S.L.GARDNER	DRAFTED BY: E.J.DUNN	CHECKED BY:	DATE: JUNE 1983


125°06'
49°36'
125°05'
49°37'
125°04'
125°03'
49°35'
49°34'
125°02'
125°01'
BULK SAMPLE
HL-78-03
1818
HL-78-13
1998
HL-78-09
1958
HL-78-01
HL-78-04
1838
HL-78-19
1711
HL-78-08
1611
HL-78-18
1604
HL-78-16
HL-78-07
1488
HL-78-17
HL-78-15
1424
HL-78-1
1623
HL-78-12
HL-78-10
HL-78-14
OUTCROP - UPPER SEAM
2000
1950
1900
1850
1800
1750
1700
1650
1600
1550
1500
1450
1400
48+00
45+00
42+00
39+00
36+00
33+00
30+00
24+00
18+00
15+00
12+00
9+00
6+00
0+00
12+00 L
6+00L
0+00
6+00R
12+00R
18+00R
Cumberland
T.
R.
0
200
400
600
800
1000 metres
CONTOUR ELEVATION 50 feet a.s.l.
LEGEND
Approximate Boundary of Hamilton Lake Coal Licences
HL-78-1 Drillhole Location and Number
1623 Elevation of Top of Seam
Contours, Good Control
Contours, Limited Control
APPENDIX I
Cf Hamilton Lake 83/2*/A*/1
MAP B
WELDWOOD OF CANADA LTD.
HAMILTON LAKE COAL LICENCES
STRUCTURE CONTOURS
ELEVATION OF UPPERMOST
SEAM - BLOCKS A & B
(57/11 m3)
SCALE: 1:7500
NTS: 92 F/11
DRAWN BY: S.L. GARDNER
DRAFTED BY: E.J. DUNN
CHECKED BY:
DATE: JUNE 1983

LINE 30+00 N BLOCK 'A'



LINE 12+00 N BLOCK 'B'



APPENDIX I XA

WELDWOOD OF CANADA LTD.

HAMILTON LAKE COAL LICENCES

SECTION 12+00N & 30+00N

SCALE: HORIZONTAL AND VERTICAL 1:2500			
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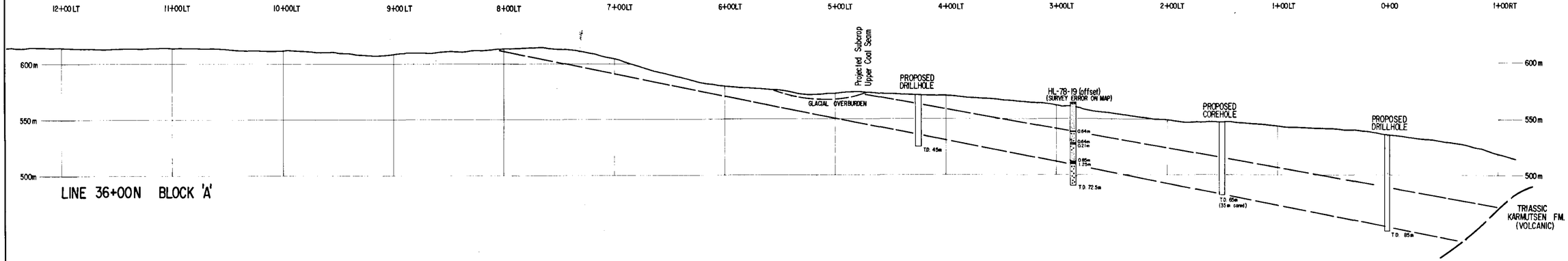
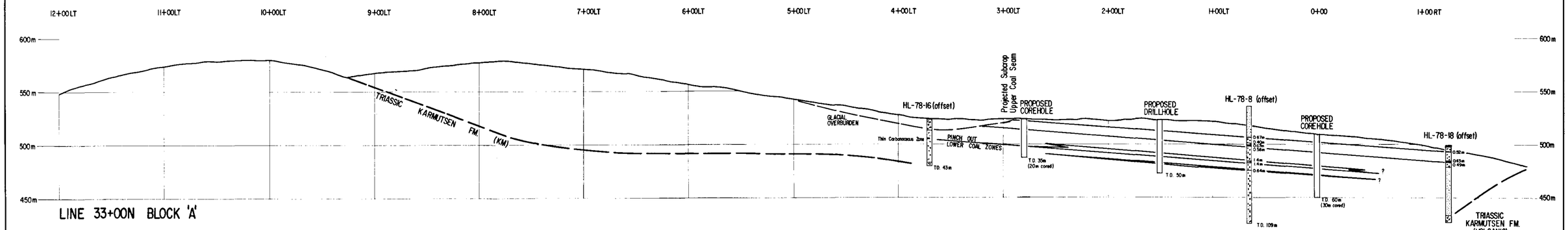


LINE 36+00N BLOCK 'A'



LINE 33+00N BLOCK 'A'

APPENDIX I X B

WELDWOOD OF CANADA LTD.

HAMILTON LAKE COAL LICENCES

SECTION 33+00N & 36+00N

SCALE: HORIZONTAL AND VERTICAL 1:2500			
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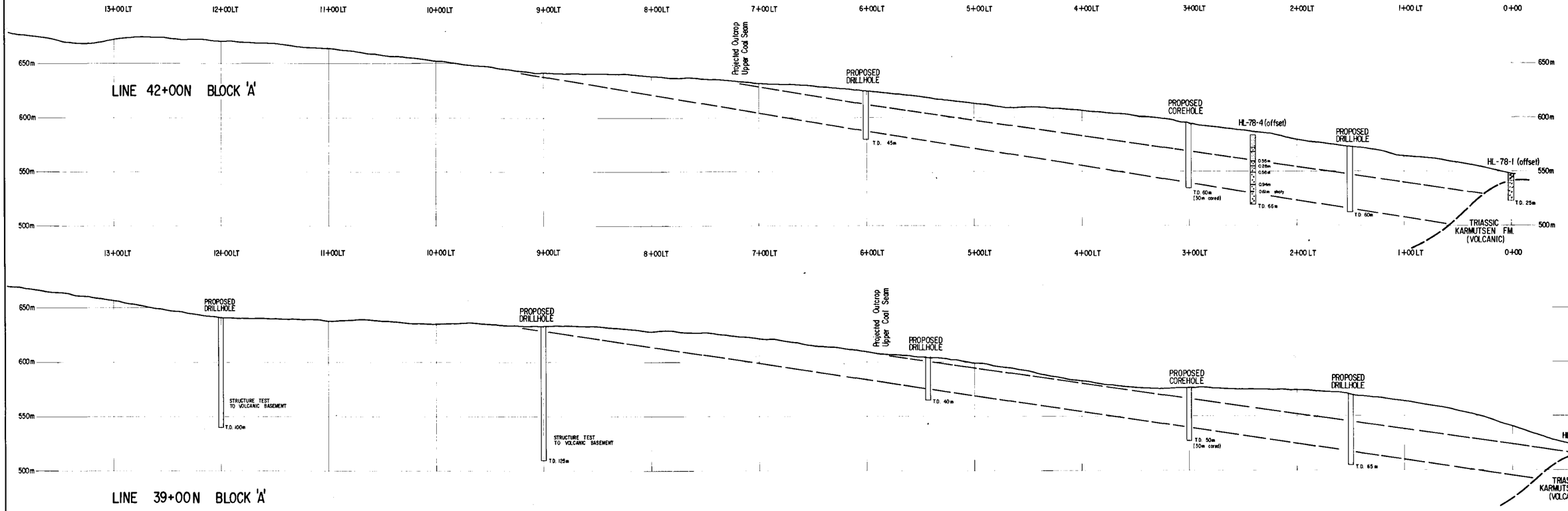

APPENDIX I

WELDWOOD OF CANADA LTD.

HAMILTON LAKE COAL LICENCES

SECTION 39+00N & 42+00N

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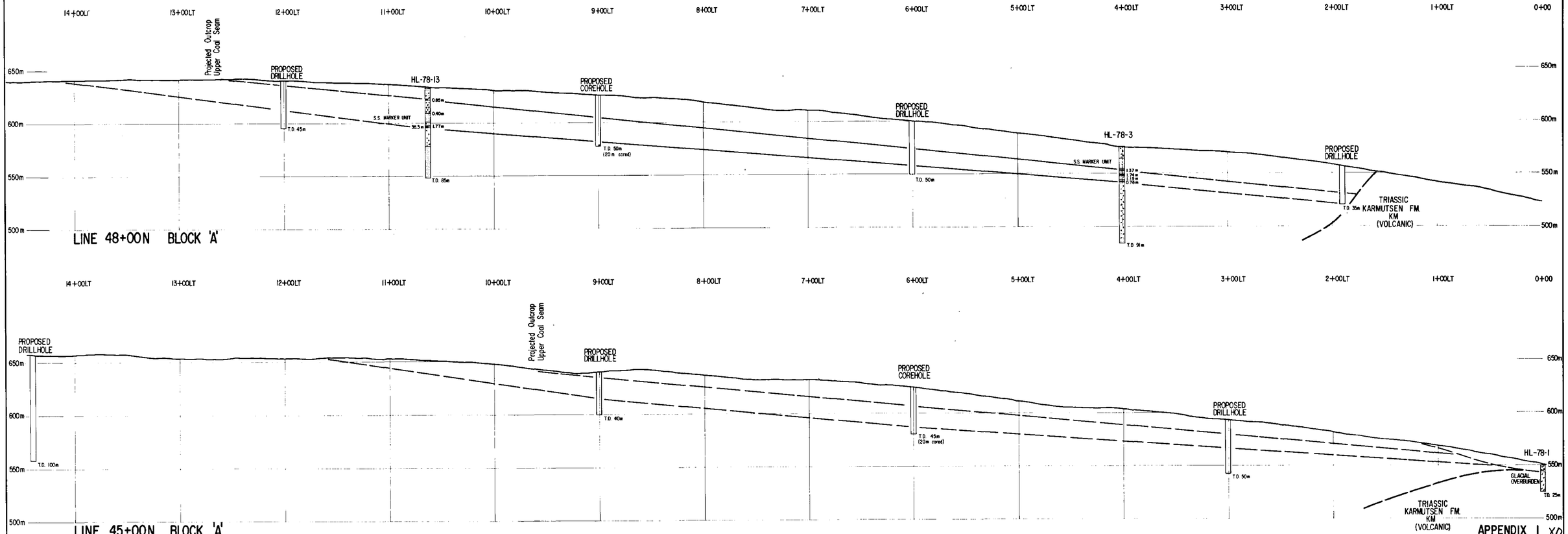

APPENDIX I XD

WELDWOOD OF CANADA LTD.

HAMILTON LAKE COAL LICENCES

SECTION 45+00N & 48+00N

SCALE: HORIZONTAL AND VERTICAL 1:2500			
DRAWN BY: S.L.GARDNER	DRAFTED BY: E.J.DUNN	CHECKED BY:	DATE: JUNE 1983

APPENDIX II

APPENDIX II

PHOTOGRAPHS

PLATE I - Outcrop exposure of Karmutsen Fm. basalt showing flow lava structures. Note: quartz mineralization on lower left. South end of Block "B".

PLATE II - Outcrop exposure of basal conglomeratic member. Note: characteristic greenish colour and size of pebbles and cobbles. East edge of Block "B".

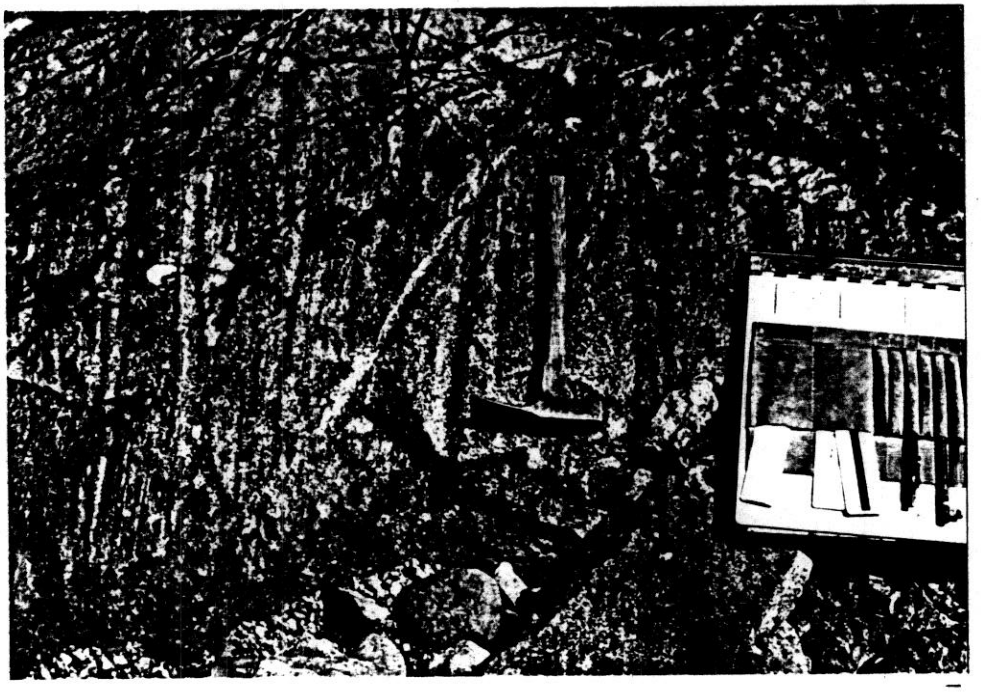

PLATE III - Exposure of Comox Sandstone showing grooves and striations caused by glacial scour. Block "B" area.

PLATE IV - Exposure of silty shale member beneath the coal measure at Hamilton Lake. Note: concretionary weathering. Hamilton Lake Block "A".

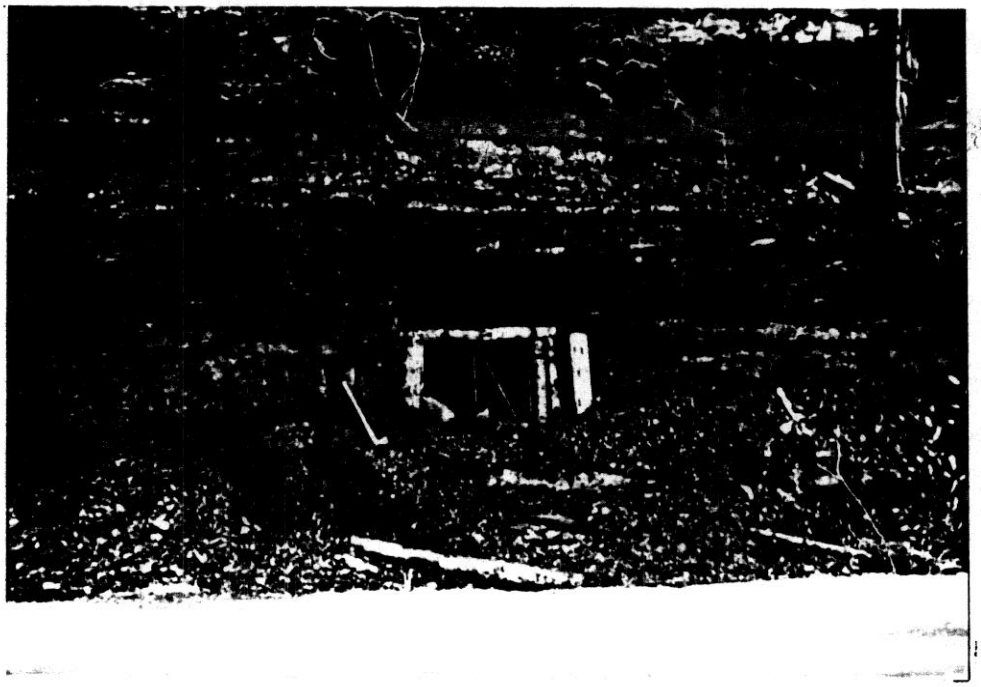

PLATE V - Hamilton Lake Adit Site. Note: fault feature through coal seams on middle and upper left. Block "A"

PLATE VI - Close-up of minor fault feature at Hamilton Lake Adit Site. Greyish siltstone member indicates a vertical displacement of .3 metres.

PLATE VII - Exposure of thin-bedded sandstone within the coal measures on Block "A". Ripple marks evident near bottom center.

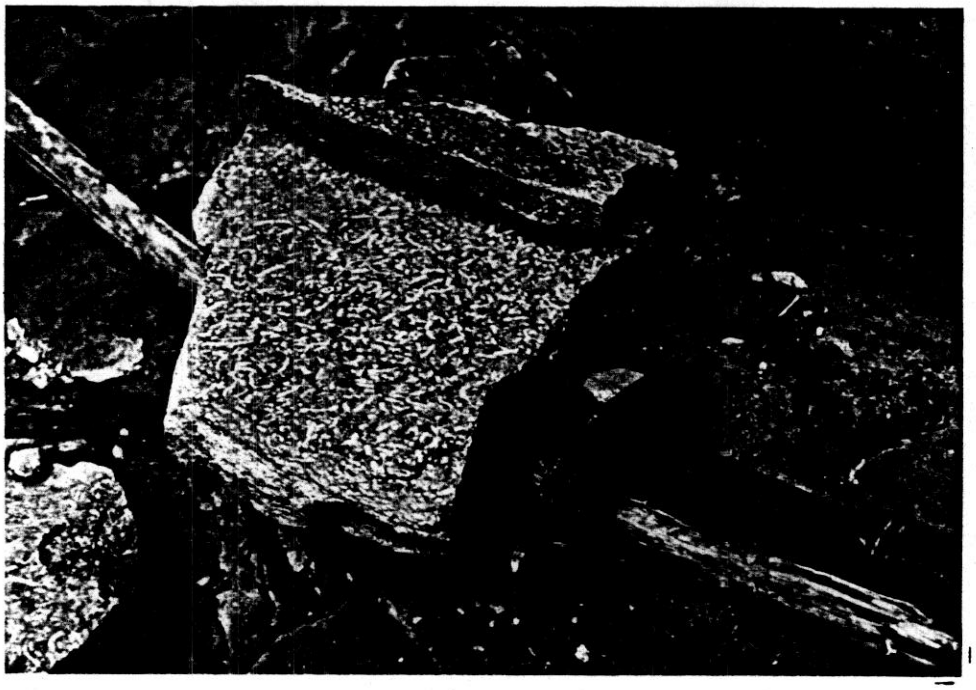

PLATE VIII - Close-up of thin-bedded sandstone showing worm burrow structures.

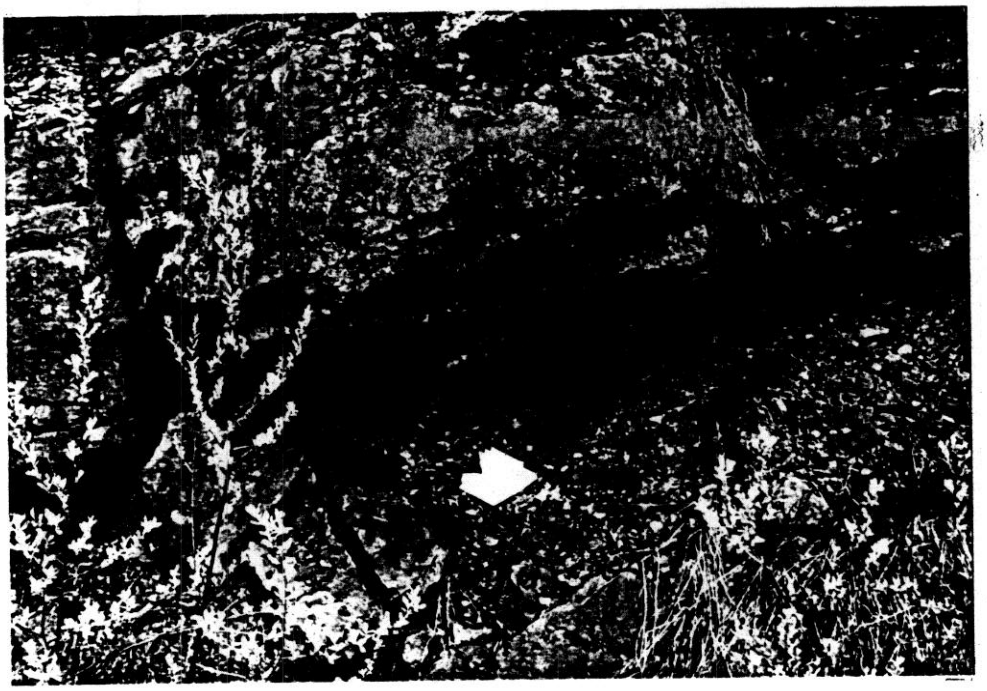

PLATE IX - Outcrop exposure showing contact of coal-bearing shale-siltstone formation with overburden massive thick-bedded sandstone. Block "B" area.

PLATE X - Exposure showing contact between basal conglomerate and overlying coal-bearing silty shale member. Block "B" area.

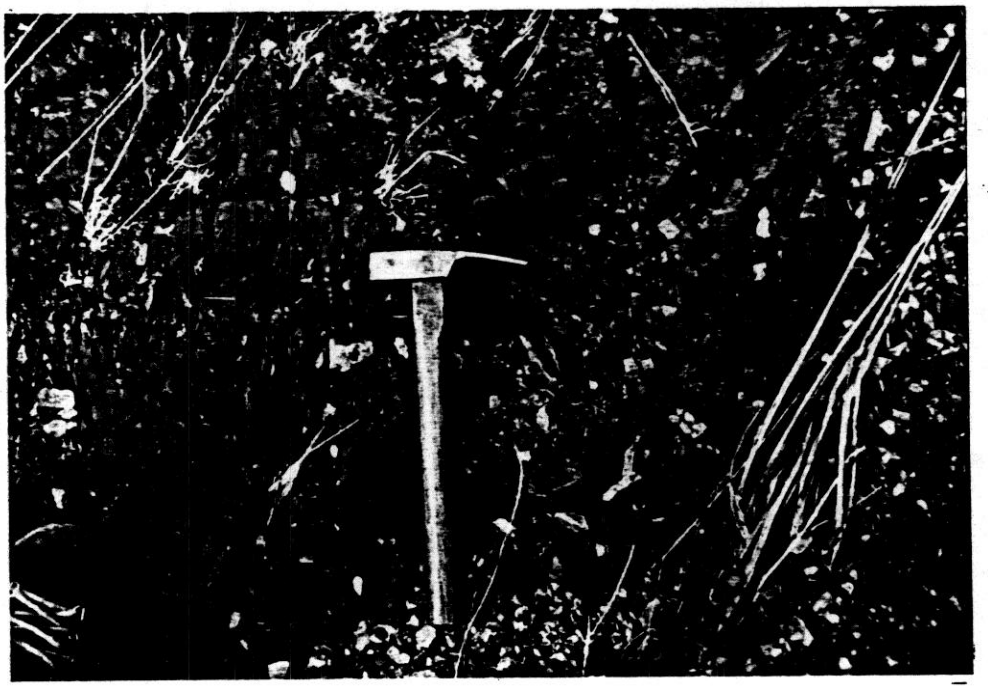

PLATE XI - Exposure of volcanic dyke that cuts through sedimentary formations west of the licence boundary on Block "B". Dyke is probably of Tertiary age.

PLATE XII - Close-up of volcanic dyke material. Note: vuggy nature. Block "B" area.

CONFIDENTIAL

COAL QUALITY DATA,

CHANNEL SAMPLE HL-83-01,

HAMILTON LAKE BLOCK B

FROM BOTH COPIES OF REPORT

CX-HAMILTON LAKE 83A

00057

057

TABLE I. - Coal Quality Data, Sample HL-83-01, Block "B".

WE HAVE ANALYZED a Coal Channel Sample " HL-83-01 ", received from you and report with the following results:

RAW HEAD Basis:	TOTAL MOISTURE %	RESIDUAL MOISTURE %	ASH %	VOLATILE MATTER %	FIXED CARBON %	SULPHUR %	CALORIFIC VALUE BTU / lb.
as received	11.7	--	22.10	27.87	38.33	0.73	8394
air dry	--	6.19	23.48	29.63	40.70	0.78	8918
dry	--	--	25.03	31.59	43.38	0.83	9506
1.7 FLOAT							
air dry	--	7.40	15.13	34.88	42.59	0.84	10146
dry	--	--	16.34	37.67	45.99	0.91	10957
1.7 SINK							
Air dry	--	5.55	50.50	--	--	--	--
dry	--	--	53.48	--	--	--	--

YIELD (dry basis) 76.5%

FSI : 0 (not agglomerating coal)

TABLE I. - Coal Quality Data, Sample HL-83-01, Block "B".

WE HAVE ANALYZED a Coal Channel Sample " HL-83-01 ", received from you and report with the following results:

RAW HEAD Basis:	TOTAL MOISTURE %	RESIDUAL MOISTURE %	ASH %	VOLATILE MATTER %	FIXED CARBON %	SULPHUR %	CALORIFIC VALUE BTU / lb.
as received	11.7	--	22.10	27.87	38.33	0.73	8394
air dry	--	6.19	23.48	29.63	40.70	0.78	8918
dry	--	--	25.03	31.59	43.38	0.83	9506
1.7 FLOAT							
air dry	--	7.40	15.13	34.88	42.59	0.84	10146
dry	--	--	16.34	37.67	45.99	0.91	10957

YIELD (dry basis) 76.5%

FSI : 0 (not agglomerating coal)

1.7 SINK							
Air dry	--	5.55	50.50	--	--	--	--
dry	--	--	53.48	--	--	--	--