ELCO MINING LIMITED

K- ELK RIVER 77(1)B.

REPORT
on
EXPLORATION AND COAL QUALITY TESTWORK
conducted in 1976/77
on the
ELK RIVER COAL PROJECT

(Coal Licenses Nos. 64,
65, 421 through 434, 481 through 489,
515, 771 through 779, 951 through 957)

NTS - Map MOUNT HEAD 82J/7W

OPEN FILE

GOLD COMMISSIONER
RECEIVED and RECORDED
FEB 27 1978
M.R. #.....
VICTORIA, B.C.

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 276

Submitted to the
B.C. Ministry of Mines and Petroleum Resources

Calgary, February 15, 1978

H. Gruss, P. Geol.
Manager Exploration

TABLE OF CONTENTS

(Text)

		Page No.
1.	Objectives	1
2.	Scope of Work and Basis of Information	3
3.	Topography	7
	3.1 Terrain Description of Coal Licenses Area	7
	3.2 Surveying and Map Development	9
4.	Geology	12
	4.1 Stratigraphy of the Deposit	12
	4.1.1 Seam Stratigraphy	14
	4.2 Structure	20
5.	Coal Reserves	21
	5.1 General, Definitions and Criteria	21
	5.2 Overall Coal Potential (CIP)	25
	5.3 Mineable Coal Reserves (ROM)	33
	5.4 Open Pit mineable Clean Coal Reserves	38
	5.5 Oxidized Coal Reserves	43
6.	Coal Quality	45
	6.1 Objectives of Coal Quality Work	45
	6.2 Raw Coal Quality	48
	6.3 Blending Requirements and Blends	59
	6.4 Clean Coal Quality and Cokeability	64
7.	Supplemental Plan of Operations For Extended Term of Licence	81

TABLE OF CONTENTS

(Illustrations)

			Page No.
Table	II-6.5.4.1-T1	Summary of Exploration Programs	5
Map	II-6.5.4.1-M1	Areas of Elk River Exploration 1968-1977	6
Map	3.2-M1	Index Map of Coal Licence Area, 1:50,000	8
Map	II-6.2.2-M2	Topographic Map Index, Metric 1:1000 and 1:2000 Series	10
Map	II-6.2.2-M3	Topographic Map Index, Metric 1:5000, 1:10,000 and 1:20,000 Series	11
Figure	II-6.3.2-F1	List of Formations, Time-Stratigraphic Sequence	13
Figure	II-6.3.2-F2	Summary of Local Stratigraphy	15
Table	II-6.3.2-T3	Summary of Seam Stratigraphy	18
Figure	A-II-6.3.2-F4	Section 250+00	19
Figure	II-6.4.1-F2	Diagram of Terms and Criteria for Reserves Calculation	23
Table	II-6.4.1-T1	Specific Gravities Used in Coal Reserves Calculations and Mine Planning	24
Table	II-6.4.2-T2	Geological Reserves	26
Table	A-II-6.4.2-T7	Geological Reserves/Summary of Coal & Waste Calculations (Source: Data Bank, Nov.11,1977)	28
Table	A-II-6.4.2-T3	Geological Reserves - Section 110+00	29
Table	A-II-6.4.2-T4	Geological Reserves - Section 130+00	30
Table	A-II-6.4.2-T5	Geological Reserves - Section 150+00	31
Table	A-II-6.4.2-T6	Geological Reserves - Sections 100+00 to 160+00	32
Table	II-6.4.3-T1	Alternative D Mineable Reserves, Non-Oxidized Coal	35
Table	II-6.4.3-T2	Mineable Reserves of Non-Oxidized Coal, Comparison of 1977 and 1976 Figures.	36
Table	II-6.4.5-T2	Run of Mine and Clean Coal Reserves (Met. Coal)	41
Figure	II-6.4.3-F1	Open Pit Geological and Mineable Reserves (East Flank)	42
Table	II-6.4.6-T1	Oxidized Coal Reserves, In-Place	44
Table	II-6.5.4.3-T1	Data Basis for Raw Coal Quality Assessment	48
Graph	II-6.5.2.3-G1	Bore hole Sample Test Procedure Flow Sheet	49
Table	II-6.5.4.5-T1	Average Quality of Elk River Coal (CIP)(Summary of all Exploration Programs between Sections 160+00 and 400+00)	51
Graph	II-6.5.4.5-G2	95% Confidence Levels for 1975-77 Drill Cores (CIP) Coal Ash %	52

			Page No.
Table	II-6.5.4.10-T1	Size/Gravity/Ash-Distribution of ROM Coal (1975/76 Bulk Samples, Composite "C")	57
Table	II-6.5.5.4-T2	1.5 Float Coal Quality Variations for Years 1 to 9 and 10 to 19	63
Table	II-6.5.6.2-T1	Elk River Seam Coals, Specified According to Quality Groups	65
Table	II-6.5.6.2-T2	Run of Mine Composite Samples, Mine Plans "A", "C" and "D".	67
Table	II-6.5.6.2-T3	Clean Coal Composite Samples, Mine Plans "A", "C" and "D"	68
Table	II-6.5.6.3-T1	Mean Quality Characteristics of Elk River Coals (1975/76 Bulk Samples)	69
Table	II-6.5.6.3-T2	Average Clean Coal Characteristics for The Mining Alternatives of The Pre-feasibility and of the Feasibility Stages (Based on 1975/76 Bulk Sample Analyses)	70
Table	II-6.5.6.3-G1	Volatile Matter $\bar{R}_m$ of Vitrinite	72
Table	II-6.5.6.3-T4	Maceral Analysis of Elk River Composite Samples (STELCO)	74
Graph	II-6.5.6.3-G3	Petrographic Stabilities of Elk River Coals	75
Table	II-6.5.6.3-T5	Average Geiseler Plastometer Data for Elk River Seams and Blends (STELCO)	77
Graph	II-6.5.6.3-G5	Mean Reflectance and Maximum Fluidity in Elk River Coals in Comparison with Blend Components Used in Japan	78
Graph	II-6.5.6.3-G6	G-Values of Elk River Coals and Blends	79

LIST OF APPENDICES

*A-II-6.3.2-M1	Summary of Exploration Work	
*A-II-6.2.2-M1	Plan Showing Survey of Horizontal Control in the Elk River valley, 1:50,000, 1¼" = 1 mi., British Columbia, 1976 (McELHANNEY)	
*A-II-6.2.2-M2	1:10,000 Series Topography consisting of 4 map sheets: Mount Veits Sheet, Mount Bleasdell Sheet, Gardner Creek Sheet, and Mount Loomis Sheet.	
*A-II-6.3.2-M2	Geological Map of the Project Area	
A-4.1-F1	Cross-Section	150+00 (2 sheets)
A-4.1-F2	" "	170+00 (2 ")
A-4.1-F3	" "	180+00 (2 ")
A-4.1-F4	" "	190+00 (3 ")
A-4.1-F5	" "	200+00 (2 ")
A-4.1-F6	" "	210+00 (2 ")
A-4.1-F7	" "	220+00 (2 ")
A-4.1-F8	" "	230+00 (3 ")
A-4.1-F9	" "	240+00 (3 ")
A-f.1-F10	" "	250+00 - east (3 ")
A-4.1-F11	" "	250+00 - west (2 ")
A-4.1-F12	" "	260+00 (3 ")
A-4.1-F13	" "	270+00 (3 ")
A-4.1-F14	" "	280+00 (3 ")
A-4.1-F15	" "	290+00 (2 ")
A-4.1-F16	" "	300+00 (2 ")
A-4.1-F17	" "	307+00 (2 ")
A-4.1-F18	" "	311+00 (2 ")
A-4.1-F19	" "	320+00 (2 ")
A-4.1-F20	" "	325+00 (2 ")
A-4.1-F21	" "	327+50 (2 ")
A-4.1-F22	" "	328+75 (2 ")
A-4.1-F23	" "	330+00 (2 ")
A-4.1-F24	" "	340+00 (2 ")
A-4.1-F25	" "	350+00 (2 ")
A-4.1-F26	" "	360+00 (2 ")
A-4.1-F27	" "	370+00 (2 ")

* K-ELK-RIVER 77(2)A.

*	A-4.1-F28	Cross-Section 380+00	(2 sheets)
	A-4.1-F29	" " 390+00	(2 ")

△	A-4.1-Vol.I-VI	1976/77 Diamond and Rotary Borehole Lithology and Geophysical Logs (arranged according to drilled cross-section
○	A-6.2-Vol.I&II	Core and Rotary Sample Analyses, 1976/77, Birtley Engineering and Warnock Hearsey

△ K - ELK RIVER 77 (3) A
○ K - ELK RIVER 77 (4) A.

1. Objectives

Assessment of the exploration data obtained during ELCO'S 1975/76 Prefeasibility Study, and referred to in the Stage-I-Report, basically confirmed the results of earlier exploration and testwork conducted by SCURRY and EMKAY.

The conclusion developed was that earlier assessments and expectations for the property were reliable, in particular with respect to:

- Open Pit coal reserves with favourable coal/overburden ratios.

- Individual seam qualities and overall average coal qualities determined from the test sampling of boreholes, trenches and tunnels.

It was further concluded, that in general, bulk samples and composites as tested in 1975/76 were sufficiently representative for this stage of the project's development, and that the quality of an overall Elk River clean coal blend would meet the requirements of the partners in the Elk River Coal Project.

The density of existing information on the deposit, however, was considered to be inadequate for the preparation of the Feasibility Study and to meet the various requirements of a Stage II - Report.

A comprehensive exploration program, therefore, had to be planned and conducted to provide the information required for such studies and reports.

Emphasis of this additional work (performed in 1976/77) was to be directed on the following objectives:

- Prove the representativeness of the 1975/76 bulk samples for the entire open pit area under consideration.

- Prove a minimum of 120 million tonnes of open pit mineable clean coal reserves meeting the required quality specifications,

- Establish from the various seams, one clean coal blend of a quality acceptable to the partners.

- Support mine planning in optimizing pit limits as required to prove overall clean coal reserves and related quality.

2. Scope of Work and Basis of Information

In order to establish greater geological control of the deposit and to meet the requirements for a Feasibility Study and a Stage II Report, an exploration program of the following scope was conducted:

- Establishment of an up-to-date topographic map system which would meet all planning requirements and comply with Canada's metrification scheme. This was developed as follows:
  - aerial photography (230 km^2),
  - grid survey,
  - a tie-in to the National UTM grid,
  - development of a digitized terrain model, and
  - development of a new topographic basemap system in 5 different metric scales.

- Reduced the diamond drilling grid from 600 x 150 m to 300 x 150 m approx. by drilling of 92 diamond bore holes* (17,630.3 m) in the future open pit area.

- Conducted a dense grid drilling program in the northern part of the deposit on intervals of less than 300 m in order to study the variances in seam thickness, geometry and quality by drilling 25 rotary holes (4,168.7 m).

- Excavated trenches along the diamond drill grid intervals for geological mapping and seam outcrop study.

- Obtained a bulk sample (300 tonnes) by trenching, for the purpose of conducting a commercial size breaker test and attrition tests.

* Note: A total of 99 diamond boreholes (19,775.5 m) were drilled throughout the entire project area during the 1976/77 exploration program. See Map A-II-6.3.2-M1.

- Recalculated the open pit run-of-mine reserves, clean coal reserves and overburden ratios, and, assessed the mineable underground coal potential.

- Conducted additional quality studies to confirm previous conclusions that a metallurgical quality coal that is acceptable by all the partners can be produced at a constant quality and acceptable rate of recovery (974 coal samples).

- Conducted a basic exploration drilling program on the West flank of the valley to establish the geology and coal quality of the deposit in this part of the licenses' area 95 holes with 1,507.2 m).

- Conducted a comprehensive reclamation program comprising:

  - backfilling,
  - spreading of top soil,
  - repeated fertilizing and seeding, and
  - erosion control of disturbed areas (66.2 ha).

This exploration program triples the information available on the deposit until 1975 and represents a reliable basis of data compatible with the requirements of this stage of the project's development.

Table II-6.5.4.1-T1 (Page 5) exhibits the total volume of exploration work conducted on the Elk River deposit so far and together with Map II-6.5.4.1-M1 (Page 6) gives an overview of the various areas covered by the individual exploration programs.

Map A-II-6.3.2-M1 describes the location of previous and more recent exploration sites in greater detail.

TABLE II-6.5.4.1-T1

SUMMARY OF EXPLORATION PROGRAMS

PROGRAM NBR	PROGRAM YEAR	CONDUCTED BY	INVESTIGATED AREA (Figure)	INVESTIGATIONS TYPE*	INVESTIGATIONS NUMBER	SAMPLES TYPE**	SAMPLES NUMBER
1	1968	North American Coal Corporation	Big Weary Ridge	D R T A	6 13 Several 8	BHS BS	12*** 7
2	1969	Scurry-Rainbow Oil Company Limited	Big and Little Weary Ridges, Western Flank	D T A	16 18 3	BHS BS CHS	62*** 8 15
3	1970/72	EMKAY Canada Natural Resources Ltd. and Scurry Rainbow Oil Co. Ltd.	N-End Big Weary Ridge, Little Weary Ridge	D R T A	27 15 21 1	BHS BS CHS	160*** 18 67
4	1975/76	Elco Mining Limited Exploration & Bergbau GmbH	Little Weary Ridge, N-Half of Big Weary Ridge	D T A	24 2 3	BHS BS CHS	231 15 51
5	1976/77	Elco Mining Limited Exploration & Bergbau GmbH	Little Weary Ridge, N-Half of Big Weary Ridge, Western Flank	D R T	97 25 2	BHS BS CHS	970 1 4
SUB TOTAL				D R T A	170 53 22(+) 15	BHS CHS BS	1435 137 49
GRAND TOTAL:					260		1621

*) D= Diamond Hole R = Rotary Hole

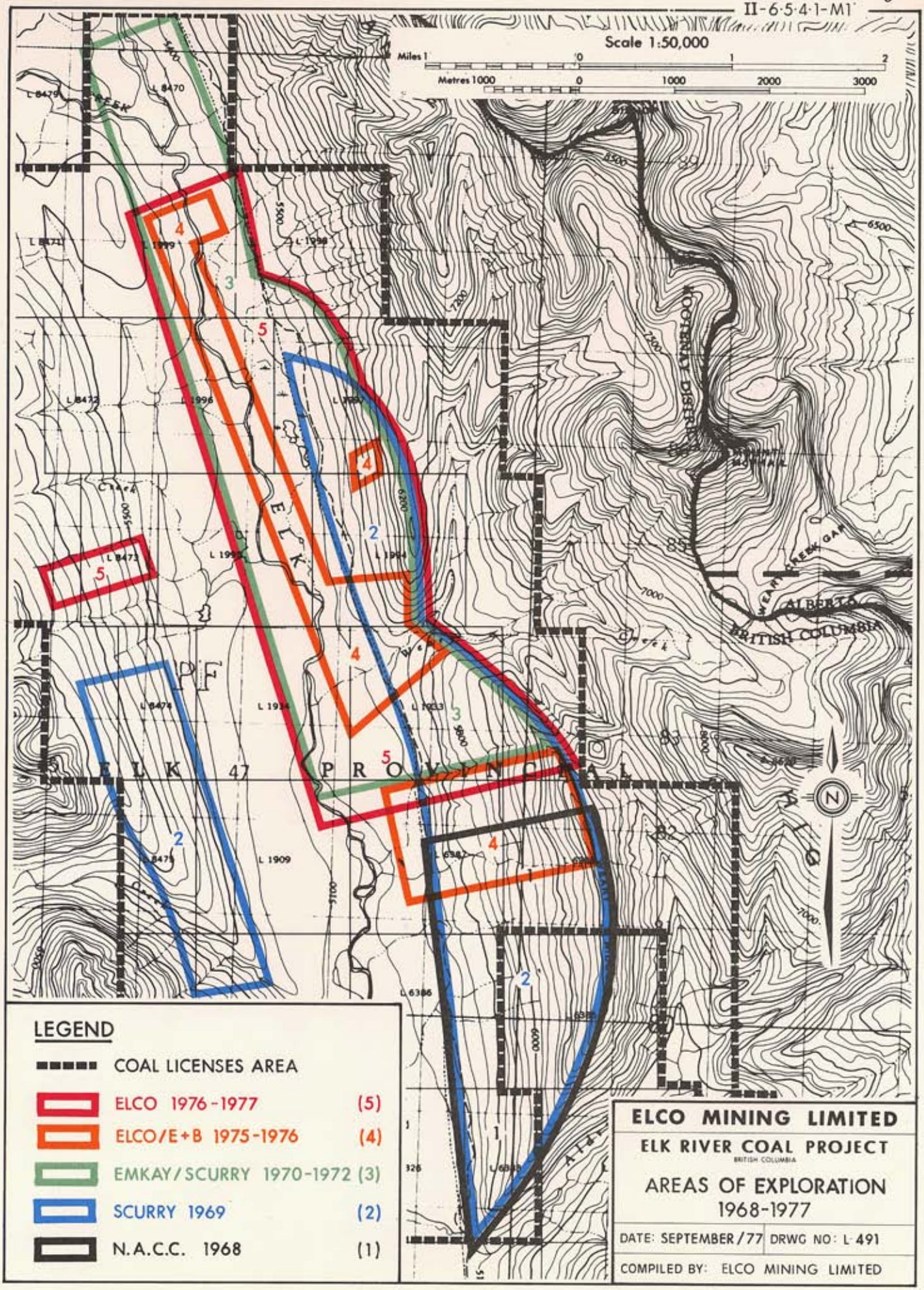
T= Trench A = Adit

**) BHS = Bore Hole Samples

CHS = Channel Samples

BS = Bulk Samples

***) between sections 170+00 and 390+00 only


Scale 1:50,000
Miles 1 0 1 2
Metres 1000 0 1000 2000 3000
ELK 47 PROVINCIAL
KOOTENAY DISTRICT
ALBERTA
BRITISH COLUMBIA
N
LEGEND
COAL LICENSES AREA
ELCO 1976-1977 (5)
ELCO/E+B 1975-1976 (4)
EMKAY/SCURRY 1970-1972 (3)
SCURRY 1969 (2)
N.A.C.C. 1968 (1)
ELCO MINING LIMITED
ELK RIVER COAL PROJECT
BRITISH COLUMBIA
AREAS OF EXPLORATION
1968-1977
DATE: SEPTEMBER/77 DRWG NO: L-491
COMPILED BY: ELCO MINING LIMITED

3. Topography

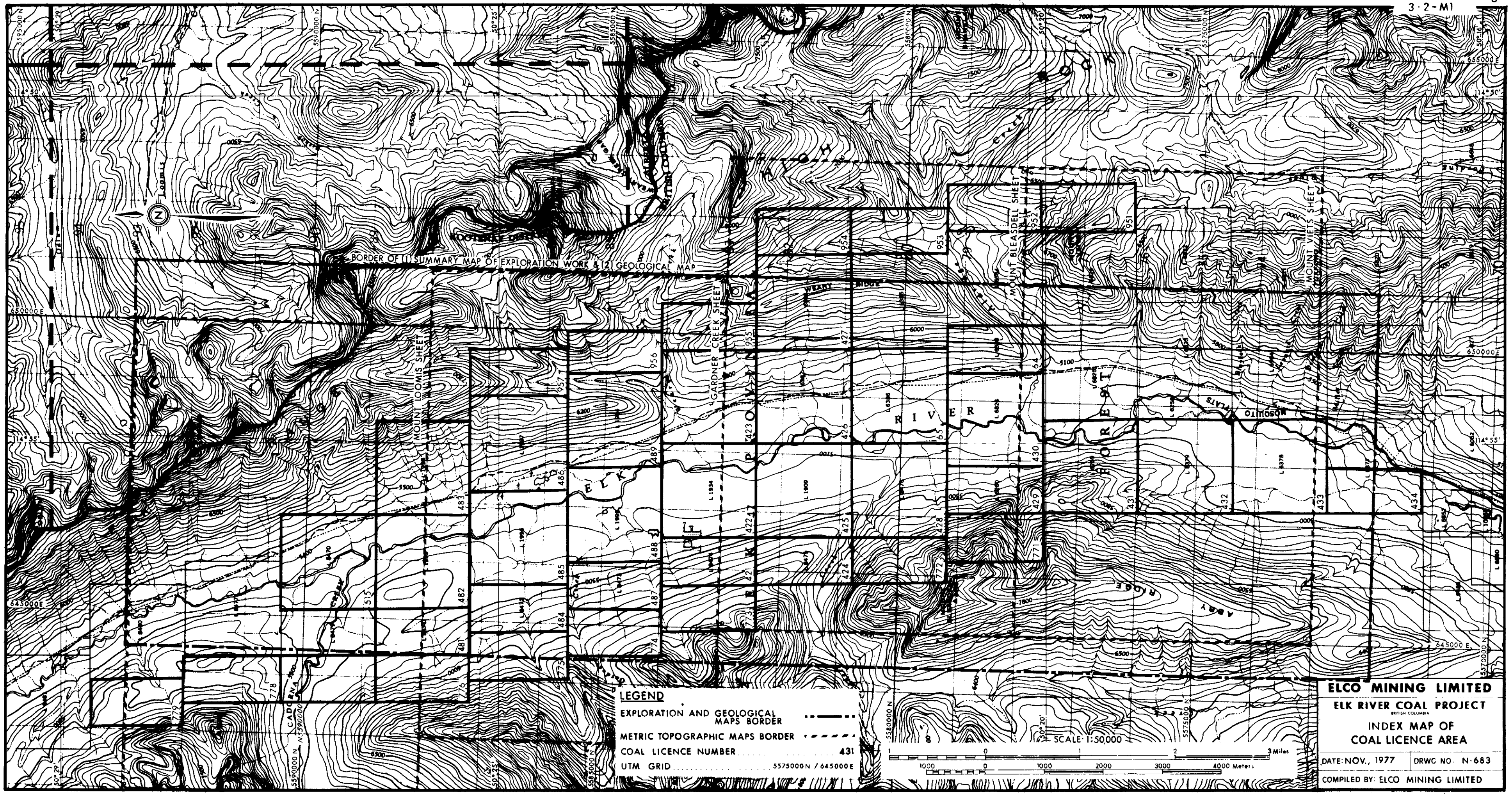
3.1 Terrain Description of Coal Licences Area

(Map 3.1-M1) Index Map of Coal Licence Area, 1:5000, page 8)

The projects coal licence area roughly covers the upper part of the Elk Valley between the confluences of Aldridge Creek and the Elk River in the south, and Cadorna Creek and the Elk River in the north. This represents a section of the Elk Valley approximately 12 km long and includes the eastern and western slopes of the valley which is approximately 1.8 km wide. The valley floor is situated at an elevation of 1,500 m on the southern end of the property and raises to 1,600 m approx. on its northern end.

This area of the valley is flanked on the east and west by ridges which range from 300 m to 650 m of relief above the valley floor and these in turn are flanked by two mountain chains with relief ranging from 2590 m to 2800 m above sea level.

This portion of the valley is a typical "U"-shaped glaciated valley which has had only minor subsequent river downcutting. The Elk River meanders within a flood plain of 100 m to 200 m wide and has incised itself approximately 10 - 20 m into glacial till and bedrock.


BORDER OF (1) SUMMARY MAP OF EXPLORATION WORK & (2) GEOLOGICAL MAP
MOUNT TOMIS SHEET
GARDNER CREEK SHEET
MOUNT BLEASDELL SHEET
MOUNT YIETS SHEET
ELK RIVER
PORTAGE
WEARY RIDGE
ABBY RIDGE
MOSQUITO FLATS
Grave Creek
Loomis
Kootenay Park
LEGEND
EXPLORATION AND GEOLOGICAL MAPS BORDER
METRIC TOPOGRAPHIC MAPS BORDER
COAL LICENCE NUMBER 431
UTM GRID 5575000N / 645000E
SCALE 1:50,000
3 Miles
4000 Meters
ELCO MINING LIMITED
ELK RIVER COAL PROJECT
BRITISH COLUMBIA
INDEX MAP OF
COAL LICENCE AREA
DATE: NOV., 1977
DRWG NO. N-683
COMPILED BY: ELCO MINING LIMITED

3.2 Surveying and Map Development

All work prior to 1976 was based on topographic maps which were developed from various stages of aerial photography. This mapping was controlled by a local grid system which covered the Fording Coal mining operation and had been extended to the Elk River Valley in the early 1970's.

In 1976 new aerial photography of the project area was flown. Horizontal and vertical ground control tying the local, existing grid system into the National UTM grid system was established as shown in Map A-II-6.2.2-M1.

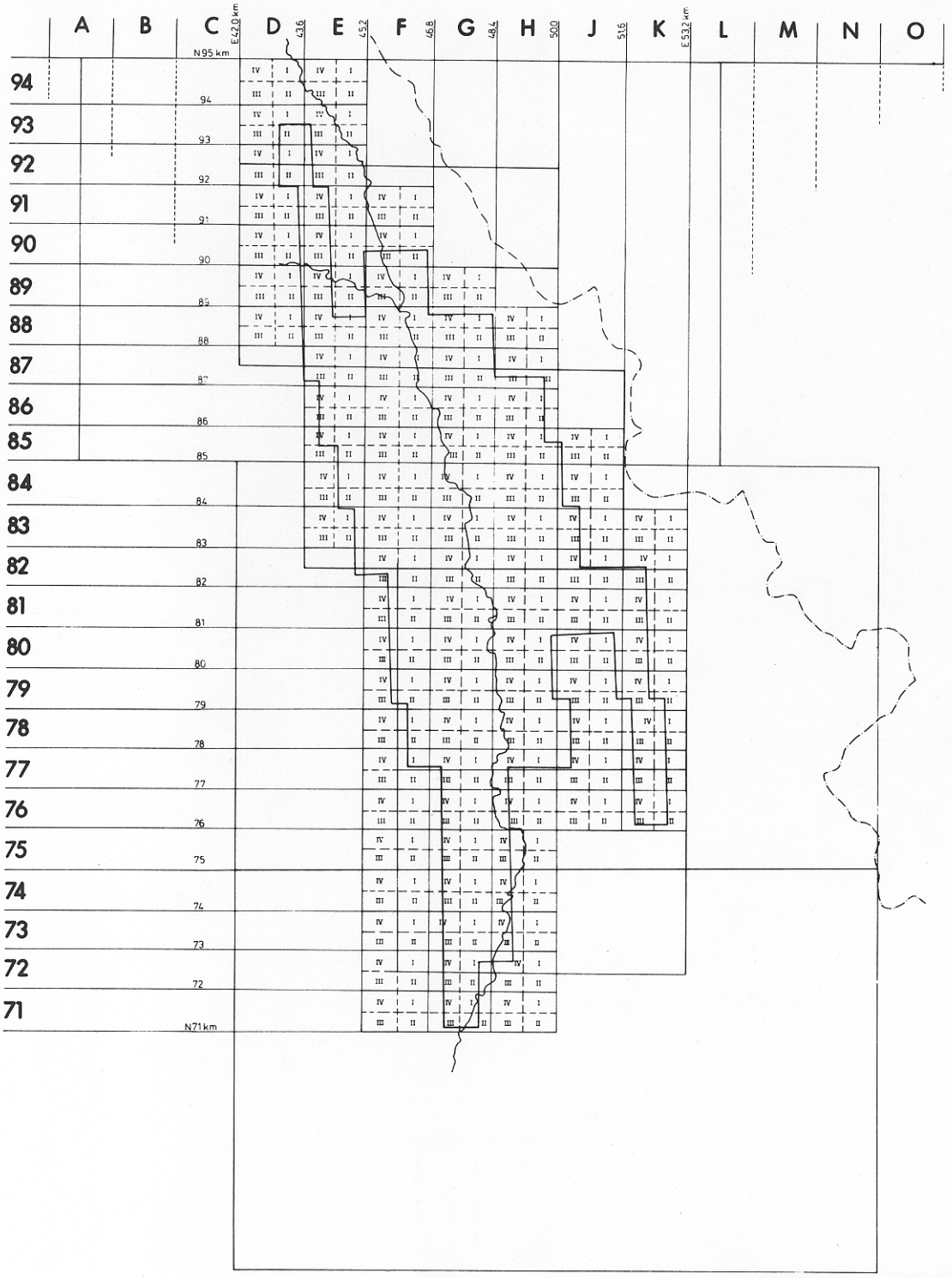
The aerial photographs were evaluated numerically, coded and recorded on magnetic tape.

The GEOMAP-80 SYSTEM, a computorized mapping system was used to produce new metric topographic base maps of the project area in 5 different scales.

Map II-6.2.2-M2, page 10, is the index for the new metric 1:1000 and 1:2000 topographic map series of ELCO'S Elk River valley coal licences. Map II-6.2.2-M3, page 11, is the index for the new metric 1:5000, 1:10,000 and 1:20,000 topographic map series of ELCO'S Elk River valley coal licences. Map A-II-6.2.2-M2, is the new metric 1:10,000 topographic map of ELCO'S Elk River Coal Licences.

For future assessment in the construction and mining operation phase this computor terrain model can be updated by aerial photography as well as terrestrial surveys when required.

All exploration work during the 1976/77 program was performed using location references according to the old base line system established for previous programs.



ELCO MINING LIMITED

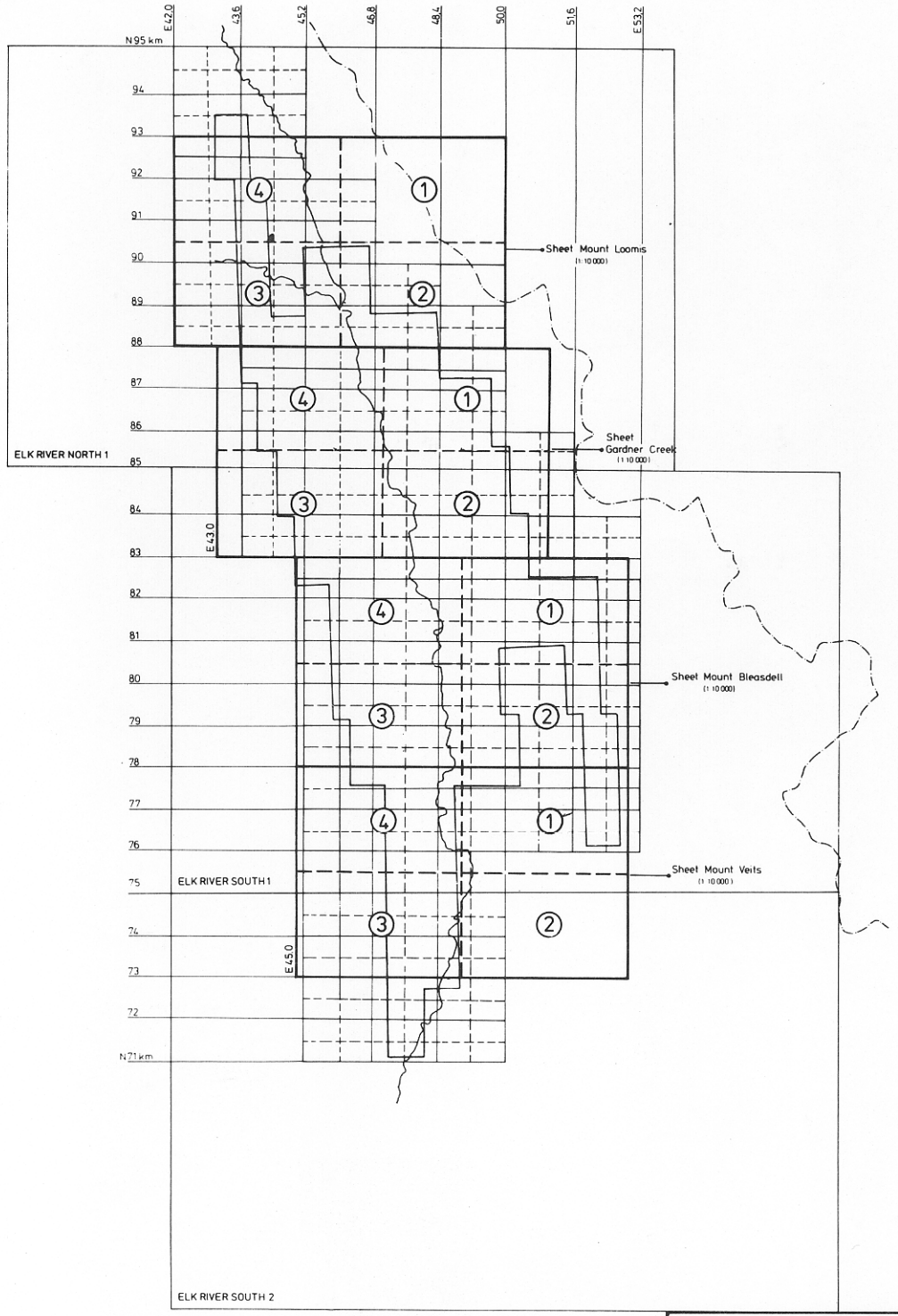
ELK RIVER COAL PROJECT
BRITISH COLUMBIA

TOPOGRAPHIC MAP INDEX
METRIC 1:1000 & 1:2000 SERIES

DATE: AUG., 1977	DRWG NO: L·357
COMPILED BY: ELCO MINING LIMITED	

Date: March 1977

Supplement:



ELCO MINING LIMITED

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

TOPOGRAPHIC MAP INDEX
METRIC 1:5000, 1:10,000 & 1:20,000 SERIES

DATE: AUG., 1977	DRWG NO: L·358
COMPILED BY: ELCO MINING LIMITED	

Date March 1977 / Revised April 1977 | Supplement

4. Geology

4.1 Stratigraphy of the Deposit

The project area is located within the Continental Ranges, specifically the Elk Range, of the Rocky Mountain Thrust Belt in the Cordilleran Geosyncline of Western Canada. The surrounding mountains were formed by the late Laramide orogeny which confined the mountains to the upper plate of the Lewis Thrust.

The List of Formations presented on page 13 as Figure II - 6.3.2 - F1 outlines the time-stratigraphic sequence of the formations encountered on the property. Descriptions of these formations and their members will be confined to the coal-bearing Kootenay Formation and its immediate stratigraphic neighbours, i.e. the Blairmore conglomerate above the Fernie shales below. These three formations form a sequence of lithologies which results from the change from a typical marine environment, in which the Fernie was deposited, through to the terrestial depositional environment of the lower Blairmore. The coal seams of the Kootenay were deposited in swampy, sometimes deltaic conditions during a period of cyclically emerging and receding coastlines between the marine and terrestial depositional periods.

The upper Jurassic Fernie Formation is, at least locally, a typical marine lithology which varies from paper-thin black and dark grey fissile shales to fairly massive grey near-slates. Thin beds of cherty conglomerate and quartzitic sandstones and siltstones are occasionally found but make up less than ten percent of the total sequence. The thickness of the formation varies from 150 m to 450 m with an average of 300 m.

TIME – STRATIGRAPHIC SEQUENCE

EON	ERA	SERIES	PERIOD	STAGE	FORMATION	AGE (M.Y.)
PHANEROZOIC	CENOZOIC	NEOGENE	QUATERNARY	RECENT	(ALLUVIUM)	
				PLEISTOCENE	(DRIFT)	1.5-2.0
	MESOZOIC		LOWER CRETACEOUS	ALBIAN	BLAIRMORE	105
				ALBIAN (?)	KOOTENAY	106
				APTIAN (?)		112
				BARREMIAN (?)		118
				HAUTERIVIAN		124
				VALANGINIAN		130
				BERRIASIAN		136
			UPPER JURASSIC	UPPER VOLGIAN-UPPER TITHONIAN		141
				LOWER VOLGIAN-PORTLANDIAN		146
				KIMMERIDGIAN		151
				OXFORDIAN	FERNIE	157
	PALEOZOIC	UNDIFFERENTIATED				

NOTE: (?) INDICATES THE STAGE MAY NOT BE PRESENT IN THE KOOTENAY FORMATION IN THE ELK VALLEY

ELCO MINING LIMITED

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

LIST OF FORMATIONS

DATE: SEPTEMBER, 1977 | DRWG NO: L-531

COMPILED BY: ELCO MINING LIMITED

The major coal-bearing formation of southeastern British Columbia is the Jurassic - Lower Cretaceous Kootenay Formation which, within the confines of the ELCO coal licenses, is more than 1000 meters thick. The basal unit is a light coloured, friable and poorly cemented sandstone known as the Moose Mountain Member. Above the basal sandstone is a series of interbedded sandstones, siltstones, shales, mudstones and coal seams, approximately 680 meters thick, which make up the main coal-producing sequence of the Kootenay Formation. The upper 400 meters of the Kootenay is mainly shales and thin coal seams, including several marine bands which are indicated by the fossil remains found. Coals in this part of the formation are generally more shaly than those in the lower part.

Overlying the Kootenay is the apparently conformable Blairmore, but the contact is, in fact, an erosional surface. The basal Blairmore is the Cadomin conglomerate, a widespread and easily recognized unit found throughout the Front Ranges of the Rocky Mountains. It is composed of medium to large quartz and chert pebbles in a sandy or silty matrix and averages 60 meters in thickness.

Figure II - 6.3.2 - F2 on page 15 summarizes the local stratigraphy in the project area in terms of lithology and thickness. Geological Map A - II - 6.3.2 - M2 shows the occurrance and outcrops of the local stratigraphy as described above.

4.1.1 Seam Stratigraphy

Any discussion of individual seam stratigraphy on the eastern flank must include some comments on seam correlation, a major problem in the upper stratigraphy of the Kootenay Formation. Such comments can be divided into two sections with the first dealing with the seams numbered 1 to 11, inclusive, and the second covering seams numbered 12 to 27, inclusive (counted from bottom to top).

SUMMARY OF LOCAL STRATIGRAPHY

FORMATION	MEMBER	THICKNESS	LITHOLOGY
BLAIRMORE (CRETACEOUS)	CADOMIN	50-90m. (165'-295')	QUARTZ AND CHERT PEBBLE CONGLOMERATE
~~	~~~~~~~~~~ Erosional Contact ~~~~~~~~~~		~~~~~~~~~~
KOOTENAY (CRETACEOUS - JURASSIC)	UPPER COAL - BEARING SEQUENCE	400m. (1,300')	INTERBEDDED MARINE SHALES, CONTINENTAL SANDSTONES AND THIN COAL SEAMS
	LOWER COAL - BEARING SEQUENCE	680m. (2,200')	COAL SEAMS WITH INTERBEDDED SANDSTONES, SILTSTONES, MUDSTONES, AND SHALES
	MOOSE MOUNTAIN	50-90m. (165'-295')	LIGHT COLOURED, MEDIUM GRAINED, POORLY CEMENTED SANDSTONES, BECOMING QUARTZITIC TOWARDS TOP
FERNIE (JURASSIC)		150-450m. (490'-1,475)	MARINE SHALES WITH MINOR SANDSTONES AND SILTSTONES

ELCO MINING LIMITED

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

SUMMARY OF LOCAL STATIGRAPHY

DATE: SEPTEMBER, 1977 | DRWG NO: L-532

COMPILED BY: ELCO MINING LIMITED

II-6-3-2-F2

The correlation of seams numbered 1 through 11 presents no difficulty. From the extreme south to the north end of the property these seams are continuous and consistent with only minor local variations in geometry. Geophysical log interpretation is both consistent and reliable as a correlation tool. Seam Nos. 1 and 5 do present an exception to the general nature of the lower seams in that they are not continuous from section to section throughout the property. For the most part, however, they are small and do not always constitute coal mining members. The upper seams, i.e. those numbered from 12 through 27, inclusive, and the many smaller unnumbered seams even higher in the stratigraphy, present a more difficult problem with regard to their correlation. Even the interpretation of geophysical logs is not a tool which can be used consistently for correlation purposes. For example, Seam No. 17, is, in actuality, a group of single seams which occupy a general stratigraphic interval in the Kootenay sequence. Constant revision of the upper seam stratigraphy and correlation will be required in the future as more information is obtained from drilling. trenching and/or actual mining.

Cross Sections A-4.1-F1 through F29 and Map A-II-6.3.2-M2 illustrate in detail the development of the various seams across the deposit.

A-4.1-Vol. I - VI 1976/77 Diamond and Rotary Borehole Lithology and Geophysical logs.

A brief descriptive outline of the important features of the seams and seam groups in the proposed open pit area is given in Table II-6.3.2-T3 on page 18. In summary, the total coal thickness considered mineable adds up to 90 meters and is distributed over a total of 35 individual mining members (seams & splits) separated by waste rock.

Although some individual intersections do exceed mineable thickness (0.6 m true thickness) the specific waste/coal ratio does not appear to be within allowable limits and all mining alternatives have excluded the coal above Seam No. 20 from the mineable reserves figures. However, the geological reserve figures shown in Section 5 include tonnages for Seams Nos. 21 and 24, inclusive.

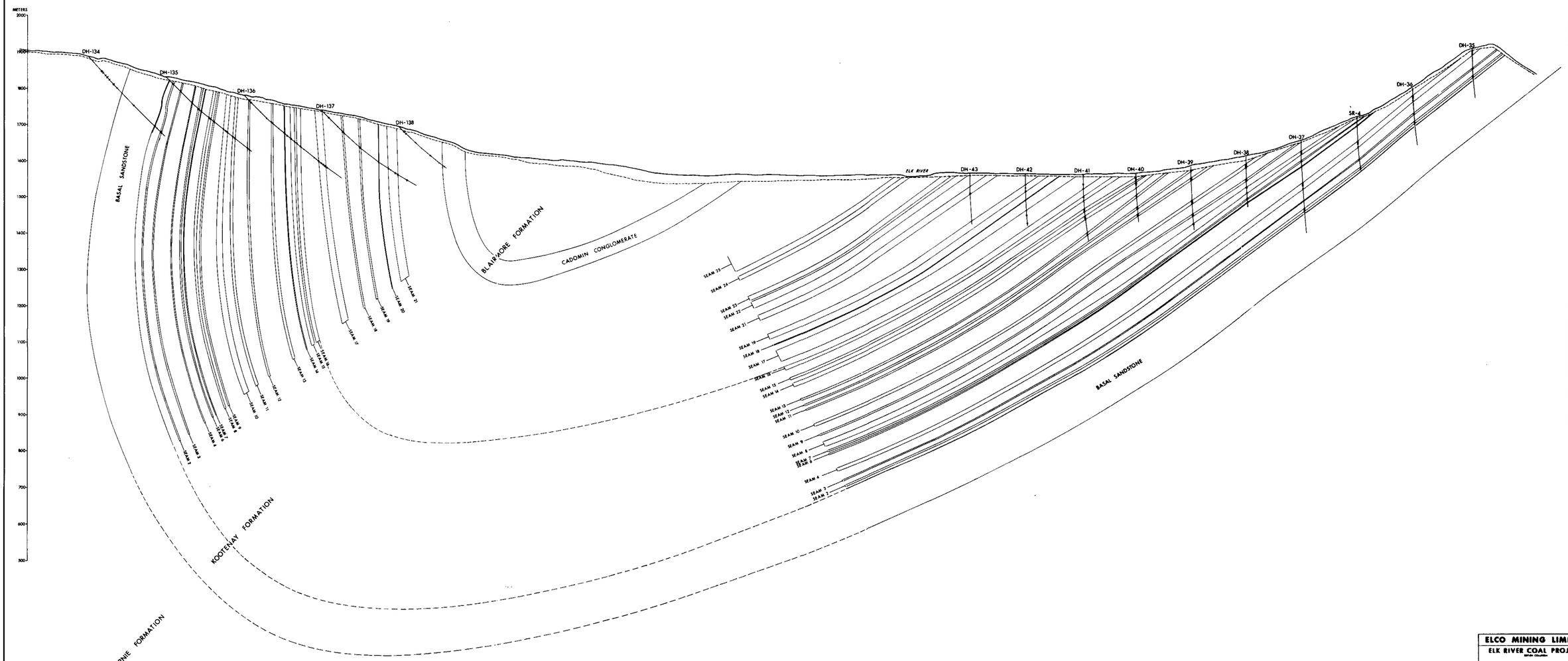
Correlation of seams on the western flank was accomplished by stratigraphic position only. The complete Kootenay section between the basal sandstone and the Cadomin conglomerate was drilled to their relative positions above the sandstone. Geophysical logs could not be used as an accurate seam identification method. Cross-Section 250+00 (Figure II-6.3.2-F4, page 19) is an idealized section across the Elk River valley and shows the assumed correlation.

TABLE II-6.3.2-T3

SUMMARY OF SEAM STRATIGRAPHY

SEAM No.	AVERAGE THICKNESS (M)	No. OF COAL SPLITS	MAX. SPLIT THICKNESS (M)	AVG. SPLIT THICKNESS (M)	ROCK INTERVAL (M)	DISTANCE ABOVE BASAL SANDSTONE	SEAM INTERVAL LITHOLOGY (%)			
							SS.	SLT.	SH	MS
27	8	1-8	1.4	1.0		985				
					20		55	45		
26	11	1-5	1.1	0.9		955				
					20		10	25	65	
25	60	1-6	1.5	1.0		875				
					18		60	40		
24	18	1-3	0.8	0.7		840				
					38		60	20	15	15
23	10	1-5	2.6	1.4		800				
					15		68	12	10	10
22	50	1-7	1.6	0.7		735				
					28		35	30	30	5
21	8	1-2	2.7	2.0		705				
					34		85	15		
20	21	1-5	3.5	1.4		650				
					15		37		63	
19	21	1-5	3.9	1.6		615				
					24		48		52	
18	23	1-4	5.4	2.2		570				
					25		86		14	
17	49	1-10	7.5	1.8		495				
					15		50	5	45	
16	32	1-4	3.8	1.5		445				
					30		52	18	30	
15	15	1-4	5.8	2.6		400				
					20		77		23	
14	20	1-5	5.8	1.8		360				
					18		50	21	29	
13	14	1-3	7.0	1.8		325				
					30		68		32	
12	12	1-2	5.5	2.6		280				
					20		63	7	30	
11	5.3	1-3	8.3	3.0		255				
					20		79	18	3	
10	9	1-3	8.4	5.3		225				
					40		81	9	10	
9	4.9	1-2	6.7	4.9		180				
					37		40	6	54	
8	8.3	2-3	5.8	3.2		137				
					20		45		55	
7	1.6	1-3	2.6	1.6		115				
					9		13		37	50
6	1.9	1-3	2.1	1.5		105				
					20		8	85	7	
5	2.3	1-2	1.7	1.1		85				
					20		80	10	10	
4	11.0	1-4	10.3	4.3		60				
					20		74	6	20	
3	2.3	1-4	2.3	2.3		39				
					20		73	13	14	
2	4.3	1-3	6.8	4.3		14				
					20		35		45	20
1	0.5	1-2	1.0	0.5		(-5.6)				

SS : SANDSTONE ; SLT : SILTSTONE ; SH : SHALE ; MS: MUDSTONE
ALL MEASUREMENTS ARE TRUE STRATIGRAPHIC THICKNESSES



ELCO MINING LIMITED

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

SECTION 250+00

DATE: AUGUST, 1977 | DRWG NO: P 433

COMPILED BY: ELCO MINING LIMITED

4.2 Structure

In general, the identifiable structure of the immediate project area consists of two distinct sections of dipping Kootenay Formation. On the eastern slopes of the Elk River valley one section consists of moderately dipping beds which form the main part of the proposed mine area. The beds dip westerly at an average of 40° and a fairly constant dip is maintained from south to north. On the west side of the valley the beds vary in dip from a normal 80° east to an overturned 95° with an average of approximately 90°. Figure II-6.3.2-F4, page 19, is a complete section across the valley and illustrates the expected nature of the fold beneath the valley floor.

The only faulting of major importance that is observed on the property is outside the mining area as presently envisaged. Within the mining area no faults are either observed or interpreted. However, it is likely that minor structural disturbances, particularly in the nature of low angle thrust faults along the coal seams, are fairly common. Major thrust faults are observed in the field south of Section 150+00 in the Big Weary Ridge area.

Inherent structural features of the Kootenay Formation are typical of those found in most sedimentary stratigraphies. Most sandstones show classic crossbedding and gradational grain size. Fracturing and jointing of the massive units are interpreted from both open and calcite-filled fissures. The shales show cleavages which are most predominate at approx. 45° to the bedding. Both the mudstones and siltstones, and in a few cases the sandstone, show thin slickensided, coal-filled shrinkage or dewatering cracks.

5. Coal Reserves

5.1 General, Definitions and Criteria

The various exploration states of the deposit from 1968 to 1977 resulted in a number of coal reserves calcualtions for different open pit areas under consideration at the time, as well as estimates of the total coal potential of the property.

Based on the previous and additional exploration work done in this (1976/77) stage of the project new coal reserves calculations were conducted with new parameters and within boundaries adjusted to the new requirements.

These comprise of the following "Coal Reserves in Place" (C.I.P.) for open cast methods:

- Baseline Stations 000+00 and 400+00,
- above an elevation of 1,356 m, equivalent to 215 m below the valley floor (on Station 250+00 with a gradient of 2/3% up and down the valley), and
- above Seam No. 2 to approx. Seam No. 22.

Coal in Place (C.I.P.) reserve calculations (eastern flank, between 400+00 and 160+00) of the 1976/77 Feasibility Study and this report were compiled with the assistance of geological computor programming (Table II-6.4.2-T7, page 28).

Geological information south of Baseline Station 160+00, however, has not yet been fed into the databank. Coal reserves assessments of this area are based on information obtained in the prefeasibility stage with the exception of Section 150+00 which has been drilled in detail in the scope of the latest exploration program. Coal reserves for this area were recalculated to include coal to elevation 1356 m (Tables II-6.4.2-T3 through T6, pages 29 through 32).

Open Cast reserves (C.I.P.) on the western flank were assessed by conventional means on the basis of cross section 250+00 (A-4.1-F11).

Within these open cast coal reserves (C.I.P.) the "Mineable Coal Reserves" (R.O.M. = Run of Mine reserves) have been blocked out as per mining plan and final pit limits (Alternative "D").

For all coal reserve figures, the same definitions were used as applicable in the United States of America (Averitt, 1969) and introduced into Canada by B.A. Latour and L.P. Christmas in 1970.

The following principal definitions, terms, parameters and methods were applied in all 1977 open pit reserve computations (See Figure II - 6.4.1 - F2, page 23 and Table II - 6.4.1 - T1, page 24):

(a) Oxidation Level = 4.6 m from surface, restricted to areas with till cover less than 4.6 m only
Oxidized Coal = above oxidation level
Unoxidized Coal = below oxidation level

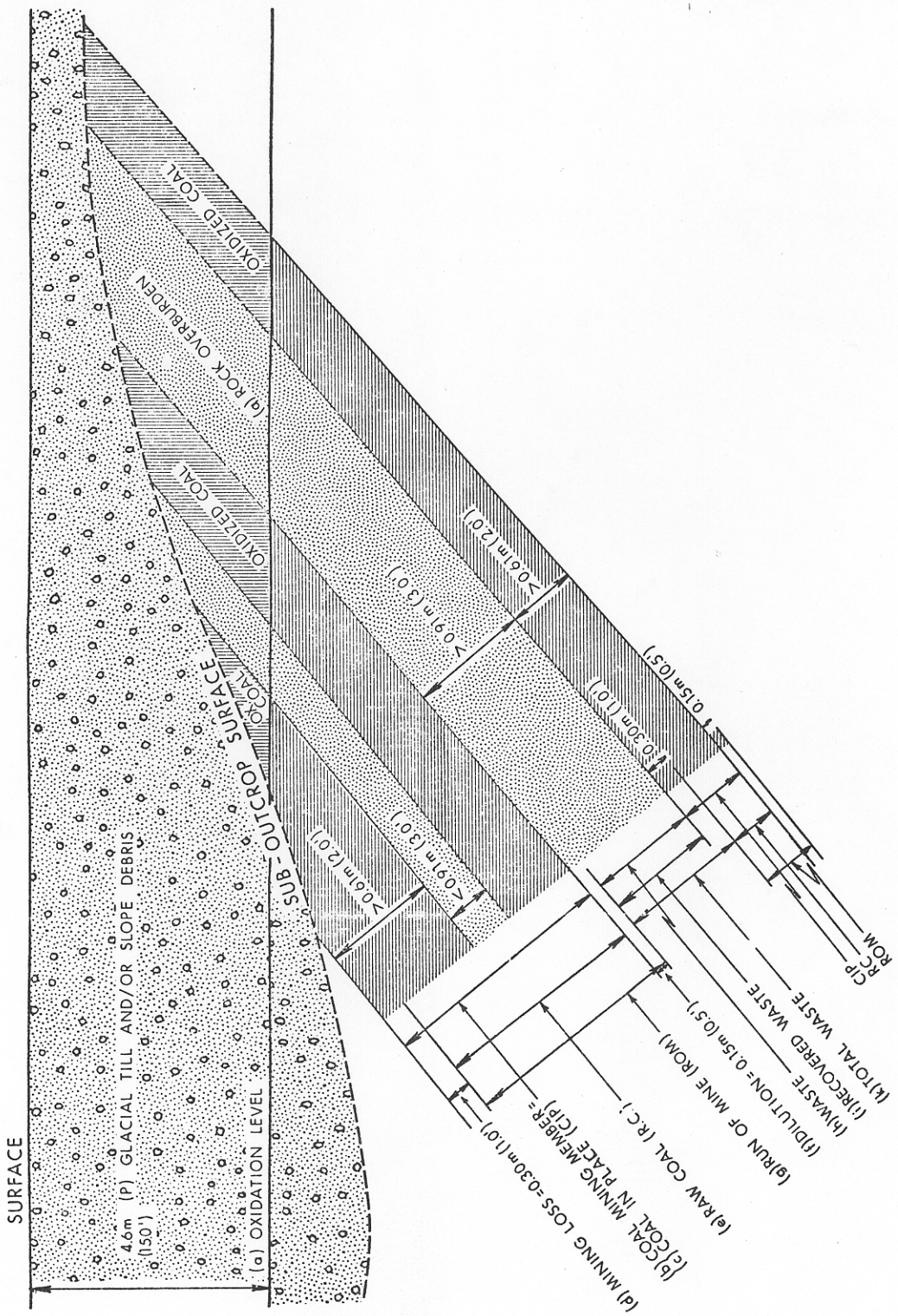
(b) Coal Mining Member = one or more coal splits or seams of more than 0.6 m true thickness each, separated by one or more rock partings of less than 0.9 m true thickness each, identical with "Coal in Place/C.I.P.)".

(d) Mining Loss = 0.3 m of coal at the hanging wall of each coal mining member

(e) Raw Coal (R.C.) = Coal in Place (b) minus Mining Loss (d).

(f) Dilution = 0.15 m of rock from the footwall

(g) Run of Mine Coal (R.O.M.) = Coal in Place (CIP) minus Mining Loss plus Dilition (b-d+f).



ELCO MINING LIMITED	
ELK RIVER COAL PROJECT BRITISH COLUMBIA	
DIAGRAM OF TERMS AND CRITERIA FOR RESERVES CALCULATIONS	
DATE: Oct., 1977	DRWG NO: L 562
COMPILED BY: ELCO MINING LIMITED	

TABLE: II-6.4.1-T1

SPECIFIC GRAVITIES USED IN

COAL RESERVES CALCULATIONS & MINE PLANNING

CATEGORY	IN PLACE	SWELL FACTOR	LOOSE
Coal in Place	1.35 t/bm^3	0.65	0.88 t/bm^3
Rock	2.50 "	"	1.62 "
Dilution Rock	2.34 "	"	1.52 "
Run of Mine	1.43 "	"	0.93 "

(h) Waste = Rock thicker than 0.9 m between two Coal Mining Members

(i) Recovered Waste = Waste minus Dilution (h-f)

(k) Total Waste = Waste minus Dilution plus Mining Loss (h-f+d)

(p) Overburden = Glacial Till and Slope Debris

For the purpose of estimating coal reserves mineable by any underground method and located below the level of reserves mineable by open cast methods (below 1.356 m a.s.l.) a true minimum coal split thickness of 1.0 meter was applied. Underground coal reserves were estimated between Baseline Stations:

- 0+00 and 430+00 on the east flank and
- 0+00 and 400+00 on the west flank

and based on Cross-Section 250+00 (see Figure II-5.3.2-F4 on page 19).

5.2 Overall Coal Potential (CIP)

Table II-6.4.2-T2, page 27 summarizes the geological reserves of the overall coal potential of the property according to locations, classification and parameters as outlined above.

In summary, the total coal potential (CIP) including proven, indicated and inferred reserves totals

4,513.31 million tonnes

This represents an increase of approximately 109%, relative to the last estimate completed by SCURRY/EMKAY in 1971.

In considering the total geological in-place reserves it must be noted that there is a significant change in coal quality from the east to the western flank of the syncline as indicated by the drilling on Cross-Section 250+00. The coal intersected on the western flank was placed in a lower rank classification and, therefore, cannot as yet be categorized as metallurgical coal.

Therefore, the reserve figures shown in Table II-6.4.2-T2, page 26 are preliminarily divided into coking and non-coking reserves as follows:

Type of Coal	Location	Coal in Place (CIP) (in 1000's) tonnes	Mining Method
Coking Coal:	East Flank - 215m below valley floor	562,786	Open cast
	East Flank - 215m below valley floor	1,904,000	Underground
	TOTAL	2,466,786	
Bituminous Coal assessed as Non-Coking":	West Flank - 215m below valley floor	275,524	Open cast
	West Flank - 215m below valley floor	1,771,000	Underground
	TOTAL	2,046,524	
	GRAND TOTAL	4,513,310	

TABLE II - 6.4.2 - T2

GEOLOGICAL RESERVES
(in 1,000's)

LOCATION	CATEGORY	COAL IN PLACE	WASTE	RATIO
POTENTIAL OPEN PIT COAL (above pit bottom at 215m = 700')				
EAST FLANK				
400+00 to 160+00	Proven	343,236 t (378,353 st)	2,045,742 bm^3 (2,675,730 byd^3)	5.78 bm^3/t (6.86 byd^3/st)
160+00 to 100+00	Proven	132,460 t (146,015 st)	704,990 bm^3 (922,095 byd^3)	5.32 bm^3/t (6.32 byd^3/st)
100+00 to 000+00	Indicated	87,090 t (96,000 st)	*not assessed as yet*	
SUBTOTAL		562,786 t (620,368 st)	-- --	-- --
WEST FLANK 223+60 to 276+40	Proven	33,484 t (36,912 st)	243,890 bm^3 (319,000 byd^3)	7.28 bm^3/t (8.64 byd^3/st)
within 000+00 to 400+00	Inferred	242,040 t (266,800 st)	*not assessed as yet*	
SUBTOTAL		275,524 t (303,712 st)	-- --	-- --
POTENTIAL UNDERGROUND COAL				
400+00 to 000+00 (below pit bottom at 215m = 700')	Inferred	3,542,000 t (3,904,000 st)	--	--
430+00 to 400+00 (East Flank only)	Inferred	133,000 t (146,000 st)	--	--
SUBTOTAL	Inferred	3,675,000 t (4,050,000 st)	--	--
GRAND TOTAL	All Categories	4,513,310 t (4,974,080 st)		

A detailed break down of the CIP reserves by seams and within the area of mine plan Alternative "D" (block 160+00 to 400+00) is given on Table II-6.4.2-T7, page 28. Additional "backup" information is provided in tables A-II-6.4.2-T3 through T6, pages 29 through 32.

TABLE A - II - 6.4.2 - T7

GEOLOGICAL RESERVES/SUMMARY OF COAL AND WASTE CALCULATION (Source: Databank, Nov. 11, 1977)
(m^3 and t in 1000's)

SECTION 160+00 to 400+00

SEAM NO.	AVERAGE TRUE THICKNESS (m)	COAL IN PLACE (C.I.P.) (m^3)	COAL IN PLACE (C.I.P.) (t)	MINING LOSS (m^3)	MINING LOSS (t)	RECOVERED RAW COAL (t)	DILUTION ROCK (m^3)	DILUTION ROCK (t)	R.O.M. = REC.RAW COAL + DIL.ROCK	WASTE (IN PLACE) (m^3)	OXIDIZED RAW COAL m^3	OXIDIZED RAW COAL t	REC.WASTE = WASTE I.P. - DILUTION ROCK m^3	TOT.WASTE = REC.WASTE + Ox. R.C. + MIN.LOSS m^3	RATIO WASTE/ROM m^3/t	SEAM NO.
1	1.43	486.8	679.0	101.9	143.2	535.8	51.2	130.5	666.4	40,854.0	6.8	9.5	40,802.8	40,929.6	61.42	1
2	4.51	15,398.6	23,595.3	1,193.5	1,865.4	21,729.8	602.2	1,488.6	23,218.5	68,325.2	529.2	788.8	67,723.0	69,446.1	2.99	2
3	2.34	7,703.1	11,676.6	1,034.2	1,577.6	11,398.2	518.7	1,299.1	11,398.2	66,422.8	291.1	416.9	65,904.1	67,229.4	5.90	3
4	8.50	27,370.4	42,896.0	2,056.2	3,252.0	39,644.0	1,033.4	2,558.4	42,202.4	119,912.0	698.3	1,108.3	118,878.6	121,633.2	2.88	4
5	0.96	1,295.1	1,942.8	404.1	604.2	1,338.5	202.3	506.6	1,845.2	24,046.1	24.8	36.7	23,843.8	24,272.7	13.15	5
6	1.85	4,778.2	7,730.6	1,007.0	1,608.4	6,122.1	504.5	1,133.6	7,255.8	50,568.6	59.4	92.3	50,064.1	51,130.6	7.05	6
7	2.16	5,202.3	8,245.2	720.7	1,147.8	7,097.3	361.5	908.5	8,005.8	37,952.8	53.8	87.5	37,591.3	38,365.8	4.79	7
8	5.98	17,581.8	26,830.2	1,598.8	2,422.4	24,407.8	802.8	1,978.4	26,386.2	86,605.9	169.8	250.3	85,803.1	87,570.9	3.32	8
9	4.83	13,283.8	20,800.9	892.4	1,397.1	19,403.7	448.7	1,104.0	20,507.8	71,728.4	174.0	265.2	71,279.7	72.346.2	3.53	9
10	7.34	18,765.9	28,584.9	1,170.4	1,796.8	26,788.0	589.6	1,472.0	28,260.1	86,329.5	111.9	172.0	85,739.9	87,022.4	3.08	10
11	5.84	14,876.8	24,472.3	936.0	1,547.0	22,925.3	469.4	1,142.5	24,067.9	39,487.7	199.8	348.6	39,018.3	40,154.2	1.67	11
12	5.09	12,489.1	20,434.8	1,415.4	2,282.0	18,152.7	708.7	1,775.2	19,927.9	62,239.6	99.4	158.9	61,530.9	63,045.8	3.16	12
13	3.90	9,706.3	15,457.6	1,354.6	2,157.6	13,299.9	678.1	1,688.5	14,988.5	56,875.0	136.2	218.4	56,196.9	57,687.8	3.85	13
14	4.50	9,952.6	16,035.6	1,542.8	2,468.5	13,567.1	772.8	1,921.7	15,488.8	58,003.9	146.0	237.8	57,231.1	58,560.1	3.78	14
15	4.57	10,049.6	16,407.4	1,036.7	1,688.8	14,718.5	518.6	1,274.5	15,993.1	82,158.5	96.9	156.2	81,639.9	82,764.7	5.18	15
16	3.27	7,726.4	12,110.0	1,045.7	1,624.7	10,485.2	523.4	1,297.6	11,782.8	68,561.4	34.0	57.1	68,038.0	69,117.8	5.87	16
17	4.38	11,186.2	17,148.3	1,606.0	2,505.7	14,642.5	803.9	2,010.6	16,653.2	127,778.7	112.4	172.3	126,978.8	128,697.4	7.73	17
18	4.12	9,617.6	14,533.6	1,367.4	2,094.2	12,439.3	684.4	1,710.1	14,149.4	88,277.2	60.0	92.0	87,592.8	89,020.3	6.29	18
19	2.53	5,321.2	8,829.7	1,193.9	1,919.4	6,910.2	596.8	1,498.9	8,409.1	87,866.1	44.5	73.9	87,269.3	88,507.8	10.53	19
20	2.75	6,380.0	10,573.0	1,336.0	2,175.2	8,397.7	668.5	1,667.2	10,064.9	127,730.8	25.6	40.5	127,062.3	128,424.1	12.76	20
21	2.22	4,148.5	6,781.3	848.6	1,374.3	5,407.0	425.8	1,066.2	6,473.2	75,812.7	20.2	32.6	75,386.9	76,255.8	11.78	21
22	2.53	3,056.7	5,172.0	891.2	1,512.7	3,659.2	447.7	1,130.8	4,790.1	85,598.0	24.2	40.6	85,150.3	86,065.8	17.97	22
23	1.59	678.3	1,196.4	188.3	330.4	866.0	95.0	237.4	1,103.4	53,518.5	6.9	12.5	53,423.5	53,616.8	48.59	23
24	1.34	615.7	1,101.3	158.6	282.5	818.8	80.1	201.1	1,019.9	76,380.1	13.1	23.4	76,300.0	76,741.8	74.98	24
							Wedge Within 45° Slopes:			180,609.8 (Waste)			180,609.8 (Waste)	180,609.8 (Waste)		
							Overburden:			106,441.6 (Till)			106,441.6 (Till)	106,441.6 (Till)		
1-24	88.97	217,672.3	343,235.9	25,100.7	39,779.3	303,456.5	12,589.1	31,203.2	334,659.6	2,030,090.9	3,139.5	4,893.2	2,017,501.8	2,045,742.2	6.1 m^3/t (15.4 t/t)	1-24

A II - 6.4.2 - T3 - GEOLOGICAL RESERVES

SUMMARY OF COAL AND WASTE CALCULATION

SECTION 110+00

SEAM NO.	AVERAGE TRUE THICKNESS (FT)	BELOW OXIDATION LEVEL: COAL IN PLACE (CIP) (BYD³)	(ST)	MINING LOSS (BYD³)	(ST)	RAW COAL RECOVERED (ST)	DILUTION (BYD³)	(ST)	R.O.M. COAL = RAW COAL + DILUTION (ST)	WASTE (in place) (BYD³)	REC. WASTE = WASTE + DILUTION (BYD³)	TOTAL WASTE = REC. WASTE + MIN.LOSS (BYD³)
2	11.8	4634651	5654274	784111	956615	4697659	392055	827236	5524895			
3	4.8	1879319	2292769	394815	481674	1811095	147408	311031	2122126	10775023	10382968	11167079
4	6.4	2522157	3077032	394704	481539	2595493	147352	310913	2906406	35798036	35650628	36045443
6	11.5	3283181	4005480	286741	349824	3655656	143371	302513	3958169	55435124	55287772	55682476
7	11.6	3222459	3931400	278519	339793	3591607	139259	293836	3885443	12488520	12345149	12631890
8	19.1	4885353	5960131	482815	589034	5371097	241408	509371	5880468	16289597	16150338	16428857
9	13.6	2793756	3408382	387408	472638	2935744	193704	408715	3344459	30181915	29940507	30423322
10	13.3	4683177	5713476	241741	294924	5418552	120871	255038	5673590	23459018	23265314	23652722
12	5.6	1872830	2284853	239000	291580	1993273	119501	252147	2245420	26442902	26322031	26563772
13	14.3	2910540	3550859	608704	742619	2808240	304353	642185	3450425	34543321	34423820	34662820
14	16.9	2990828	3648810	502592	613162	3035648	251296	530235	3565883	26922764	26618411	27227115
15	15.4	2771517	3381251	179852	219419	3161832	89926	189744	3351576			
16	4.8	761600	929152	160000	195200	733952	80000	168800	902752	8210548	7869326	8551770
17	18.8	2417511	2949363	380852	464639	2484724	190428	401803	2886527	17187663	17107663	17267663
18	16.5	1827778	2229889	111111	135555	2094334	55556	117223	2211557	4507144	4316716	4697568
										45219815	45164259	45275370
		43456657	53017121	5432965	6628215	46388906	2616488	5520790	51909696	347461390	344844902	350277867

SEAM NO.	ABOVE OXIDATION LEVEL: OXIDIZED RAW COAL (ST)	MINING LOSS (BYD³)	(ST)	OXIDIZED RAW COAL RECOVERED (ST)	DILUTION ROCK (BYD³)	(ST)	OXIDIZED R.O.M. COAL = OX. R.C. REC. + DIL. RK. (ST)	GLACIAL TILL + SLOPE DEBRIS (BYD²)	ROCK OB (BYD³)	REC. OB = OB LESS DIL. (BYD³)	T. OB = REC. OB + MNG.LOSS (BYD³)	SEAM NO.
2	33566	4629	5647	27919	2315	4885	32804					2
3	15486	2667	3254	12232	1333	2813	15045		66882	64567	69196	3
4	46775	6000	7320	39455	3000	6330	45785		346889	345556	348223	4
6	264894	18962	23134	241760	9481	20005	261765		3706741	3703741	3709741	6
7	151610	10740	13103	138507	5370	11331	149838		543927	534446	553408	7
8	104508	4926	6010	98498	2463	5197	103695		474222	468852	479592	8
9	33440	3518	4292	29148	1759	3711	32859		1063556	1061093	1066019	9
10	250019	10740	13103	236916	5370	11331	248247		301563	299804	303322	10
12	47380	15110	18434	28946	7556	15943	44889		897222	891852	902592	12
13	184382	13406	16355	168027	6703	14143	182170		1023333	1015777	1030887	13
14	158657	21702	26476	132181	10852	22898	155079		694277	687574	700980	14
15	177558	9444	11522	166036	4722	9963	175999		541111	530259	551961	15
16	81731	14073	17170	64561	7037	14848	79409		602185	597463	606907	16
17									793333	786296	800369	17
18												18
	1550006	135917	165820	1384186	67961	143398	1527584	18994000	11055241	10987280	11123197	

A II - 6.4.2 - T4 - GEOLOGICAL RESERVES

SUMMARY OF COAL AND WASTE CALCULATION

SECTION 130+00																							
		BELOW OXIDATION LEVEL										BELOW OXIDATION LEVEL			ABOVE OXIDATION LEVEL								ABOVE OXIDATION LEVEL				
SEAM NO.	AVERAGE TRUE THICKNESS (FT)	COAL IN PLACE (CIP)		MINING LOSS		RAW COAL RECOVERED (ST)	DILUTION		R.O.M. COAL = RAW COAL + DILUTION (ST)	WASTE (in place)	REC. WASTE = WASTE - DILUTION	TOTAL WASTE = REC. WASTE + MIN.LOSS	SEAM NO.	OXIDIZED RAW COAL (ST)	MINING LOSS		OXIDIZED RAW COAL RECOVERED (ST)	DILUTION ROCK		OXIDIZED R.O.M. COAL = OX. R.C. REC. + DIL. RK. (ST)	GLACIAL TILL + SLOPE DEBRIS	ROCK OB	REC. OB = OB LESS DIL.	T. OB = REC. OB + MNG.LOSS	SEAM NO.
		(BYD^3)	(ST)	(BYD^3)	(ST)	(ST)	(BYD^3)	(ST)	(ST)	(BYD^3)	(BYD^3)	(BYD^3)		(ST)	(BYD^3)	(ST)	(ST)	(BYD^3)	(ST)	(ST)	(BYD^3)	(BYD^3)	(BYD^3)	(BYD^3)	
2	14.8	4443256	5420772	299815	365774	5054998	149908	316306	5371304				2	79526	2963	3615	75911	1482	3127	79038					2
4	11.3	3335593	4069423	295185	360126	3709297	147593	311421	4020718	18424634	18274726	18574541	4	32985	3704	4518	28467	3704	7815	36282		133333	131851	134814	4
6	6.1	1363357	1663296	222407	271337	1391959	111203	234638	1626597	20712709	20565116	20860301	6									554074	550370	554074	6
7	6.7	1265622	1544059	187778	229089	1314970	93889	198106	1513076	21983325	21872122	22094529	7												7
8	29.9	5445190	6643132	182296	222401	6420731	91148	192322	6613053	9335601	9241712	9429490	8												6
9	12.3	2772420	3382352	216296	263881	3118471	108148	228192	3346663	20580896	20489748	20672044	9	35733	2222	2711	33022	1111	2344	35366		80741	80741	80741	9
10	25.1	6896025	8413151	797814	973333	7439818	398956	841797	8281615	24694538	24586390	24802686	10	99663	6444	7862	91801	3223	6801	98602		167407	166296	168518	10
12	31.8	8884348	10838905	971075	1184712	9654193	485539	1024487	10678680	28722602	28323646	29121460	12	337324	30368	37048	300276	15185	32040	332316		861111	857888	864332	12
13	18.4	3143894	3835551	521407	636117	3199434	260708	550094	3749528	44781239	44295700	45266775	13	195689	25443	31028	164661	12722	26843	191504		1977777	1962592	1992960	13
14	7.7	872389	1064315	113889	138945	925370	56945	120154	1045524	4471211	4210503	4731910	14	55379	5926	7230	48149	2963	6252	54401		196444	183722	209165	14
15	14.6	1478711	1804027	101630	123989	1680038	50815	107220	1787258	10045073	9988128	10102017	15	82181	4629	5647	76534	2315	4885	81419		650370	647407	653333	15
16	11.7	1190002	1451802	279927	341511	1110291	139964	295324	1405615	12749883	12699068	12800698	16	32812	6110	7454	25358	3056	6448	31806		453889	451574	456203	16
17	16.7	1605531	1958748	261334	318827	1639921	130668	275709	1915630	13145343	13005379	13285306	17									100000	96944	103054	17
18	17.6	1502268	1832767	85259	104016	1728751	42679	90053	1818804	2869875	2739207	3000541	18												
										27482822	27440143	27525402													
		44198606	53922300	4536112	5534058	48388242	2268163	4785823	53174065	259999751	257731588	262267700		951292	87809	107113	844179	45761	96555	940735	19842038	5175146	5129385	5217194	

A II - 6.4.2 - T5 - GEOLOGICAL RESERVES

SUMMARY OF COAL AND WASTE CALCULATION

SECTION 150+00

SEAM NO.	AVERAGE TRUE THICKNESS (FT)	BELOW OXIDATION LEVEL: COAL IN PLACE (CIP) (BYD³)	(ST)	MINING LOSS (BYD³)	(ST)	RAW COAL RECOVERED (ST)	DILUTION (BYD³)	(ST)	R.O.M. COAL = RAW COAL + DILUTION (ST)	WASTE (in place) (BYD³)	REC. WASTE = WASTE - DILUTION (BYD³)	TOTAL WASTE = REC. WASTE + MIN.LOSS (BYD³)
2	10.1	1838074	2242450	171852	209659	2032791	85926	181304	2214095			
3	5.2	506548	617988	96370	117571	500417	48185	101670	602087	9967741	9881815	10053667
4	10.6	1699363	2073223	171740	209523	1863700	85870	181186	2044886	13046889	12998704	13095074
6	5.6	970263	1183721	156222	190591	993130	78111	164814	1157944	17814267	17728397	17900137
7	4.8	581133	708982	118704	144819	564163	59352	125233	689396	7788463	7710352	7866574
8	23.0	3033712	3701129	229630	280149	3420980	121018	255348	3676328	6382100	6322748	6441452
9	19.1	2808716	3426634	319148	389361	3037273	159574	336701	3373974	15599019	15478001	15707631
10	35.9	4697645	5731127	928472	1132735	4598392	269556	568763	5167155	13370069	13210495	13529643
11	11.3	1705634	2080873	142593	173963	1906910	71296	150435	2057345	21176670	20907114	21835586
12	18.2	1898992	2316770	206078	251415	2065355	119037	251168	2316523	7211186	7139890	7282483
13	21.0	1749798	2134754	230148	280781	1853973	115074	242806	2096779	6663967	6544930	6751008
14	8.5	949357	1158435	106482	129908	1028527	53241	112339	1140866	10847548	10732474	10962622
15	16.6	1523054	1858126	157630	192309	1665817	78815	166300	1832117	5233538	5180297	5286779
16	20.7	2075359	2531938	132074	161130	2370808	66037	139338	2510146	11737056	11658241	11815871
17	20.1	1953214	2382921	382741	466944	1915977	191369	403789	2319766	15267681	15201644	15333718
18	28.7	3021276	3685957	426706	520581	3165376	213353	450175	3615551	17309111	17117742	17500483
19	6.3	409424	499497	140444	171342	328155	70223	148171	476326	19569396	19356043	19782749
20	7.1	607415	741046	124000	151280	589766	62000	130820	720586	9981495	9911272	10051716
TOTAL ALL SEAMS	15.2	32028977	39075571	4241034	5174061	33901510	1948037	4110360	38011870	17139926 226106122	17077926 224158085	17201926 228399119

SEAM NO.	ABOVE OXIDATION LEVEL: OXIDIZED RAW COAL (ST)	MINING LOSS (BYD³)	(ST)	OXIDIZED RAW COAL RECOVERED (ST)	DILUTION ROCK (BYD³)	(ST)	OXIDIZED R.O.M. COAL = OX. R.C. REC. + DIL. RK. (ST)	GLACIAL TILL + SLOPE DEBRIS (BYD³)	ROCK OB (BYD³)	REC. OB = OB LESS DIL. (BYD³)	T. OB = REC. OB + MNG.LOSS (BYD³)	SEAM NO.
2	62356	5556	6778	55578	2778	5862	61440		395111	392333	397889	2
3	38172	4889	5965	32207	2444	5157	37364		162370	159926	164815	3
4	53355	5333	6506	46849	2667	5627	52476		654556	651889	657222	4
6	111232	8852	10799	100433	4426	9339	109772		581259	576833	585685	6
7												7
8												8
9												9
10												10
11												11
12	246250	22519	27473	218777	11259	23756	242533		339185	327926	350445	12
13	51186	4370	5331	45855	2185	4610	50465		296296	294111	298481	13
14	50860	3111	3795	47065	1556	3283	50348		94815	93259	96370	14
15	116638	7889	9625	107013	3944	8322	115335		498814	494870	502759	15
16	178409	10333	12606	165803	5167	10902	176705		292593	287426	297759	16
17	87420	14111	17215	70205	7056	14888	85093		589630	582574	596685	17
18	115276	12556	15318	99958	6278	13247	113205		818852	812574	825130	18
19	59089	10889	13285	45804	5444	11487	57291		834000	828556	839445	19
20	24807	4444	5422	19385	2222	4688	24073		353333	351111	355555	20
	1195050	114852	140118	1054932	57426	121168	1176100	16361482	5910814	5853388	5968240	

A II - 6.4.2 - T6 - GEOLOGICAL RESERVES

SUMMARY OF COAL AND WASTE CALCULATION

SECTION 100+00 to 160+00				BELOW OXIDATION LEVEL									ABOVE OXIDATION LEVEL										ABOVE OXIDATION LEVEL	
SEAM NO.	AVERAGE TRUE THICKNESS (FT)	COAL IN PLACE (CIP)		MINING LOSS		RAW COAL RECOVERED (ST)	DILUTION		R.O.M. COAL = RAW COAL + DILUTION (ST)	WASTE (in place) (BYD^3)	REC.WASTE = WASTE + DILUTION (BYD^3)	TOTAL WASTE = REC. WASTE + MIN.LOSS (BYD^3)	SEAM NO.	OXIDIZED RAW COAL (ST)	MINING LOSS		OXIDIZED RAW COAL RECOVERED (ST)	DILUTION ROCK		OXIDIZED R.O.M. COAL = OX. R.C. REC. + DIL. RK. (ST)	GLACIAL TILL + SLOPE DEBRIS (BYD^3)	ROCK OB (BYD^3)	REC. OB = OB LESS DIL. (BYD^3)	T. OB = REC. OB + MNG.LOSS (BYD^3)	SEAM NO.
		(BYD^3)	(ST)	(BYD^3)	(ST)		(BYD^3)	(ST)							(BYD^3)	(ST)		(BYD^3)	(ST)						
2	12.2		13317496			11785448			13110294				2	175448			159408			173282					2
3	5.0		2910757			2311512			2724213				3	53658			44439			52409					3
4	9.4		9219678			8168490			8972010				4	133115			114771			134543					4
6	7.7		6852497			6040745			6742710				6	376126			342193			371537					6
7	7.7		6184441			5470740			6087915				7	151610			138507			149838					7
8	24.0		16304392			15212808			16169849				8	104508			98498			103695					8
9	15.0		10217368			9091488			10065096				9	69173			62170			68225					9
10	24.8		19857754			17456762			19122360				10	349682			328717			346849					10
11	11.3		2080873			1906910			2057345				11												11
12	18.5		15440528			13712821			15240623				12	630954			547999			619738					12
13	17.9		9521164			7861647			9296732				13	431257			378543			424139					13
14	11.0		5871560			4989545			5752273				14	264896			227395			259828					14
15	15.5		7043404			6507687			6970951				15	376377			349583			372753					15
16	12.4		4912892			4215051			4818513				16	292952			255722			287920					16
17	18.5		7291032			6040622			7121923				17	87420			70205			85093					17
18	20.9		7748613			6988461			7645912				18	115276			99958			113205					18
19	6.3		499497			328155			476326				19	59089			45804			57291					19
20	7.1		741046			589766			720586				20	24807			19385			24073					20
		119684240	146014992	14210111	17336334	128678658	6832688	14416973	143095631	833567263	826734575	840944686		3696348	338578	413051	3283297	171148	361121	3644418	55197520	22141201	21970053	22308631	

5.3 Mineable Coal Reserves (ROM)

For the purpose of this report the C.I.P. reserves with open cast mining potential (215 m below valley floor) have been set equivalent to "Run of Mine - R.O.M. - Reserves". They therefore, amount to a total of:

(a) 562.786 million tonnes on the eastern flank (met. coal)

(b) 275.524 million tonnes on the western flank (non met. coal)

838.310 million tonnes ROM

This total open cast mining potential can be subdivided into

(1) reserves within the boundaries of the surface mine described by "Alternative D" on the east flank,

(2) reserves beyond the boundaries and pit bottom (172 m) of the "Alternative D" mine, but with further open cast mining potential (Pit bottom at 215 m) on the east flank,

(3) reserves with open cast mining potential (pit bottom at 215 m) on the west flank.

In summary, these reserves amount to:

(1) 220.604 million tonnes ROM
(2) 342.182 " " "
(3) 275.524 " " "

838.310 million tonnes

Table II-6.4.3-T1, page 35 is a seam by seam summary of the (ROM) reserves of non-oxidized coal in "Alternative D" (the area between Sections 160+00 and 400+00 with a pit bottom of 172 m below valley floor) which amount to a total of

220.604 million tonnes

The reserves figures given in Table II-6.4.3-T1, page 35, are based on a mining member definition which allows for extraction of seams or splits which have a minimum true thickness of 0.60 m. In an actual mining operation, depending on the type of equipment employed, thin mining members may have to be mined as waste and not recovered. In order to estimate the effect of increasing the minimum thickness on the total reserves figures a calculation was made in which coal seams or splits less than 1.20 m were excluded from the mineable reserves. The results of this calculation are recorded as follows:

Minimum Mining Member True Thickness	ROM Reserves (in 1,000's)
0.60 m	220,604 tonnes
1.20 m	216,274 tonnes
Difference	4,330 tonnes

The difference of 4,330,000 tonnes represents a decrease of mineable reserves of only 2.0% due to the change in mining member definition. This figure is well within the tolerance limits for reserves calculations of this magnitude.

The ROM coal reserves as quoted in detail on Table II-6.4.3-T2, page , (220,604,000 tonnes) for Alternative "D", and which are comprised of the recovered ROM coal to a pit bottom of 172 m below valley floor, are burdened with a combined waste/overburden/oxidized coal volume of 721,248,000 bm^3. This corresponds to a specific waste/ROM ratio of

3.27 bm^3/ tonne ROM

for the open cast mine under planning in the Feasibility Study.

TABLE II - 6.4.3. - T1

ALTERNATIVE D

MINEABLE RESERVES NON-OXIDIZED COAL

(in 1,000's)

SEAM	Coal in Place		Rec. Raw Coal		Run of Mine		ROM % of Total
	t	st	t	st	t	st	
2	20273	22347	18014	19857	19967	22010	9.05
3	9762	10761	7320	8069	9432	10397	4.28
4	36838	40607	33892	37360	36440	40168	16.52
5	1782	1964	1324	1459	1720	1896	0.78
6	8538	9412	6045	6664	8201	9040	3.72
7	6852	7553	5840	6437	6715	7402	3.04
8	22953	25301	19659	21670	22507	24810	10.20
9	17701	19512	16353	18026	17519	19311	7.94
10	24324	26813	21416	23607	23931	26379	10.85
11	17053	18798	15593	17188	16855	18580	7.64
12	17979	19818	14636	16133	17527	19320	7.95
13	11456	12628	9304	10256	11165	12307	5.06
14	11039	12168	8899	9809	10749	11849	4.87
15	6767	7459	5900	6504	6650	7330	3.01
16	5111	5634	4124	4546	4978	5487	2.26
17	4938	5443	3984	4392	4809	5301	2.18
18	1335	1472	1143	1260	1309	1443	0.59
19	97	107	75	83	94	104	0.04
20	37	41	33	36	36	40	0.02
TOTALS	224,835	247,838	193,554	213,356	220,604	243,175	100.00

TABLE II - 6.4.3 - T2

MINEABLE RESERVES OF NON-OXIDIZED COAL

COMPARISON OF 1977 and 1976 FIGURES

(in 1000's)

	ELCO MINING LTD./TECHMAN LTD.		
	1977 Alt. "D"	1976 Alt. "A"	1976 Alt. "C"
COAL IN PLACE	224,835 t (247,838 st)	162,240 t (178,875 st)	123,466 t (136,126 st)
RECOVERABLE RAW COAL	193,533 t (213,356 st)	142,472 t (157,081 st)	106,690 t (177,630 st)
RUN-OF-MINE	220,604 t (243,147 st)	158,352 t (174,589 st)	118,342 t (130,476 st)
*TOTAL WASTE - including oxidized coal	721,248 bm^3 (934,364 byd^3)	792,985 bm^3 (1,043,401 byd^3)	535,443 bm^3 (704,530 byd^3)
RATIO	3.27 bm^3/t (3.84 byd^3/st)	5.00 bm^3/t (5.98 byd^3/st)	4.52 bm^3/t (5.40 byd^3/st)

* Oxidized coal reserves are shown in Chapter II-6.4.7, Table II-6.4.7-T1.

The potential of the Elk River Project licence area to produce coal from underground mining techniques requires a more detailed investigation than has been undertaken up to now. The latest assessment undertaken by ELCO in 1977 gives a total underground in place reserve of 3,675,000,000 t from 215 m below valley floor to the bottom of the syncline. This figure covers coal seams and splits of a minimum true thickness of 1.0 m only.

Using 50% as a mining recovery the recoverable ROM coal reserves from underground sources would amount to 1,838 million tonnes.

Due to the lack of knowledge on coal quality development in the bottom of the syncline, this potential has to be considered one half metallurgical and one half non metallurgical coal.

The reserves mineable by underground methods would be increased in the case that the potential open pit mineable coal between 172 m and 215 m below valley floor would also be considered underground coal. Taking into account a minimum recoverable seam/split thickness of 1.0 m (true), an underground mining recovery of 50%, and a 10% safety pillar below the open cast mine, the resulting ROM reserves (underground) in addition to the above figures would be

87.392 million tonnes (east flank, met. coal)
123.986 million tonnes (west flank, non met. coal).

211.378 million tonnes

5.4 Open Pit Mineable Clean Coal Reserves

The coals of the Elk River deposit have been subjected to an extensive quality investigation, and, as a result, a figure of 62.5% of the ROM has been established as the basic total yield figure on a dry basis. This converts to a pit/rail yield of 63.0% (wet), and, any clean coal reserves blocked out on the property were computed on this basis.

The open pit mineable clean coal reserves situated on the east side of the valley (i.e. east flank of the syncline) representing bituminous coal of metallurgical grade are comprised of:

(a) As per Table II-6.4.6-T2, page 41, the proven geological reserves (CIP) of the area between Sections 160+00 and 400+00, covering Seams Nos. 2 up to No. 24 and down to a level of 215 m approx. below valley floor, amount to 343.236 million tonnes.

In the pit dimensions set for Alternative "D" and situated in the same area ROM reserves were established with a total of 220.605 million tonnes.

The difference between both the reserve figures results from disregarding CIP reserves below the actual pit bottom at 172 m, beyond Seam No. 18, and at the northern and southern pit slopes.

Applying an average Yield of 63% the total clean coal reserves for the above area (compatible with Alternative "D") amount to 138.981 million tonnes providing for a lifetime of the project, as under consideration in this report, of 37 years (using a rate of 4 Mt/a, start-up period included).

Possibilities to increase this figure by mining a higher proportion of CIP coal, i.e. extension of the pit to depth and/or on its western flank, however, appear restricted, because of increased overburden ratios and environmental effects.

(b) For the block between Sections 100+00 and 160+00, Table II-6.4.6-T2, page 41, gives geological CIP reserves of 132.46 million tonnes which include Seams Nos. 2 through 18 down to a level of 215 m approx. below valley floor.

Applying present mining technologies,i.e. overburden ratios and a pit bottom as for Alternative "D" (172 m),a reduction of above CIP reserves by 32.6% approx. would result. Under such conditions, the ROM reserves of this block would amount to 89.278 million tonnes, equivalent to 56.245 million tonnes of clean coal or an additional lifetime of 14 years at a rate of 4 mt/a.

The impact of the restrictive parameters on the pit dimensions in the distant future (+37 years) can not be assessed at present. If all seams up to Seam No. 18 are to be fully mined to the level of 215 m (approx.) below valley floor, an overall waste/ROM ratio of 5.32 bm^3/t would be achieved. In such a case that this proves to be acceptable and economical in the not too distant future, the full amount of the established CIP coal could be considered as ROM coal, resulting in an increase of clean coal reserves for an additional lifetime of 7 years.

(c) The coal reserves in the block between Sections 000+00 and 100+00 are shared with FORDING COAL LTD. The proportion of CIP coal indicated for the area controlled by ELCO amounts to 87.09 million tonnes and is comprised of seams up to Seam No. 18 down to a level of 215 m below valley floor. These reserves could be mined by open pit methods if an arrangement with FORDING COAL LTD. can be achieved.

Again, considering a pit bottom as in Alternative "D", the above CIP reserves would be reduced by 32.6% to a ROM volume of 58.699 million tonnes, equivalent to 36.98 million tonnes of clean coal or an additional life time of 9 years at a rate of 4 Mt/a.

In such case, the full volume of CIP coal could be mined in future as ROM coal, i.e. for the same reasons described under (b) of this section, clean coal reserves and life time could beincreased by another 4 years approximately.

The clean coal reserves and life time as assessed under items (a), (b) and (c) of this section are summarized in Table II-6.4.6-T2 and illustrated in Figure II-6.4.2-F1, pages 41 and 42 respectively.

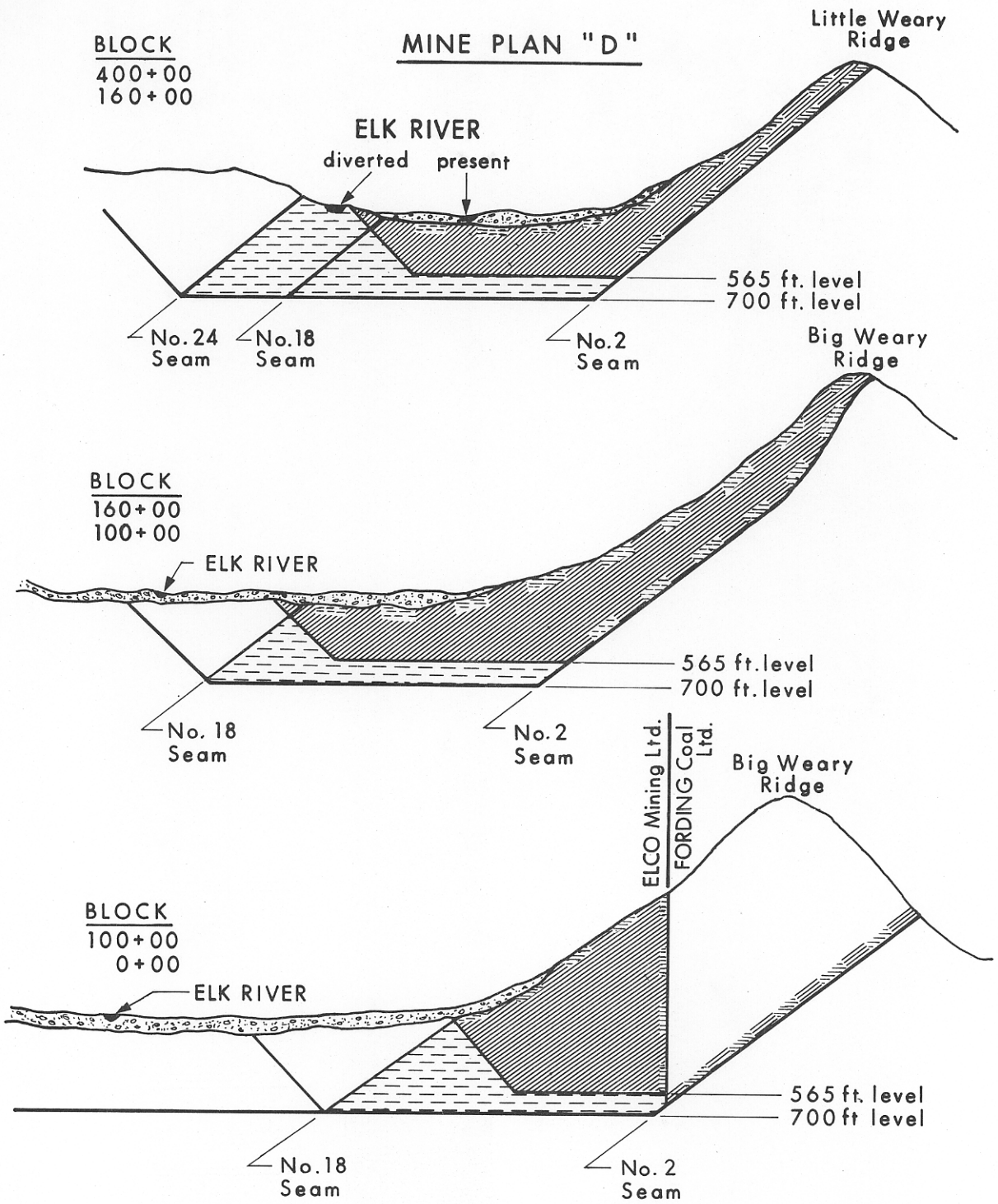
From this it becomes evident that the total geological CIP reserves of the east flank, mineable by open pit methods, amount to 562.786 million tonnes. Applying the parameters of mine plan "D" for the entire area a ROM volume of 368.581 million tonnes results which is equivalent to a total clean coal volume of 232.206 million tonnes or a combined lifetime of 60 years at a rate of 4 Mt/a.

Considering possible future extension of mining beyond the limits set by the parameters of Alternative "D", in particular south of Section 160+00, the increase in clean coal reserves and lifetime would result in grand totals of 277.033 million tonnes and 71 years.

TABLE II-6.4.5-T2
POTENTIAL OPEN PIT
R.O.M. AND CLEAN COAL RESERVES (MET. COAL)
(in 1000's)

Status	Between Sections	Run of Mine R.O.M. Within Alternative "D" Parameters	Run of Mine R.O.M. Beyond Alternative "D" Parameters	Clean Coal C.C. Within Alternative "D" Parameters	Clean Coal C.C. Beyond Alternative "D" Parameters	Total
a) proven	389+70 to 163+40	220,604 t (243,175 st)	122,632 t (135,178 st)	138,981 t (153,200 st)	75,171 t (82,862 st)	216,239 t (238,362 st)
	163+40 to 160+00	-- --		2,087 t (2,300 st)		
b) proven	160+00 to 100+00	89,278 t (98,414 st)	43,182 t (47,610 st)	56,245 t (62,000 st)	27,205 t (30,000 st)	83,450 t (92,000 st)
c) indicated	100+00 to 000+00	58,699 t (64,704 st)	28,391 t (31,302 st)	36,980 t (40,764 st)	17,622 t (19,429 st)	54,602 t (60,193 st)
TOTAL	400+00 to 000+00	368,581 t (406,293 st)	194,205 t (214,090 st)	234,293 t (258,264 st)	119,998 t (132,291 st)	354,291 t (390,555 st)

MINE PLAN "D"



LEGEND

Potential Open Pit Reserves

O/C Mineable Reserves
According To Alternative "D" Parameters

ELCO MINING LIMITED	
ELK RIVER COAL PROJECT BRITISH COLUMBIA	
OPEN PIT GEOLOGICAL AND MINEABLE RESERVES (East Flank)	
DATE: NOV. 1977	DRWG NO: L·673
COMPILED BY: ELCO MINING LIMITED	

5.5 Oxidized Coal Reserves

The oxidized coal reserves have been calculated only for Alternative "D" area. The criteria used for calculating the oxidized coal are as outlined in chapter 2.5.1 - i.e. oxidized coal exists to a depth of 4.6 meters and becomes negligible if the glacial till is greater than 4.6 meters. This figure was established by observation and measurement in the field during surface trenching. Rarely was oxidation seen to have an effect on coking quality, as determined by the standard coke-button test, below 3 meters.

The amount of oxidized coal per seam, which has been included as waste in the mineable reserves calculations, is given in Table II-6.4.7-T1, page 44, the total of which is 5,143,700 tonnes. This represents a relative small quantity in comparison to the clean coal to be produced, in particular when the 37 year lifetime of the project is considered.

Therefore, the oxidized coal will be mined and stockpiled separately and eventually washed in order to use the clean coal product either as a fuel for the dryer or to sell it as the case may be.

TABLE II - 6.4.6 - T1

OXIDIZED COAL RESERVES IN-PLACE*
(in 1,000's)

SEAM NO.	OXIDIZED COAL IN PLACE t	st	% OF TOTAL
1	9.5	10.5	0.2
2	791.6	872.6	15.4
3	420.8	463.9	8.2
4	1119.6	1234.1	21.8
5	51.8	57.1	1.0
6	91.3	100.6	1.8
7	89.3	98.4	1.7
8	250.7	276.3	4.9
9	265.5	292.7	5.2
10	172.1	189.7	3.3
11	400.5	441.5	7.8
12	182.3	201.0	3.5
13	283.3	312.3	5.5
14	272.3	300.2	5.3
15	163.2	179.9	3.2
16	61.8	68.1	1.2
17	178.2	196.4	3.5
18	100.3	110.6	1.9
19	74.6	82.2	1.5
20	44.7	49.3	0.9
21	34.6	38.1	0.7
22	42.7	47.1	0.8
23	16.8	18.5	0.3
24	24.8	27.3	0.5
TOTAL	5143.7	5668.4	100.0

* Source; Databank
Essen (Nov., 1977)
DOC. 12.8

6. Coal Quality

6.1 Objectives of Coal Quality Work

From studies conducted on the Elk River coal property prior to 1975 it was known that:

- the open pit mineable coal measures on the east side of the valley are made up by a sequence of various coal seams,
- the individual coal seams are different in their rank and coking properties, ranging from a cokeability of only marginal to excellent.

In comparison to other mines operating in the Fernie Basin where the seams being mined are characterized by satisfactory cokeability, this is only the case on an average basis for the Elk River coal seams.

From earlier studies, however, it had been demonstrated that this shortcoming, could be overcome by means of blending the different quality seams. It was this knowledge in particular, which prompted the partners of the Elk River Coal Project to investigate the possibility of developing the vast coal resources of the property.

For their purposes, however, certain conditions imperative for the use of Elk River coals in their steel mills had to be met:

- a low volatile coking coal (~22% Vol. Matter d.b.) was required, and
- a cokeability good enough to partly replace certain other coals in their future coke oven blends without deteriorating the quality of the coke produced.

To meet this requirement the following facts known from previous studies had to be kept in mind:

- the coal seams in the lower part of the coal measures (with favourable waste/coal ratios) are characterized by the desired low volatile matter content, but by deficient and unsatisfactory cokeability, and

- the coal seams in the upper part of the coal measures (with less favourable waste/coal ratios) are characterized by the desired good to excellent cokeability, but by undesired medium to high volatile matter content.

The conclusion to be drawn from this fact is that none of the seam groups would be of satisfactory quality on their own to be accepted by the consumers and that the metallurgical coal potential of the property could only be utilized under the condition that both the seam groups are mined and treated together in order to produce an acceptable coal blend quality.

Taking this into account the coal quality work in the scope of the Feasibility Study and Stage II Report was focused on the following items:

- establishing qualities and possible variations of CIP, ROM and Clean Coal in the proposed pit area on a seam by seam basis,

- the size/ash/gravity distribution, amount of dilution, and attrition of an average ROM coal,

- plant yield,

- comparing this data with data from bulk samples tested for cokeability (at a semi-industrial scale) in an earlier stage to determine the representativeness of these bulk samples for the average overall coal volume to be mined,

- establish average CIP, ROM and CC qualities to be produced over the entire lifetime of the project, and

- secure by interaction with mine planning that these average qualities would be produced on an annual or even shorter term basis.

The results of these comprehensive studies are summarized in the following chapters of this report.

6.2 Raw Coal Quality

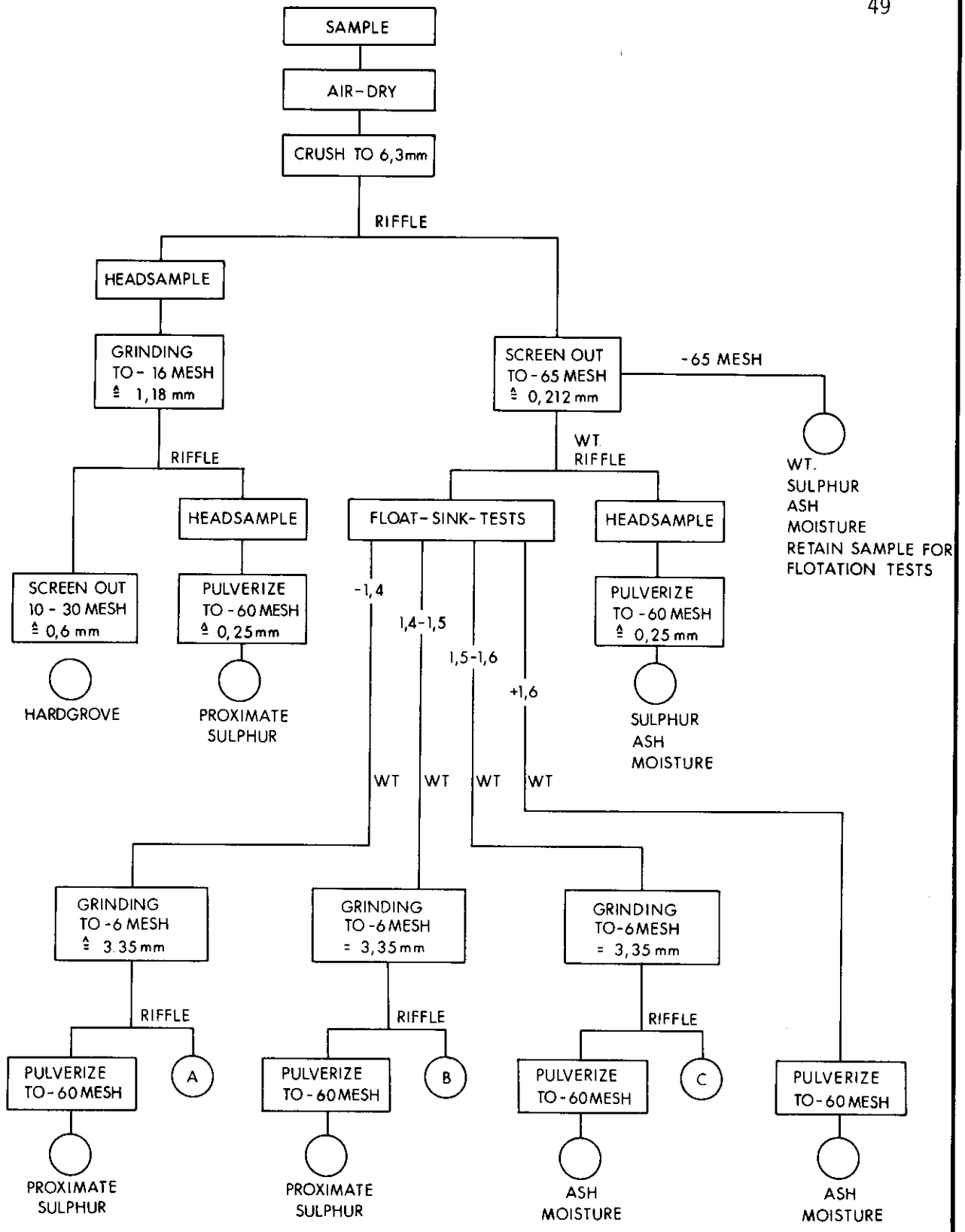
The 1976/77 coal quality assessment comprised of all coal analysis data received in that period after treatment of coal samples, (A-6.2 - Vol. I & II), according to the attached flowsheet II-6.5.2.3-G1, page 49. Coal sample analyses recorded in earlier exploration programs were also included into this assessment where possible.

Stringent rejection criteria were applied to all new, and in particular, all analysis data generated prior to 1975 to ascertain a consistent and reliable basis of information as shown on below table II - 6.5.4.3 - T1:

TABLE II - 6.5.4.3 - T1

Data Basis for Raw Coal Quality Assessment

Sample as Received (100%)	Headsample	Size Fraction 1/4" x 65 M 6.35 x 0.2 mm <65 M <0.2 mm		Gravity Fraction - 1.5 S.G. in 1/4" x 65M 6.35 x 0.2 mm Size Fraction
Analysis:	- Ash % - 1/4" x 65 M 6.35 x 0.2 mm Wt. % - core recovery (boreholes only)	- 1.5 S.G.Wt.% - 1.5-1.6 S.G. Wt. %	- Ash % - Sulphur%	- Ash % - Vol. M % - Sulphur % - Phosphorus % - F.S.I. - G-Value



MIX A,B,C FOR STELCO: MACERAL ANALYSIS

MIX A,B FOR F.S.I.: PHOSPHOROUS AND RUHR-DILATOMETER

ELCO MINING LIMITED

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

BOREHOLE SAMPLE TEST PROCEDURE FLOWSHEET

DATE: SEPT., 1977	DRWG NO: L 490
COMPILED BY: ELCO MINING LIMITED	

Table II-6.5.4.5-T1, page 51, records the average quality features of raw coal (CIP) on a seam by seam assessment from all analysis data available between Sections 160+00 and 400+00, which covers the open pit mining area (Alternative "D") under consideration in this report. Beyond that, the individual data have been investigated with respect to variation and standard deviation.

The results of this assessment can be summarized as follows:

- According to the borehole samples, the coal in place (CIP) raw coal ash for the individual seams, averages within a range of 19 and 36%. The weighted average of the mineable CIP reserves amounts to 25.1% (compare graph II-6.5.4.5-G2, page 52).

  The elementary statistics performed on the CIP raw coal ash indicate extreme variability, which, however, compensates each other to a considerable extent when the average of the mineable CIP reserves is taken into account. For this, 95% confidence limits were calculated with only ±1.2% at a standard deviation of sigma = 9.9%. The 1.5 S.G. cum. float recovery of the individual seams and the mineable CIP reserves vary accordingly.

- In comparison, the 1.5 S.G. cum. float ash proves to be much more constant for the individual seams as well as on a CIP average. It is relatively high for Seams Nos. 2 through 18 with a 7.1% to 8.5% (d.b.), but diminishes with the increasing seam numbers to a level of 5.0% to 5.5% (d.b.).

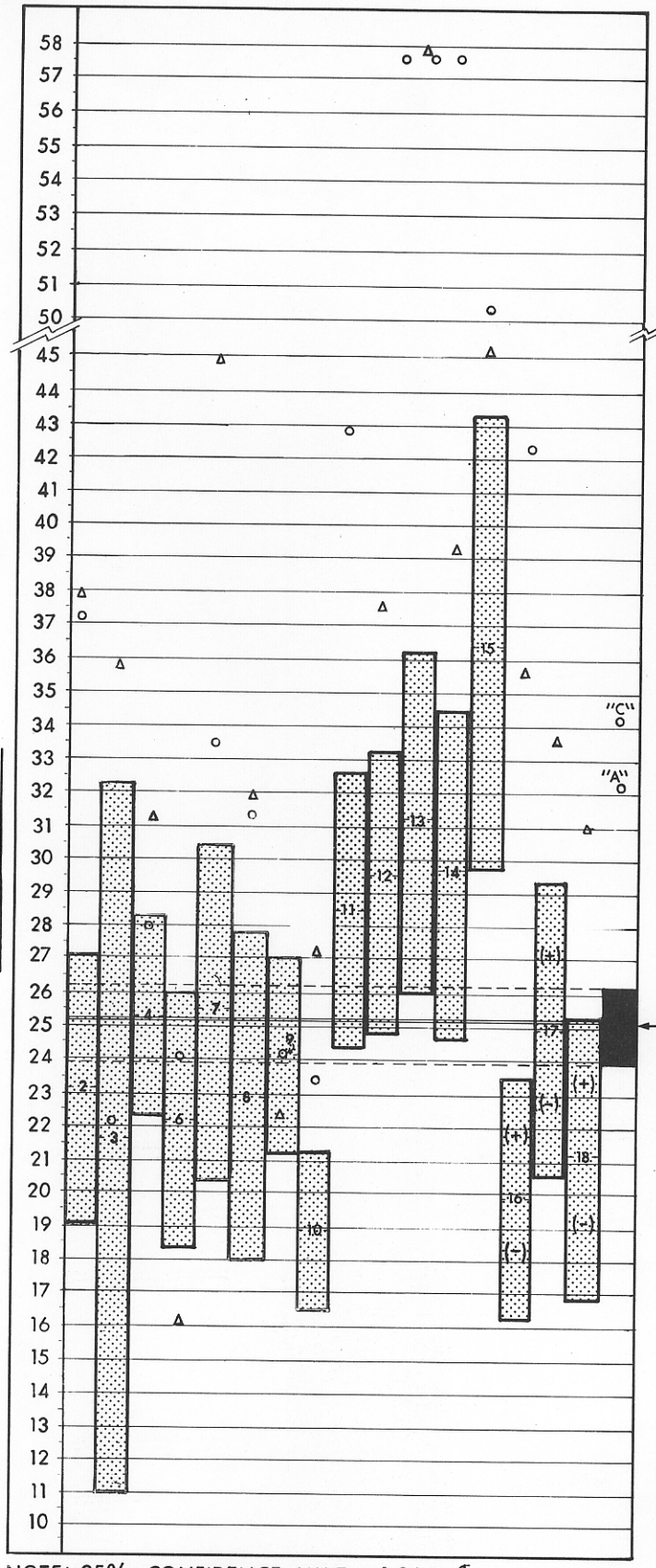
  The weighted average of the mineable CIP reserves was calculated to be 7.1% ash with a 95% confidence limits of ± 0.13% ash only.

TABLE: II - 6.5.4.5. - T1

AVERAGE QUALITY OF ELK RIVER RAW COAL (CIP)

(Summary of all Exploration Programs between Sections 160+00 and 400+00)

Seam No.	Average Seam Thickness (feet)	Total C.I.P. Ash %(d.b.)	Size 6,35-0,2mm (1/4" x 65M)									Size - 0,2 mm (-65M)		
			Total Wt.%	<1.5 S.G. cum. Float										
				Wt.%	Ash % (d.b.)	Vol.M. % (d.a.b.)	Sulphur % (d.b.)	Phosphorus % (d.b.)	F.S.I.	G-Value	Ratio 1,5/1,5-1,6S.G.	Wt.%	Ash % (d.b.)	Sulph. % (d.b.)
2	17.0	23.1	86.3	71.4	8.7	21.5	0.49	0.02	8	1.035	32.86	13.7	21.2	0.55
3	9.1	21.7	57.6	76.3	7.1	21.5	0.56	0.05	8	1.031	42.07	12.4	23.9	0.53
4	28.8	25.4	85.8	66.2	7.6	20.5	0.49	0.03	4	0	35.62	14.2	18.0	0.49
5	-	-	88.5	-	-	-	-	-	-	-	12.05	11.5	17.5	0.70
6	6.0	22.2	89.2	71.6	8.4	20.3	0.70	0.06	4½	0	34.71	10.8	17.5	0.67
7	9.8	28.8	86.1	61.7	8.3	21.3	0.62	0.02	4½	0	31.82	13.9	18.2	0.58
8	27.7	22.9	85.4	69.9	7.4	21.2	0.56	0.05	4½	0	42.56	14.6	14.2	0.57
9	20.1	24.1	89.1	67.0	7.5	21.1	0.52	0.04	4½	0	44.74	10.9	17.4	0.55
10	26.8	18.9	86.6	75.6	6.3	22.3	0.47	0.03	5	0	54.75	13.4	13.9	0.51
11	26.3	28.5	82.5	60.9	6.5	24.7	0.76	0.04	8	1.029	38.39	17.5	16.9	0.73
12	20.3	29.5	83.1	59.9	6.7	25.2	0.81	0.04	7½	1.032	39.44	16.9	18.8	0.74
13	15.3	31.1	85.6	58.1	6.5	26.5	0.84	0.06	8	1.056	32.49	14.4	22.3	0.80
14	19.8	29.6	87.6	62.6	5.9	28.0	0.78	0.04	8½	1.071	32.72	12.5	21.1	0.84
15	21.4	36.4	88.3	52.4	5.5	28.6	0.77	0.04	8½	1.071	30.71	11.7	23.4	0.79
16	15.1	19.3	87.1	75.0	5.1	29.3	0.83	0.03	8½	1.065	35.13	12.9	16.2	0.83
17	18.7	25.0	87.6	69.5	5.5	30.8	0.86	0.04	8½	1.072	38.49	12.4	19.5	0.82
18	16.4	21.1	84.9	74.0	5.1	32.0	0.75	0.04	8	1.060	45.09	15.1	15.9	0.62



LEGEND

+95% CONFIDENCE INTERVAL
MEAN
-95% CONFIDENCE INTERVAL

o BULK SAMPLES (diluted)

Δ CHANNEL SAMPLES (diluted)

NOTE: 95% CONFIDENCE LIMIT = $1.96 \times \frac{\sigma}{\sqrt{n}}$
WHEN, σ = STANDARD DEVIATION
n = NUMBER OF SAMPLE RESULTS

ELCO MINING LIMITED

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

95% CONFIDENCE LEVELS FOR 1975-77 DRILL CORES C.I.P. COAL ASH %

DATE: SEPTEMBER, 1977 | DRWG NO: L·527

COMPILED BY: ELCO MINING LIMITED

- The cum. 1.5 S.G. float volatile matters (d.a.b.) average 20% to 21% for Seams No. 2 through 8 and increase to 32% with rising seam numbers.

  All mineable CIP reserves average 23.1% with overall 95% confidence limits of ± 0.16%.

- The cum. 1.5 S.G. float sulphur contents (d.b.) vary on a seam by seam basis between 0.47% (Seam No. 10) and 0.86% (Seam No. 17) and average 0.6% for all mineable CIP reserves. Seams Nos. 2 through 10 are below this average, whereas, the upper seams are above this average.

  Although the standard deviations for the individual seams appear relatively high, the mineable CIP reserves have 95% confidence limits of ± 0.014%. This provides a satisfactory degree of predictability of sulphur grade.

- The cum. 1.5 S.G. float phosphorus content (d.b.) exhibits the lowest degree of confidence. The average of the mineable CIP reserves amounts to 0.04% with 95% confidence limits of ± 0.003%.

  This is obviously due to the highly erratic distribution of phosphorus throughout the entire deposit.

  Double-check analyses carried out in Europe, however, indicate that Canadian analyses show a phosphorus content by approx. 1/3 higher than recorded in Europe. Therefore, keeping the future product quality within specifications of <0.07% P (d.b.) should prove to be more easy than expected according to the existing basis of analysis data.

- Regarding the Free Swelling Index of the various seams, two groups can be clearly defined and distinguished. Seam Nos. 4 through 10, with an average of 4 to 5 F.S.I. in the cum. 1.5 S.G. float, indicate a low to moderate cokeability. In comparison, Seams Nos. 2 and 3, as well as Nos. 11 through 18 with an average of 7-1/2 to 8-1/2 F.S.I. indicate good to very good cokeability.

  The overall mineable CIP reserves indicate an acceptable cokeability with a weighted F.S.I. average of 6, and 95% confidence limits of $\pm$ 0.12. These figures, however, are only statistical and not measureable in practice.

- The G-Value represents a parameter used by European steelmills to assess the coking properties of a metallurgical coal. This parameter is established by means of the RUHR-dilatometer and combines the readings of several measurements conducted with this device.

  In general, a G-Value of + 0.9 indicates a satisfactory cokeability of a metallurgical coal.

  With reference to the dilatometer tests conducted with the Elk River coal samples, a satisfactory or good G-Value between 1.031 and 0.1072 could be established for Seams Nos. 2, 3 and 11 through 18.

  In comparison, no G-Value could be assessed for Seams Nos. 4 through 10 due to lack of sufficient coking capacity of these seams.

  Semi-industrial coking tests conducted in 1975/76 indicate, however, that these seams in fact do have a restricted, "dormant" cokeability which can be activated when these seam coals are blended with coals of good cokeability.

Substantial efforts have been undertaken in the 1976/77 quality assessments to investigate possible trends of the quality parameters for the individual seams along their strike and dip. The result of this comprehensive study can be summarized to the effect that in general there does not exist any trend in the coal quality features within any seam or within the open pit mining area under consideration.

Any coal analysis results and conclusions drawn so far, merely refer to drill samples, which represent the quality features of the raw coal in place (CIP). To arrive at an estimate of the quality features of a run-of-mine (ROM) coal, the CIP coal qualities have been assessed under consideration of possible mining loss and dilution.

The first step was a comparison of the boresample average qualities (Table II-6.5.4.5-T1, page 51) with:

- 1975/76 channel samples taken from individual seams which include 0.15 m of dilution from the footwall of each seam/seam split, and analysed according to the bore sample flow sheet (II-6.5.2.3-G1, page 49), and

- 1975/76 bulk samples taken from the same location as the channel samples, with the same amount of dilution, and washed in a pilot plant.

This comparison study indicated that all the channel samples analyses are within the 95% confidence limits established for the drill core samples across the deposit.

From this it becomes evident that the bulk samples extracted in 1975/76 are representative of the entire deposit and their analysis results, therefore, would represent a reliable basis for all future quality assessments, in particular with regard to

- size/ash/gravity distribution,
- amount of dilution,
- plant yield, and
- clean coal quality.

Mining the multiple seam deposit will involve, to a substantial extent, rock contamination of the run-of-mine (ROM) coal. To qualify this influence, dilution/ run-of-mine ash/yield calculations were carried out for the mineable CIP reserves on a seam by seam basis, by taking into account 0.15 m dilution (75% ash) and 0.30 m mining loss for each mining member.

This resulted in the following comparison

	C.I.P. Core S. analyzed	Plan "D" R.O.M. Reserves computed	1975/76 Bulk S. analyzed
Ash %	25.1	29	33
Yield Wt. % (d.b.)	67.1 *	69	62.5
Clean Coal Ash %	7.1 *	9.5	9.5

* Cum. 1.5 S.G. Float of + 0.2 mm fraction

Considering the "Plan D Reserves" as computed somewhat optimistic the future overall ROM coal ash and plant recovery were established with

33% Ash in ROM Coal,
62.5% Plant Yield (d.b.), at
9.5% Ash in Clean Coal Product

The above results, however, still appear amenable to further improvement by means of careful mining, handling, screening and crushing the ROM coal. Industrial size breaker and attrition tests, carried out with bulk sample in 1976/77, indicate the following possible range of

yield increase that can be expected from various amounts of breaker reject:

	ROM	Plant Feed after 4.8% breaker reject	Plant Feed after 15% breaker reject
Ash % (d.b.)	30-33	28-31	22-26
Yield % (d.b.)	67-62.5	70.0-63.6	78.5-73.5

The actual Size/Ash/Gravity distribution of the ROM coal will remain unknown until experienced in the future operation. The following table, (II-6.5.4.10-T1), exhibits the parameters as obtained from the 1975/76 bulk sample. These however, do not reflect the impact of future mining and handling.

Table II - 6.5.4.10 - T1
Size/Gravity/Ash - Distribution of ROM Coal
(1975/76 Bulk Samples, Composite "C")

Gravity	-1, 5 S.G.		1,5 - 1,8 S.G.		+ 1,8 S.G.		Total	
Size	wt.%	Ash % (d.b.)	wt.%	Ash % (d.b.)	wt.%	Ash % (d.b.)	wt.%	Ash % (d.b.)
120-12.7 mm (4" - 1/2")	6.1 (36.0)	8.7	1.1 (6.2)	38.9	9.8 (57.8)	81.4	17 (100)	52.6
12.7-0,6 mm (1/2" - 28M)	29.2 (58.3)	7.0	4.2 (8.6)	34.0	16.6 (33.1)	79.8	50 (100)	33.4
0.6 - 0.2 mm (28 - 65 M)	11.0 (73.1)	5.6	1.3 (8.9)	34.3	2.7 (18.0)	76.1	15 (100)	20.9
-0,2 mm (- 65 M)	18.0	18.5					18	18.5
TOTAL	64.3	10.1	6.6	34.9	29.1	80.0	100	32.1

Regardless of this reservation, the above table indicates that the future ROM coal would be characterized by:

- a medium sized proportion of middlings in the 1.5 - 1.8 S.G. range (6.2 - 8.9 wt.%),
- a medium ash content in the clean coal - 1.5 S.G. (5.6 - 8.7% ash)
- a medium ash content in the minus 0.2 mm fractions (18.5% ash).

Increased attention, therefore, will have to be paid to the liberation and separation of middlings and ultrafines in planning and designing the preparation plant.

6.3 Blending Requirements and Blends

It becomes evident in more detail in Table II-6.5.4.5-T1, page 60, that the raw coal characteristics, as well as the coking properties of the various seams under consideration, are different to a considerable extent.

This is applicable in particular to:

- the volatile matter content in a clean coal (1.5 S.G. float), varying between 21% (d.a.b.) approx. in Seams Nos. 2 through 10, and, 27% (d.a.b.) approx. in Seams Nos. 11 through 18.

- the coking properties of the same coal, being fundamentally different between Seams Nos. 4 through 10 (F.S.I. = 4-1/2, G-Value = 0), and, all the other seams (F.S.I. = 8, G-Value = 1.05 approx.).

It can be seen that the quality characteristics and coking properties of the Elk River coal seams divide into two separate and distinct groups.

Considering the conditions as outlined in chapter 6.1, neither of these seam groups could alone meet the requirements of the partners nor make the early development and utilization of the Elk River deposit feasible.

However, cokeability tests carried out in 1975/76 have proven to a satisfactory extent that a clean coal product obtained from a composite ROM coal (Alternatives "A" and "C") comprised of all the seams at proportions as occuring in the deposit, would represent a metallurgical coal of good blending potential and be acceptable to the partners in the project and other potential consumers.

Therefore, the mining, treatment and adding of the upper seams of the deposit (Nos. 11 through 18) to an overall blend represents an indispensable necessity for the project, and, unfavourable implications on the environment (incremental and temporary diversion of the Elk River meandering in the upper seam group outcrop area) caused by this, will have to be taken into account if the project should be implemented.

TABLE II-6.5.4.5-T1

AVERAGE QUALITY OF ELK RIVER RAW COAL

In addition, the partners in the Elk River coal project and any other consumers of its clean coal product would only accept a homogenous product whose quality characteristics would be maintained and not change or vary substantially, over the lifetime of the project, during the period of a delivery contract, or, even on a monthly or daily basis.

In order to meet these fundamental requirements, i.e. "providing a homogenous product of a constant metallurgical grade", blending of the ROM coal is required before treatment in the preparation plant. Therefore, mining is planned and scheduled in such a way that all the seams will be mined within a certain mining period, during which a representative increment is produced, reflecting the average quality composition of the entire deposit. This quantity is homogenized on a blending bed of appropriate size. By reclaiming the homogenized coal and feeding it into the preparation plant a clean coal is produced which has a quality corresponding to the average composition of the deposit.

The average composition of the deposit, in terms of the average clean coal seam qualities as recorded in table II-6.5.4.5-T1, page 51, is produced by blending the seams in proportions as occuring in the deposit. The saleable product will reflect the following clean coal specifications as established on the basis of this blending scheme:

- Ash (d.b.) 9.5% max.
- Total Moisture 6-8% (8.0% max.)
- Vol. Matters (d.b.) 22.0% approx.
- Sulphur (d.b.) 0.7% max.
- Phosphorus (d.b.) 0.045% approx.
- Free Swelling Index 5-1/2 min.

In order to guarantee the above specifications on a long as well as a short term basis, mine planning was conducted such that the various incremental seam quantities would be mined on a schedule that could appropriately meet blending requirements.

The result of this exercise reflected in Table II-6.5.5.4-T2, page 63, indicates that the target specifications can be met if the various seam groups (including the upper seams of the sequence) are mined and blended in proportions as indicated on the bottom of the table.

TABLE: II - 6.5.5.4 - T2

1.50 Float Coal Quality Variations for Years - 1 to 9 and 10 to 19

	-1	1	2	3	4	5	6	7	8	9	Avg. -1 to 9	10	11	12	13	14	15	16	17	18	19	Avg. 10 to 19	Total Reserves "D" (36 years)	1975 Bulk S. "C" (1)
Ash %, d.b.	In 1982 Production	7.1 (9.5)	7.1 (9.5)	7.1 (9.5)	7.1 (9.5)	7.1 (9.5)	7.0 (9.5)	7.0 (9.5)	7.0 (9.5)	7.0 (9.5)	7.0 (9.5)	7.1 (9.5)	7.1 (9.5)	7.0 (9.5)	7.2 (9.5)	7.0 (9.5)	7.0 (9.5)	7.1 (9.5)	7.1 (9.5)	7.2 (9.5)	7.1 (9.5)	7.1 (9.5)	7.1 (9.5)	7.0 (9.5)
Volatile M %, d.b.		21.8 (21.5)	21.2 (20.9)	21.1 (21.8)	21.0 (20.7)	21.0 (20.7)	21.1 (20.8)	21.1 (20.8)	20.9 (20.6)	21.0 (20.7)	21.1 (20.8)	20.9 (20.6)	20.8 (20.5)	21.0 (20.7)	20.4 (20.1)	21.1 (20.8)	20.9 (20.6)	20.5 (20.2)	20.9 (20.6)	20.3 (20.0)	20.5 (20.2)	20.7 (20.4)	20.7 (20.4)	20.3 (20.0)
Sulphur %, d.b.		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.49
Phosphorous %, a.d.b.		0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.052
F.S.I.		7	6-1/2	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	7
Wt.% 1.5 Float		60.2	58.1	58.2	58.8	59.2	59.2	59.3	59.6	59.2	59.1	59.5	59.6	59.0	60.0	59.1	59.3	60.2	59.6	60.0	60.0	59.7	59.6	56.6
Petrographic Stability (2)		58.6	57.2	57.1	57.0	57.0	57.0	57.0	57.0	56.9	57.0	57.0	56.8	57.0	56.1	56.7	56.7	56.1	56.8	56.0	56.1	56.6	56.5	56.4
Seams 11-20	44.8	40.9	40.8	39.0	40.5	39.5	41.0	41.86	39.5	40.1	39.7	37.3	35.4	38.8	28.4	38.3	36.9	30.9	34.5	25.8	30.5	33.7	33.6	18.8
Seams 4,6,7,9	4.6	22.9	27.8	30.3	27.9	28.2	25.7	26.3	26.4	26.3	27.5	29.8	29.7	30.2	30.0	28.9	29.7	32.0	31.0	34.8	33.2	31.3	31.2	38.6
Seams 2,3,5,8	50.6	36.2	31.4	30.7	31.6	32.3	33.3	31.84	34.1	33.6	32.8	32.9	34.9	31.0	37.6	32.8	33.4	37.1	34.5	39.4	36.3	35.0	35.2	42.6

(1) Based on Seam Percentages as per Table II - 6.5.6.2 - T2

(2) Source: STELCO, based on 1.6 S.G. cum. Float and
Seam Percentages as per Table II - 6.5.6.2 - T3

( ) Ash and Vol. M.% in brackets = product of approx. 9.5% ash.

6.4 Clean Coal Quality and Cokeability

The establishment of a clean coal product quality and its cokeability was based on two factors:

- the conclusion that the 1975/76 bulk sample washability and cokeability test results (tested at semi-industrial scales) were representative of the entire deposit, and
- the proportioning of the various seam volumes in composite blends consistent with their occurrence in the deposit.

Considering the various quality parameters, the individual seams can be classified under different aspects as exhibited in Table II-6.5.6.2-T1, page 65 .

For the purpose of planning this project, however, the following grouping of seams has been chosen:

Group	Seam Nos.	Classification
Ia	2,3,8,10	Low volatile with good to moderate cokeability
Ib	4,6,7,9	Low volatile with inferior cokeability
II	11 through 18 (incl. 19+20)	Medium to high volatile with good to excessive cokeability

In order to maintain a clean coal production of constant and acceptable quality on a long and short term basis it was established that the above groups would have to be blended at the following ideal ratios:

Ia : Ib : II = 33 : 28 : 39

ELK - RIVER - Seam coals
Specified According to Quality Groups

TABLE: II - 6.5.6.2 - T1

Seam	2	3	4	6	7	8	9	10	12	13	14	15	16	17	18
Coalification Three groups	high rank $\bar{R}_m$ 1.44 - 1.36							medium rank $\bar{R}_m$ 1.29 - 1.12					lower rank $\bar{R}_m$ 1.04 - 0.97		
Petrographic Composition Two groups	rich in inertinites corresponding to a low content of vitrinites Inertinite 39 - 53 % Vitrinite 59 - 40 %							rich in vitrinites corresponding to a low content of inertinites Vitrinite 61 - 74 % Inertinite 21 - 13 %							
Volatile Matter Three groups	low volatile 19 - 22 % Fl.B. (d.a.f.)							medium volatile 24 - 28 % Fl.B- (d.a.f.)					high volatile 30-33 % Fl.B. (d.a.f.)		
Sulphur content Two groups	very low sulphur content 0.44 - 0.68 % (dry)							low sulphur content 0.77 - 1.02 % (dry)							
Coking behaviour and coke quality Three groups	sufficient to acceptable cokeability Free Swelling-Index 6-8 Fluidity 7-109 G-value 0.945-1.022 sufficient abrasion and cohesion indices of coke M40 71-79% M10 9-15%							very weak cokeability Swelling-Index 2 - 5 1/2 Fluidity 0 - 2 G-value (a) in individual seams = 0-0.553 (laboratory) (b) in blends with all other seams in proportions of 70-55% = 0.70-0.90 high abrasion and low cohesion of coke M 40 53 - 66 % M 10 20 - 34 %					acceptable to very good cokeability Swelling-Index 7 1/2 - 8 Fluidity 79 - 1600 DDPM G-value 1.036 - 1.082 normal abrasion and normal cohesion M 40 75 - 80 % M 10 9 - 10 %		

This has been accomplished for the ROM coal by mine planning at proportions as listed in Table II-6.5.6.2-T2, page 67. From this it becomes evident that both the first 10 years as well as the entire lifetime production are very similar to the already tested bulk samples "C" and in particular "A".

Taking into account the proportions of clean coal yields obtained from the 1975/76 bulk samples of the various seams (pilot plant scale washing tests) ROM coals as recorded in Table II-6.5.6.2-T2, page 67, convert into clean coal at proportions compiled in Table II-6.5.6.2-T3, page 68. Again it becomes evident that the composite clean coal to be expected in the first 10 years, as well over the entire lifetime of the project, would also be very close to the bulk sample tests, composites "A" and "C".

This concludes that not only the raw coal quality of the 1975/76 bulk samples was representative for the entire deposit (see chapter 6.2) but also in proportion to the individual seams. Therefore, and in accordance to the mine plan (Alternative "D") established for this project, a composite ROM and clean coal will be produced in a blend very close to the ones already tested at a semi-industrial scale and accepted by the partners in the Elk River coal project.

By having proven the raw coal (ROM) quality of the 1975/76 bulk samples to be representative of the entire deposit the assumption is justified that the quality of the clean coal washed from these bulk samples would also be representative of the entire deposit.

These clean coal qualities are recorded in table II-6.5.6.3-T1, page 69, and in combination with the clean coal quantities as projected for the first 10 years and the entire lifetime of the project (table II-6.5.6.2-T3, page 68, result in weighted average clean coal qualities for the two periods as per table II-6.5.6.3-T2, page 70.

TABLE II-6.5.6.2-T2
RUN OF MINE COMPOSITE SAMPLES
MINE PLANS "A", "C" and "D"

Group	Seam #	Pre-Feasibility Stage Composite Samples, Representative for Mining Alternative "A" wt%	Pre-Feasibility Stage Composite Samples, Representative for Mining Alternative "C" wt%	Feasibility Stage Production Forecast for years -1 to 9 Mining Alternative "D" wt%	Feasibility Stage Total ROM Reserves for years -1 to 36 Mining Alternative "D" wt%
Ia	2	8.8	9.7	10.9	9.05
Ia	3	3.6	4.4	4.2	4.28
Ib	4	15.8	18.1	17.4	16.53
Ib	5	-	-	0.6	0.78
Ib	6	2.9	4.2	2.5	3.72
Ib	7	2.3	2.9	1.6	3.04
Ia	8	8.7	10.6	9.9	10.20
Ib	9	6.9	7.8	5.9	7.94
Ia	10	12.4	14.2	6.9	10.85
II	11(12)	6.7	7.6	9.1	7.64
II	12	)		8.8	7.94
II	13(13)	6.8	8.8	4.0	5.06
II	14	)		5.8	4.87
II	15(14)	5.7	5.5	5.0	3.01
II	16(15)	5.7	3.6	2.8	2.26
II	16(16)	4.3	1.6)		
II	17	4.3	1.0	3.2	2.18
II	18	5.1	0.9	1.1	0.59
II	19	-	-	0.2	0.04
II	20	-	-	0.1	0.02
		100.0	100.0	100.0	100.0
Group I(a) in %		33.5	38.9	32.5	35.16
" I(b) "		27.9	33.0	27.4	31.23
" II "		38.6	28.1	40.1	33.61

( ) figures in brackets = old sample/seam correlation

TABLE II - 6.5.6.2 - T3

CLEAN COAL COMPOSITE SAMPLES, TOTAL RESERVES

AND PRODUCTION FOR FIRST 10 and 37 YEARS (Mine Plan "D")

Group	Seam #	Pre-Feasibility Stage Composite Samples, Representative for Mining Alternative "A" wt%	Pre-Feasibility Stage Composite Samples, Representative for Mining Alternative "C" wt%	Feasibility Stage Production Forecast for First Ten Years; Mining Alternative "D" wt%	Feasibility Stage Total Clean Coal Reserves for 37 Yrs. Mining Alternative "D" wt%
Ia	2	8.0	8.8	7.6	6.5
Ia	3	5.0	6.1	5.6	5.6
Ib	4	18.8	21.3	22.7	21.4
Ib	5	--	--	0.7	--
Ib	6	3.6	5.2	2.8	4.0
Ib	7	2.1	2.6	0.9	1.7
Ia	8	8.9	10.7	12.9	13.1
Ib	9	8.5	9.5	8.6	11.3
Ia	10	15.0	17.0	8.2	12.6
II	11(12)	5.7	6.3	9.8	8.1
II	12 + 13(13) + 14	2.6	3.4	3.6 1.7 2.4	3.2 2.1 2.0
II	15(14)	4.1	3.9	4.6	2.7
II	16(15)	4.2	2.6	2.3	1.8
II	16	4.1	1.5		
II	17	4.6	1.1	3.9	2.6
II	18	4.8	0.0	1.4	1.3
II	19			0.2	
II	20			0.1	
		100.0	100.0	100.0	100.0
Group I(a) in %		36.9	42.6	35.0	37.8
" I(b) "		33.0	38.6	35.0	38.4
" II "		30.1	18.8	30.0	23.8

( ) figures in brackets = old sample/seam correlation

TABLE II-6.5.6.3-T1

Mean Quality Characterisiics of Elk River Coals
(1975/76 Bulk Samples)

Seam	Percentage of Recovery Composite A %	Composite C %	Volatile Matter (db) %	Volatile Matter (dab) %	Ash Content %	Sulphur Content %	Phosphorus Content %	Swelling Index	G-Value (laboratory)	Max. Fluidity DDPM
2	8.0	8.8	19.9	21.7	9.5	0.54	0.018	8	1.022	119
3	5.0	6.1	19.1	20.8	9.1	0.55	0.127	7 1/2	0.955	21.2
4	18.3	21.3	18.2	19.9	8.5	0.39	0.024	4	0	2.0
6	3.6	5.1	18.3	20.1	9.9	0.69	0.119	2 1/2	0	1.0
7	2.1	2.6	18.8	20.9	10.7	0.61	0.043	5	0	1.8
8	8.9	10.7	19.2	20.9	8.7	0.48	0.055	5	0.384	3.1
9	8.5	9.5	18.5	21.3	8.3	0.45	0.027	4 1/2	0.250	2.3
10	15.0	17.0	21.0	22.8	8.6	0.44	0.026	6	0.718	2.9
11(12)	1.5	1.8	22.7	24.8	9.1	0.71	0.048	8 1/2	1.038	132
12 + 13(13) + 14	2.6	3.4	23.4	26.2	10.5	1.01	0.060	8 1/2	1.054	284
15 (14)	4.1	3.9	26.0	28.2	8.1	0.84	0.052	8 1/2	1.083	1004
16 (15)	4.2	2.6	25.8	28.0	8.2	0.80	0.047	8	1.052	280
16	4.1	1.5	27.6	30.6	10.4	0.78	0.096	8	1.067	1090
17	4.6	1.1	29.2	31.3	7.1	0.76	0.065	8	0.069	1146
18	3.7	0.0	30.6	33.0	7.4	0.76	0.048	8	1.080	2220
19	1.1	0.0	30.6	33.0	7.4	0.76	0.048	8	1.080	2220
A	100.0		21.3	23.3	8.8	0.58	0.051	7 1/2	0.952	17.1
C		100.0	20.1	22.2	9.4	0.51	0.050	6 1/2	0.850	5.2

( ) figures - Brackets = 1975 bulk samples/seam correlation

TABLE II-6.5.6.3-T2

AVERAGE CLEAN COAL CHARACTERISTICS FOR MINING ALTERNATIVES "A", "C" and "D"

(Based on 1975/76 Bulk Samples Analyses)

Components	Pre-Feasibility Stage			Feasibility Stage Alternative "D"			
	Composite Samples Representative for Mining Alternatives			Production Forecast		Total Reserves	
	"A" %	"C" %	VARIATION OF SEAMS AVERAGE	Years -1 to 9		Years -1 to 36	
	(DOC. 12.7, Annex 5, Table 11)			%		%	
Vol. Matter %(d.b)	21.3	20.1	18.2 - 30.6	20.8	(20.7)	20.5	(20.4)
%(d.a.b.)	23.3	22.2	19.9 - 33.0	22.8	(22.9)	22.5	(22.3)
Ash % (d.b)	8.8	9.4	7.1 - 10.7	8.8	(9.5)	8.9	(9.5)
Fixed Carbon % (d.b.)	69.9	70.5					
Sulphur %(d.b.)	0.58	0.51	0.39 - 1.01	0.57	(0.6)	0.55	(0.6)
Phosphorus % (d.b)	0.051	0.050	0.018 - 0.127	0.046	(0.04)	0.046	(0.03-0.04)
Alkali Oxides %(d.b)	0.10	0.09					
Free Sweeling Index	7 1/2	6 1/2	4 - 8 1/2	6	(6)	6	(6)
G-Value (laboratory)	0.95	0.85	0 - 1.083	0.948**		0.875**	
Max. Fluidity (DDPM)	17.1	5.2	1 - 2,220	15.8	(17.9)	10.7	
Rm Vitrinite %	1.31	1.36	1.0 - 1.47		(1.34)		(1.35)

( ) Figures in Brackets: results in independent computer calculations by TECHMAN, based on bore samples' assessment.

** G-Value calculated according to Graph II - 6.5.6.3 - G1, page 72.

Also from this table it can be concluded that the clean coal to be produced according to the mine plan of this project would be of the same quality as in bulk samples "A" and "C".

Some uncertainty in this assessment, however, is created by the fact that the figures obtained by measuring the cokeability of individual coal samples (e.g. F.S.I., G-Value, Fluidity) can only be used for weighted average calculations to a limited extent. Therefore, to eliminate this uncertainty, the 1976/77 bore sample quality investigations were supplemented by an extensive testing program involving maceral analysis and fluidity testwork.

From this it was learned that the 1975/76 bulk sample clean coal cokeability was representative for the entire deposit. It was also learned that no cokeability trends along strike and dip of the individual seams occur across the deposit, beyond a minor level of inherent variation.

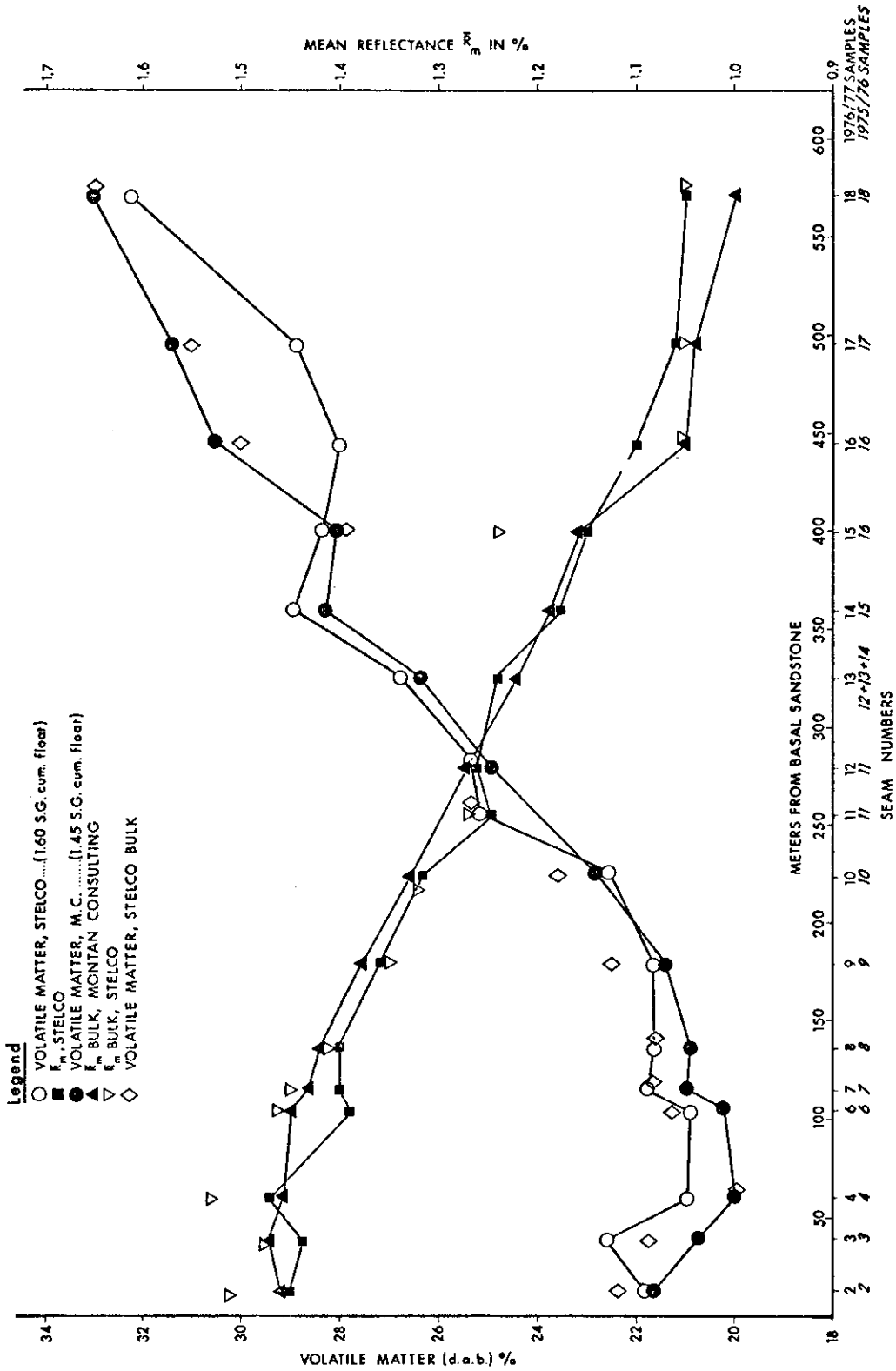
As a result of the above assessments the cokeability of the average Elk River clean coal (according to mine plan "D") can be described in terms of the various parameters as follows:

a. Volatile Matter and Rank

The rank of a coal is characterized by the volatile matter content (d.a.b.) and the mean reflectance $R\tilde{m}$. These parameters are exhibited on graph II-6.5.6.3-G1, page 72, by seams. A good coincidence between 1976/77 bore samples and 1975/76 bulk samples is recorded in support of the assessment that the 1975/76 bulk samples were representative for the entire deposit with respect to volatile matter and rank of the clean coal.

b. Sulphur and Phosphorus

Average sulphur contents which range between 0.5 - 0.6% (d.b.) for any blends are in the same magnitude for the sulphur contents of other metallurgical coals shipped from the Fernie Basin.



ELCO MINING LIMITED

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

VOLATILE MATTER AND
R_m OF VITRINITE

DATE: AUGUST, 1977 | DRWG NO: L-439

COMPILED BY: ELCO MINING LIMITED

It should be noted that the average sulphur content of the individual seams varies between 0.39 and 1.01%, and, in general, indicate an increase from the lower seams to the higher ones. Coefficients of variation and 95% confidence levels, however, are of the order where the control of the sulphur grade in a clean coal should be handled without difficulties.

The situation with regard to phosphorus is different. Averages of any blends analyzed in Canada proved to be in the vicinity of 0.05% P (d.b.) and would result in a phosphorus content of 0.07% on an average when carbonized. This, however, would represent the utmost acceptable to any consumer. In comparison, double check analyses on phosphorus conducted in Europe suggest that the Canadian analyses might be by 20-30% too high. Therefore, it is probable that the average phosphorus content of a clean coal product will prove to be in the order of 0.03 - 0.04%, which is well within specifications.

c. Petrography and Maceral Analysis

Results of maceral analysis conducted with 68 bore samples recovered from all the seams and across the entire deposit are recorded in summary on table II-6.5.6.3-T4, page 74. It becomes evident that the total percentage of reactives in the composites under consideration is in the range of 64.3 - 66.7% together with a mean reflection $\bar{R}m$ around 1.35.

Comparison of individual measurements on a seam by seam basis has indicated that mean reflectance and vitrinoid contents do not trend across the deposit, and, based on the petrographic composition, the cokeability would not change accordingly.

d. Petrographic Stability for North American Use

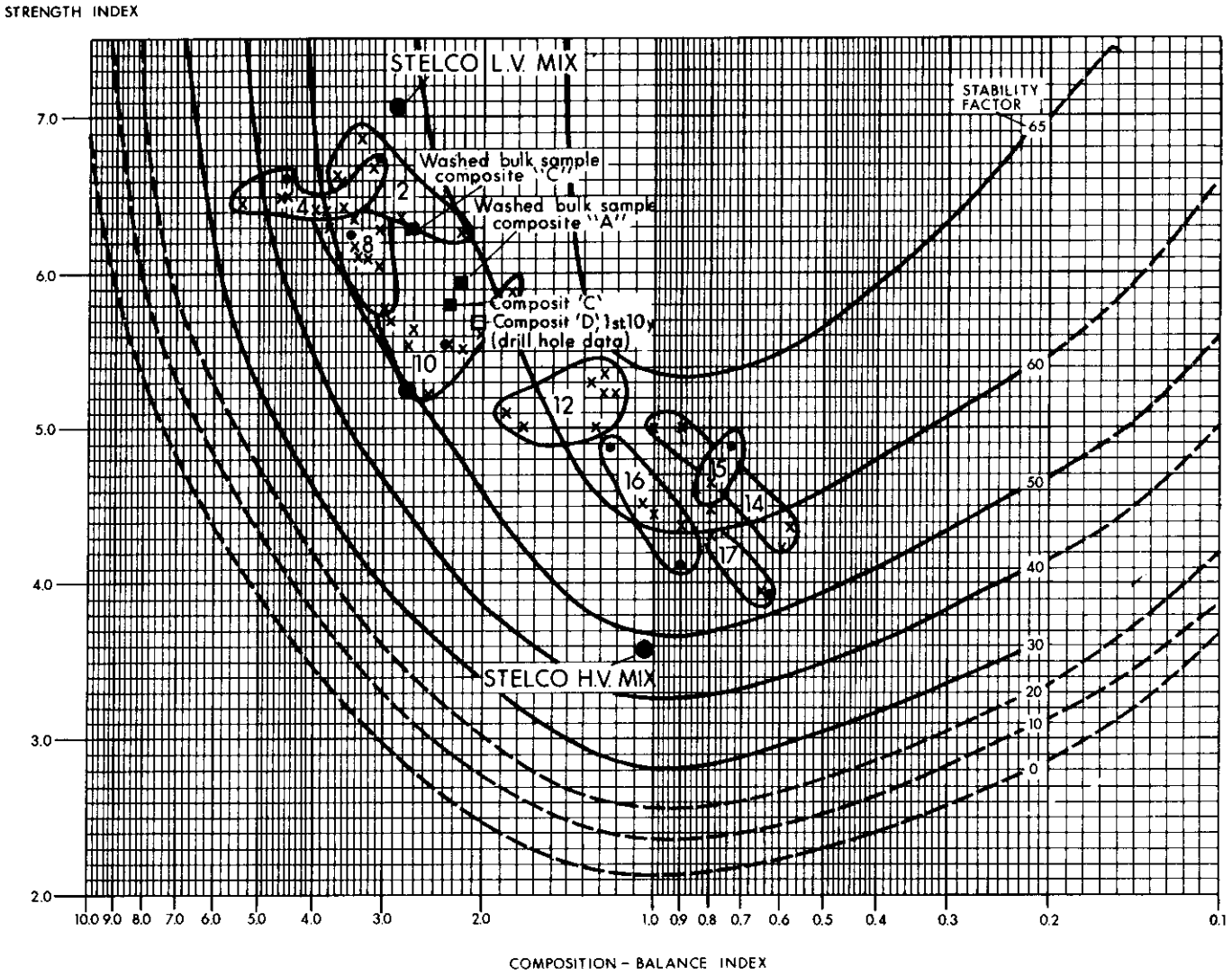
Graph II-6.5.6.3-G3, page 75, shows the petrographic stabilities on a seam by seam basis, plotted against composite blends and coking coal mixes as used by one of the Canadian partners in the project (STELCO).

TABLE : II - 6.5.6.3 - T 4

MACERAL ANALYSIS OF ELK RIVER COMPOSITE SAMPLES (STELCO)

MACERALS	1975/76 BULK SAMPLES "A"	1975/76 BULK SAMPLES "C"	1976/77 DRILL SAMPLES "C"	1976/77 DRILL SAMPLES "D" Years -1 to 9	1976/77 DRILL SAMPLES "D" Years -1 to 36
REACTIVES:					
Total Vitrinoids %	57.4	56.9	55.7	55.47	56.16
Exinoids & Resinoids %	1.4	0.3	0.16	0.32	0.21
1/3 Semifusinoids *) %	7.9	7.9	8.44	8.08	8.38
INERTS:					
2/3 Semifusinoids	15.9	15.6	16.98	16.31	16.83
Fusinoids	12.1	14.0	12.17	11.40	11.90
Micronoids	0.4	1.1	1.87	1.86	1.87
Mineral Matter %	4.9	4.2	4.68	4.56	4.65
R_m Vitrinoids	1.36	1.43	1.36	1.34	1.35
Total Reactives	66.7	65.1	64.30	65.87	64.75
Total Inerts	33.3	34.9	35.70	34.13	35.25

*) Semifusinoids correspond to Semi-inertinite of R max. <2.0 % as used in Europe.



- ● 1975 BULK SAMPLES
- x 1976-77 DH SAMPLES

(12) SEAM NUMBER

- ■ 1975 BULK SAMPLES COMPOSITE 'A' & 'C'
- □ COMPOSITES 'C' & 'D' BASED ON 1976/77 DRILL HOLE SAMPLES

ELCO MINING LIMITED

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

PETROGRAPHIC STABILITIES OF ELK RIVER COALS

DATE: AUGUST, 1977	DRWG NO: L-446
COMPILED BY: STELCO	

Petrographic stabilities for the first 10 years of production as well as the entire lifetime of the project amount to 57.6 units and 56.5 units respectively and prove to be in the same category as the 1975/76 bulk samples tested earlier.

The location of the Elk River blend in the stability diagram indicates the high blending potential of this coal. In fact, the use of 30% Elk River blend as a replacement for a STELCO low-vol. mix in their anticipated 1984 blend would result in an increase of 0.2 stability units.

e. Fluidity for Japanese Use

Table II-6.5.6.3-T5, page 77, records the average fluidity data for the individual seams and various blends. A good coincidence between bulk and bore samples' data becomes evident. On Graph II-6.5.6.3-G5, page 78, the average fluidity figures of the Elk River coal are plotted against the mean reflectance to assess the coking potential for use by the Japanese steel industry.

The graph is self-explanatory and shows the position of the Elk River blend coal in comparison to US - low vol. and Australian medium vol. coals which can be considered its main competitors on this market.

f. Coking Capacity (G-Value) for European Use

The coking capacity is derived by a mathematical formula from test results obtained by a Ruhr dilatometer. The G-Value established by this means is plotted on a graph versus the volatile matter content (d.a.b.) of the coal, and the position of the relevant coal in the diagram evaluates the cokeability of the coal.

Graph II-6.5.6.3-G6, page 79, exhibits a good to excessive coking capacity for the Elk River Seams 2, 3 and 11 through 18, situated between the fields of US - high and low vol. coking coals. Seam Group 4 through 10, however, are characterized by a deficient coking capacity.

TABLE: II - 6.5.6.3 - T5

Average Gieseler Plastometer Data for Elk River Seams and Blends (STELCO)

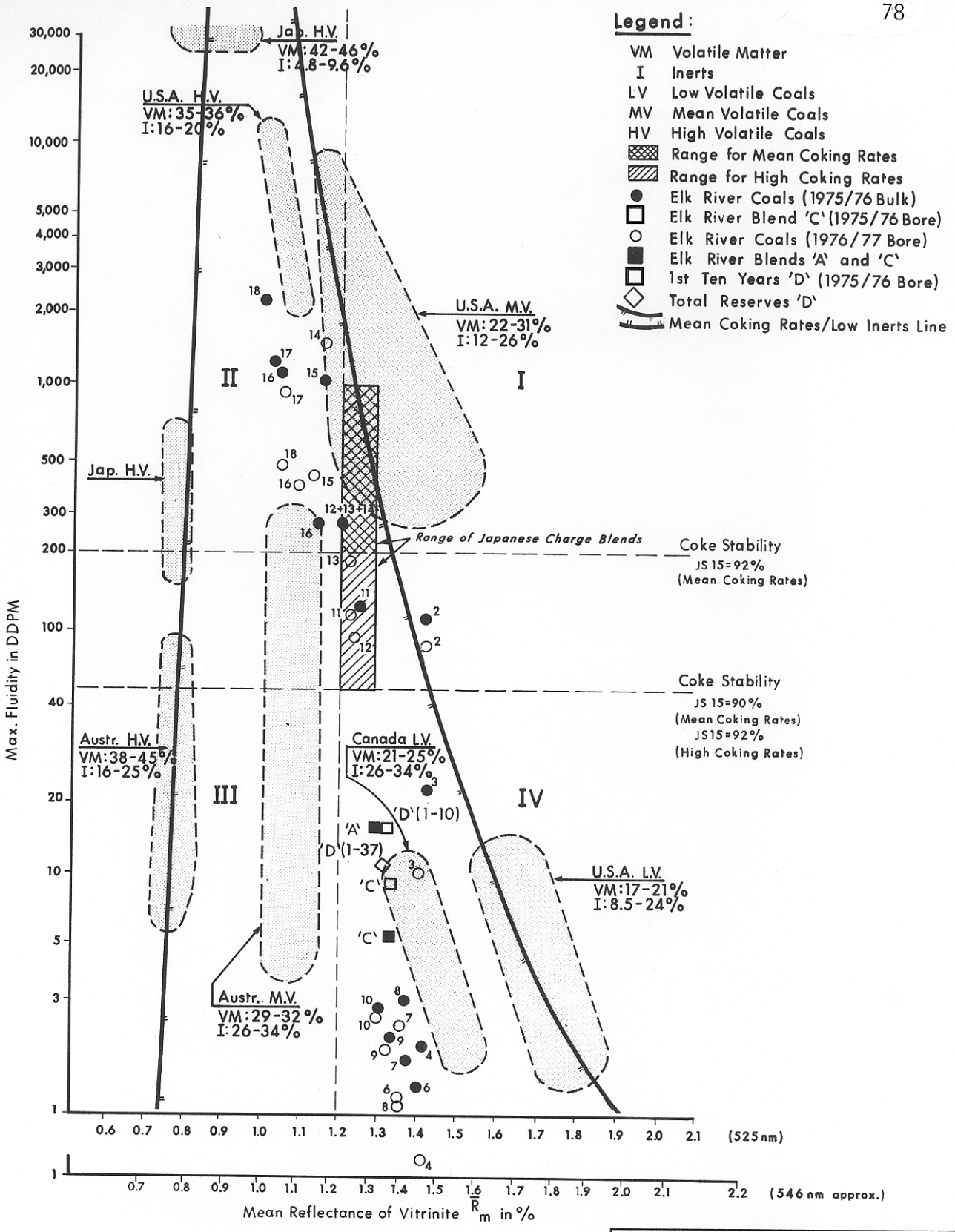
Gieseler Plastometer Properties	Seam Number																Alternatives			
	2	3	4	6	7	8	9	10	11	12	13	14	15	16	17	18	"A"	"C"	"D" Years 1-10	"D" Years 1-37
Max. Fluidity (ddm) Drill Holes (1976-77)	82	10	0.7	1.3	1.8	1.2	2.1	2.8	121	99	193	1109	421	408	977	491	--	9.3[xx]	15.8[xx]	10.7[xx]
Bulk (1975)	125	17	1.9	0.7	2.0	2.9	2.0	3.4	172	NA	NA	NA	1331	636	1869	3314	35	8.4		
Bulk (1975)[x]	119	21.2	2.0	1.0	1.8	3.1	2.3	2.9	132	284			1004	1030	1146	2220	17.1	5.2		
Max. Fluidity Temp.(°C) Drill Holes (1976-77)	473	473	466	467	470	467	467	465	463	462	460	459	458	459	458	459			466	466
Bulk (1975)	477	483	486	474	481	483	481	478	477	NA	NA	NA	465	464	463	452	473	478		
Melting Range (°C) Drill Holes (1976-77)	52	45	4	11	24	7	13	19	61	57	63	81	71	70	79	69	55	44	37	33
Bulk (1975)	60	48	25	54	27	29	25	38	63	NA	NA	NA	83	72	73	79				

NA - Not Available

x) Overall average of STELCO, Montan Consulting, Italsider, CMR Results

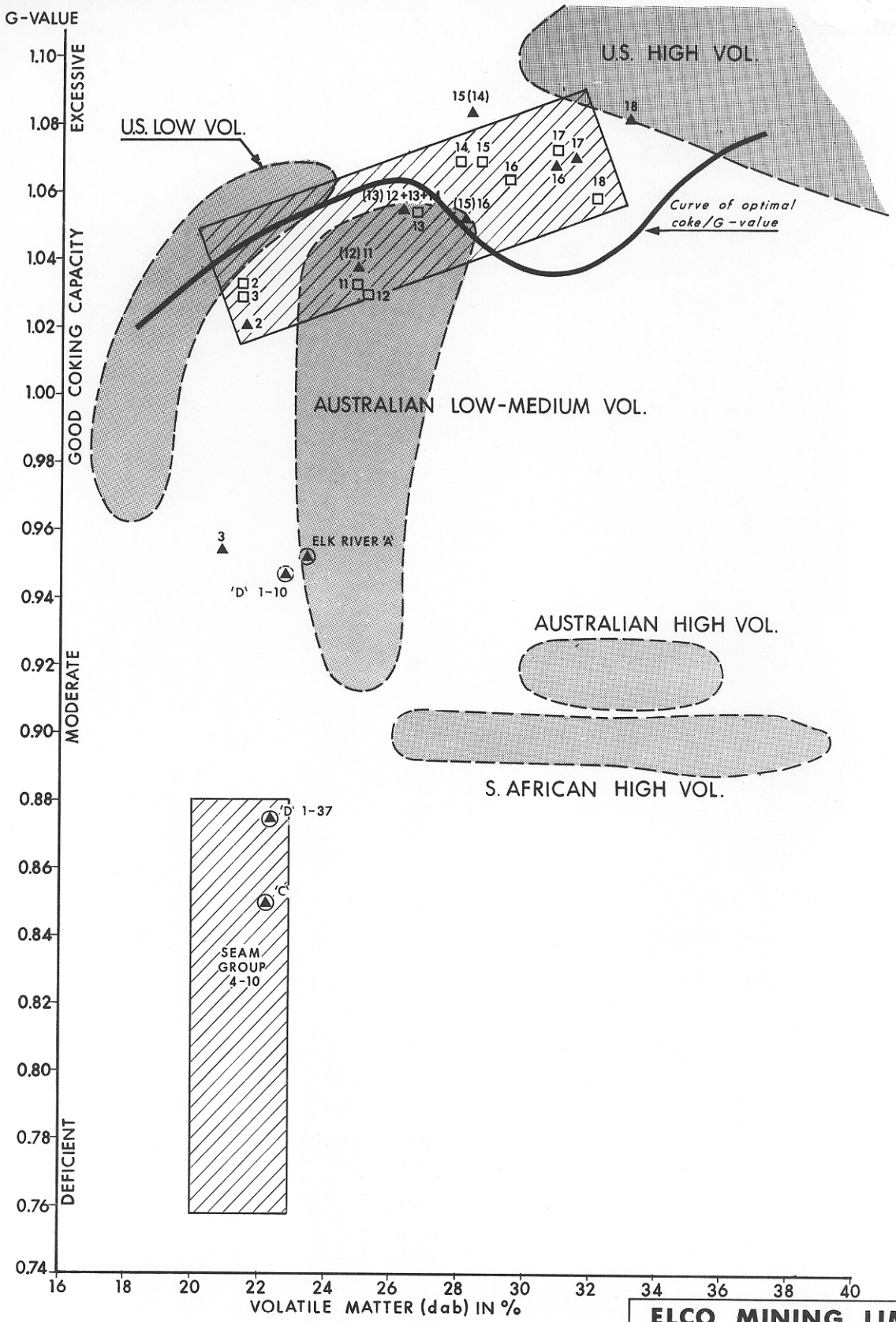
xx) Calculated

NOTE: Max. Fluidity Temp. and Melting Range for Alternatives "D" are very broad and general estimates only.



Note: ELCO data plotted on 546nm scale.

ELCO MINING LIMITED	
ELK RIVER COAL PROJECT BRITISH COLUMBIA	
MEAN REFLECTANCE AND MAX. FLUIDITY IN ELK RIVER COALS IN COMPARISON WITH BLEND COMPONENTS USED IN JAPAN	
DATE: AUGUST, 1977	DRWG NO: L·440
COMPILED BY: ELCO MINING LIMITED	



Legend

- ▲ 1975/76 BULK SAMPLES
- □ 1975/77 1.5 S.G. FLOAT OF ALL DRILL SAMPLES
- ⏏ COMPOSITE SAMPLES

ELCO MINING LIMITED

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

G-VALUES OF ELK RIVER COALS AND BLENDS

DATE: AUGUST, 1977 | DRWG NO: L-444

COMPILED BY: MONTAN CONSULTING

Only when blended with the high coking capacity seam group can a moderate cokeability be achieved for this coal. This is provided for by the projected production of the first 10 years, and, to a less extent, for the entire production life of the project.

g. Final Assessment of Elk River Coal Cokeability

Using the individual seam clean coal tonnages and average quality data in proportions as produced in the first 10 years and during the entire lifetime of the project, the following parameters

- petrographic stability,
- fluidity/$\bar{R}m$ ratio, and
- G-Values

can be established by means of computation.

By plotting these data on relevant charts, the first 10 years average clean coal always plots in the immediate vicinity of composite "A", which has been accepted by the partners of the project because of the results of its 1975/76 cokeability tests.

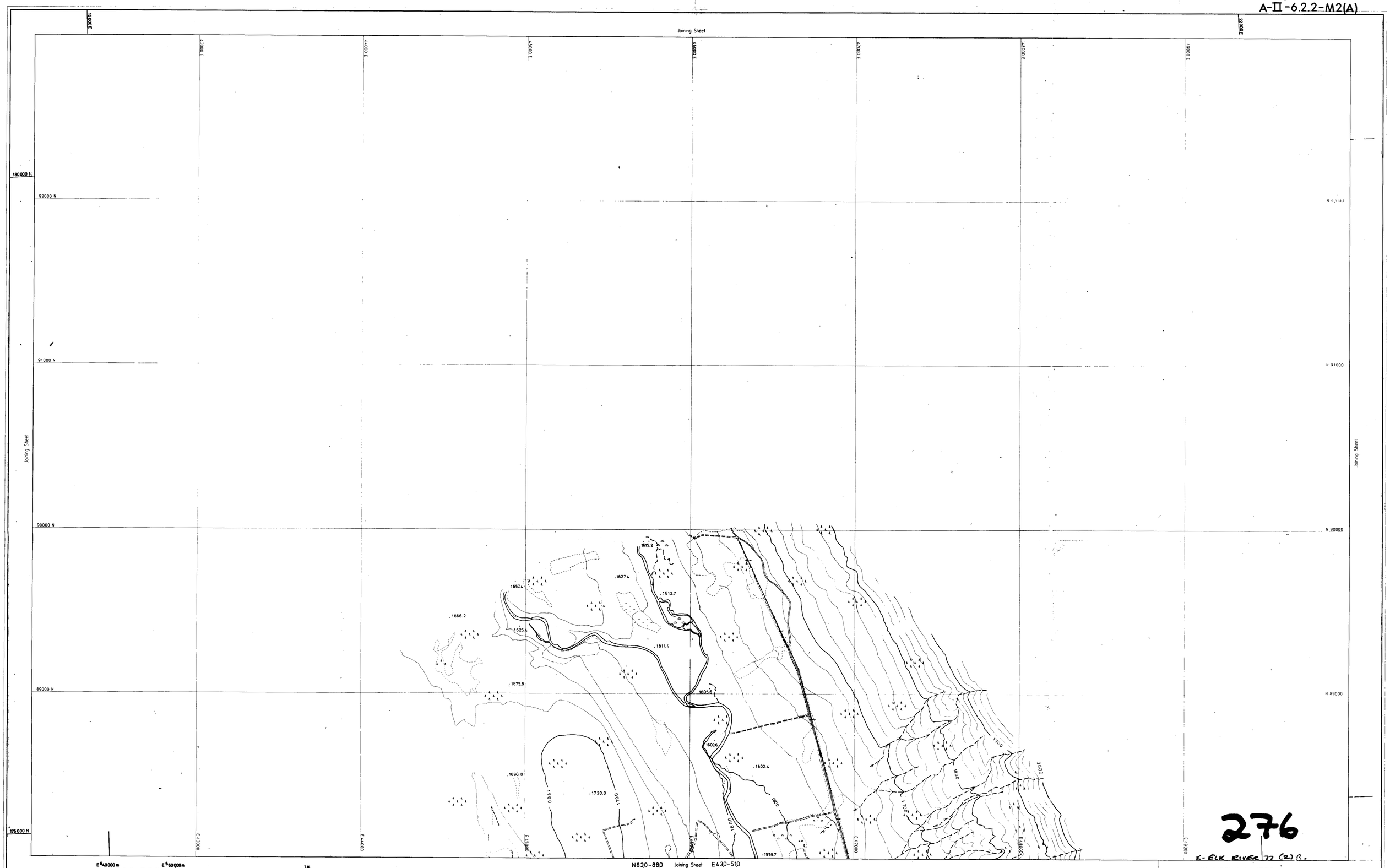
In comparison, the position of the reserves to be mined over the entire lifetime of the project proves to be between the tested composites "A" and "C". This is attributable to the lower percentage of high-volatile seams with excessive coking capacity in composite D_{1-37}.

Therefore, it is justified to conclude that the final assessment of the Elk River coal's cokeability, as arrived at in 1975/76, is also applicable for the first ten years average production of the project as well as for the rest of the projected 37 years of operation as considered in the Feasibility Report.

7. Supplemental Plan of Operations for Extended Term of Licence

Planning and scheduling of further work on the Elk River Coal licences during the next licence term (ending December 5, 1978) has not been implemented to date, due to the preparation of the Feasibility Study and the Stage II Report. When plans for further work have been completed, a "Supplementary Plan of Operations", pursuant to Section 3.(2) of the Coal Act Regulations, will be filed at least 30 days prior to commencement of work.

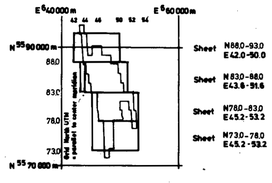
A-II-6.2.2-M2(A)



276

K-ELK RIVER 77 (2) B.

Sheet division:



Sheet N88.0-93.0 E42.0-50.0

Sheet N83.0-88.0 E43.6-51.6

Sheet N78.0-83.0 E45.2-53.2

Sheet N73.0-78.0 E45.2-53.2

UTM
Zone 11
Center Meridian
= 117° W. Gr.

Angle of Convergence
= 1° 38'

Magnetic Declination
= 20°

REMARKS:

AERIAL SURVEYING
MCELHANNEY SURVEYING & ENGINEERING, LTD
VANCOUVER, CANADA

NUMERICAL EVALUATION
RHEINBRAUN, KÖLN
GERMANY

COMPUTER PLOTTING
GEOMAP 80, SYSTEM
GEOMESS ING. GMBH
ESSEN, KETTWIG
GERMANY

EMGS CO-ORDINATES (METRIC GRID)
BEARINGS ARE REFERRED TO THE CENTRAL MERIDIAN OF UTM. ZONE 11, 117°00'00" W.
THE ORIGIN OF THE CO-ORDINATES IS THE FEDERAL GOVERNMENT CO-ORDINATE FOR MT. BLEASDELL WHICH IS CLASSIFIED BY THE GOVERNMENT AS A FOURTH ORDER STATION.
DISTANCES ARE REDUCED TO 1500M DATUM AND THE CO-ORDINATES ARE IN METRES.
*MK/MCELHANNEY SYSTEM (METRES)

LEGEND:

FEDERAL GOVERNMENT CONTROL SHOWN △
HORIZONTAL CONTROL △ 1304
HIGH-TENSION LINE
CREEK
ROAD
TRACK OR TRAIL
BUILDINGS
CONTOURS 1700 1600
LAKE
LAND USE BOUNDARY
SWAMP
MIXED FOREST

ELCO MINING LIMITED
ELK RIVER COAL PROJECT
Topographic Map
Sheet N 88.0 - 93.0 E 42.0 - 50.0 MOUNT LOOMIS

0 0.5 1km

Scale 1: 10 000

Date : Aerial Survey October 1976

Number of Map:

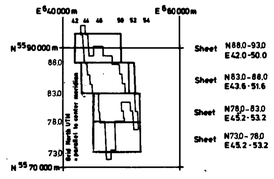
N880-930 Joining Sheet E420-500

N780-830 Joining Sheet E450-530

Joining Sheet N880-930 E420-500

Joining Sheet N730-780 E450-532

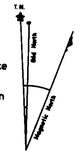
Sheet division:



UTM
Zone 11
Center Meridian
= 117° w. Gr.

Angle of Convergence
= 1° 38'

Magnetic Declination
= 20°



Date : Aerial Survey October 1976

REMARKS:

AERIAL SURVEYING
MCELHANNEY SURVEYING & ENGINEERING, LTD
VANCOUVER, CANADA

NUMERICAL EVALUATION
RHEINBRAUN, KÖLN
GERMANY

COMPUTER PLOTTING
GEOMAP 80, SYSTEM
GEOMESS ING. GMBH
ESSEN, KETTWIG
GERMANY

EMGS CO-ORDINATES (METRIC GRID)
BEARINGS ARE REFERRED TO THE CENTRAL MERIDIAN OF UTM. ZONE 11, 117°00'00" W.
THE ORIGIN OF THE CO-ORDINATES IS THE FEDERAL GOVERNMENT CO-ORDINATE FOR MT. BLEASDELL WHICH IS CLASSIFIED BY THE GOVERNMENT AS A FOURTH ORDER STATION.
DISTANCES ARE REDUCED TO 1500 M DATUM AND THE CO-ORDINATES ARE IN METRES.
x MK/ MCELHANNEY SYSTEM (METRES)

LEGEND:

FEDERAL GOVERNMENT CONTROL SHOWN △
HORIZONTAL CONTROL △ 1304
HIGH-TENSION LINE
CREEK
ROAD
TRACK OR TRAIL
BUILDINGS
CONTOURS 1700 1600
LAKE
LAND USE BOUNDARY
SWAMP
MIXED FOREST

ELCO MINING LIMITED
ELK RIVER COAL PROJECT

Topographic Map

Sheet N830-880 E430-510 GARDNER CREEK

0 0.5 1km

Scale 1: 10 000

Number of Map:

276

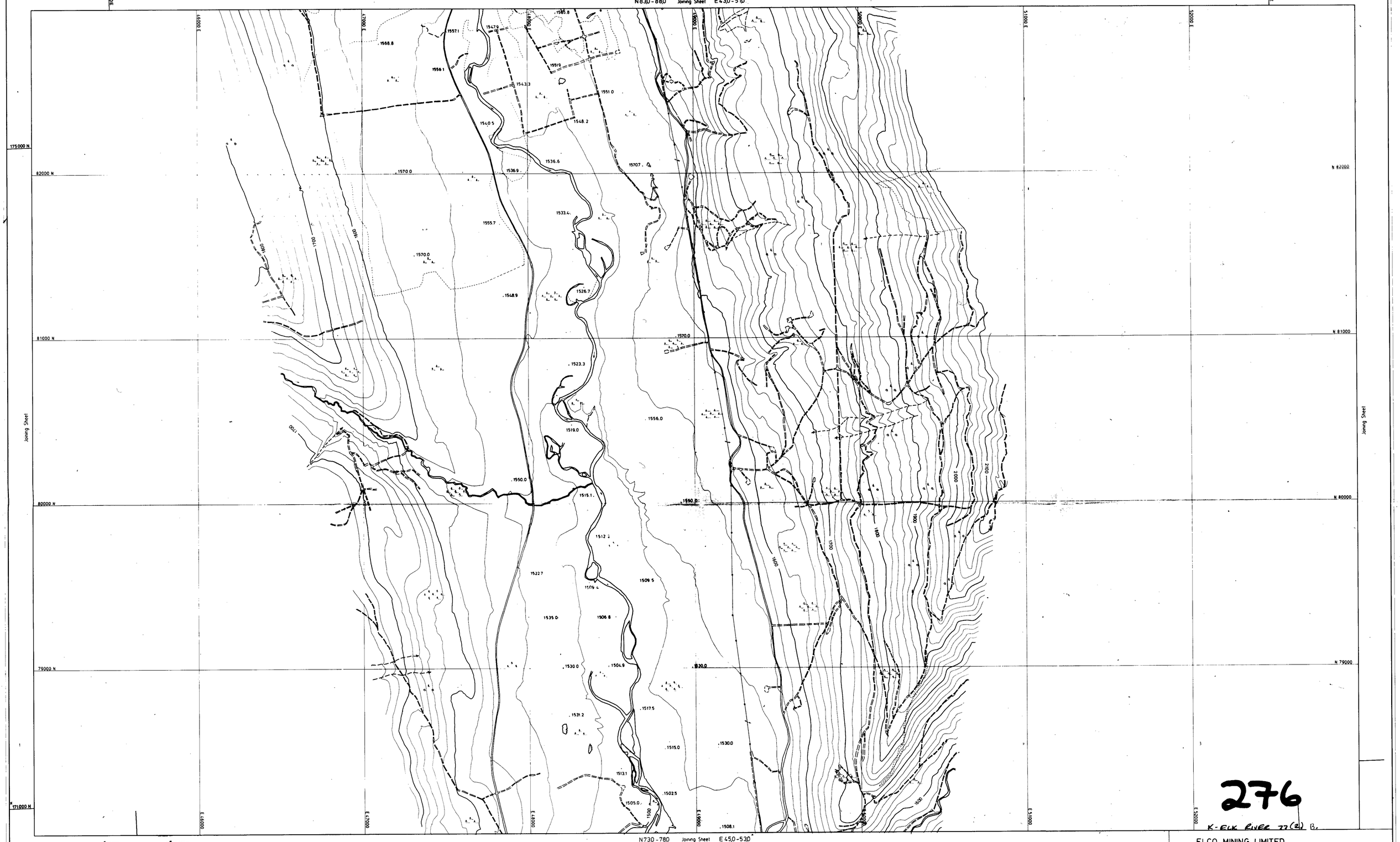
K-ELK RIVER 72 (2) B

N830-880 Joining Sheet E430-510

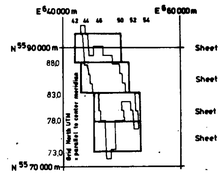
Joining Sheet

N730-780 Joining Sheet E450-530

Joining Sheet



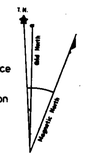
Sheet division:



UTM
Zone 11
Center Meridian
= 117° w. Gr.

Angle of Convergence
= 1° 38'

Magnetic Declination
= 20°



REMARKS:

AERIAL SURVEYING
MCELHANNEY SURVEYING & ENGINEERING, LTD VANCOUVER, CANADA

NUMERICAL EVALUATION
RHEINBRAUN, KÖLN GERMANY

COMPUTER PLOTTING
GEOMAP 80, SYSTEM GEOMESS ING. GMBH ESSEN, KETTWIG GERMANY

EMGS CO-ORDINATES (METRIC GRID)
BEARINGS ARE REFERRED TO THE CENTRAL MERIDIAN OF UTM. ZONE 11, 117°00'00" W.
THE ORIGIN OF THE CO-ORDINATES IS THE FEDERAL GOVERNMENT CO-ORDINATE FOR MT. BLEASDELL WHICH IS CLASSIFIED BY THE GOVERNMENT AS A FOURTH ORDER STATION.
DISTANCES ARE REDUCED TO 1500M DATUM AND THE CO-ORDINATES ARE IN METRES.
x MK/MCELHANNEY SYSTEM (METRES)

LEGEND:

FEDERAL GOVERNMENT CONTROL SHOWN △
HORIZONTAL CONTROL △ 1304
HIGH-TENSION LINE
CREEK
ROAD
TRACK OR TRAIL
BUILDINGS
CONTOURS 1700 1600
LAKE
LAND USE BOUNDARY
SWAMP
MIXED FOREST

Date : Aerial Survey October 1976

ELCO MINING LIMITED
ELK RIVER COAL PROJECT
Topographic Map
Sheet N780-830 E450-530 MOUNT BLEASDELL

0 0.5 1km

Scale 1: 10 000

Number of Map:

276
K-ELK RIVER 77(2) B.

N78.0 - 83.0 Joining Sheet E45.0 - 53.0

18000E 19000E 20000E 21000E 22000E 23000E 24000E 25000E

165 000 N

77000 N

76000 N

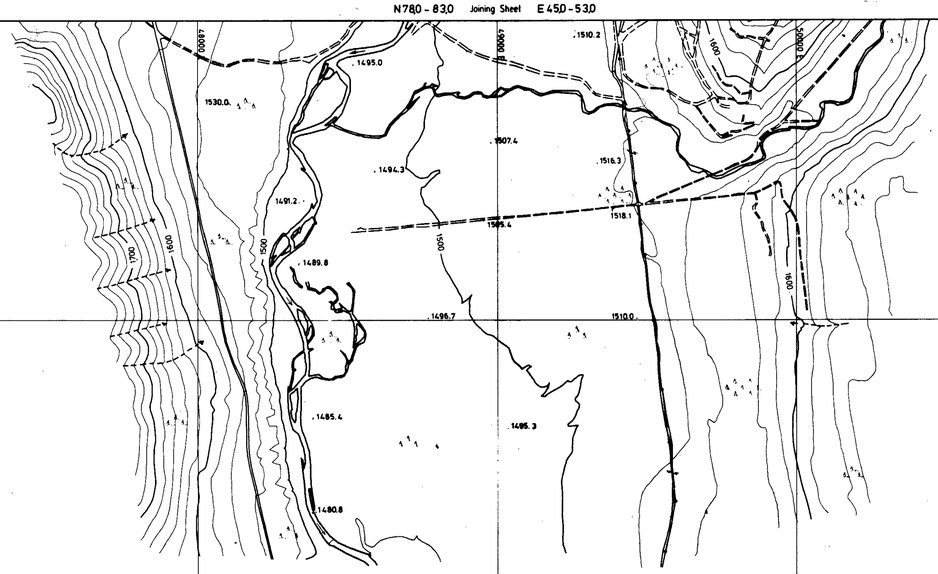
75000 N

74000 N

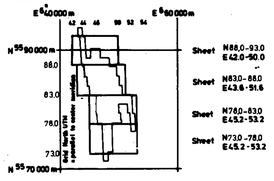
161000 N

Joining Sheet

Joining Sheet



Sheet division:

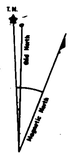


Sheet N88.0-93.0 E42.0-90.0
Sheet N83.0-88.0 E43.6-51.6
Sheet N78.0-83.0 E45.2-53.2
Sheet N73.0-78.0 E45.2-53.2

UTM
Zone 11
Center Meridian
= 117° w. Gr.

Angle of Convergence
= 1° 38'

Magnetic Declination
= 20°



Date : Aerial Survey October 1976

REMARKS:

AERIAL SURVEYING
MCELHANNEY SURVEYING & ENGINEERING, LTD VANCOUVER, CANADA

NUMERICAL EVALUATION
RHEINBRAUN, KÖLN GERMANY

COMPUTER PLOTTING
GEONAP 80, SYSTEM GEOMESS ING. GMBH ESSEN, KETTWIG GERMANY

EMGS CO-ORDINATES (METRIC GRID)
BEARINGS ARE REFERRED TO THE CENTRAL MERIDIAN OF UTM, ZONE 11, 117° 00' 00" W.
THE ORIGIN OF THE CO-ORDINATES IS THE FEDERAL GOVERNMENT CO-ORDINATE FOR MT. BLEASDELL WHICH IS CLASSIFIED BY THE GOVERNMENT AS A FOURTH ORDER STATION.
DISTANCES ARE REDUCED TO 1500M DATUM AND THE CO-ORDINATES ARE IN METRES.
x MK/ MCELHANNEY SYSTEM (METRES)

LEGEND:

FEDERAL GOVERNMENT CONTROL SHOWN △
HORIZONTAL CONTROL △ 1304
HIGH-TENSION LINE
CREEK
ROAD
TRACK OR TRAIL
BUILDINGS
CONTOURS 1700 1600
LAKE
LAND USE BOUNDARY
SWAMP
MIXED FOREST

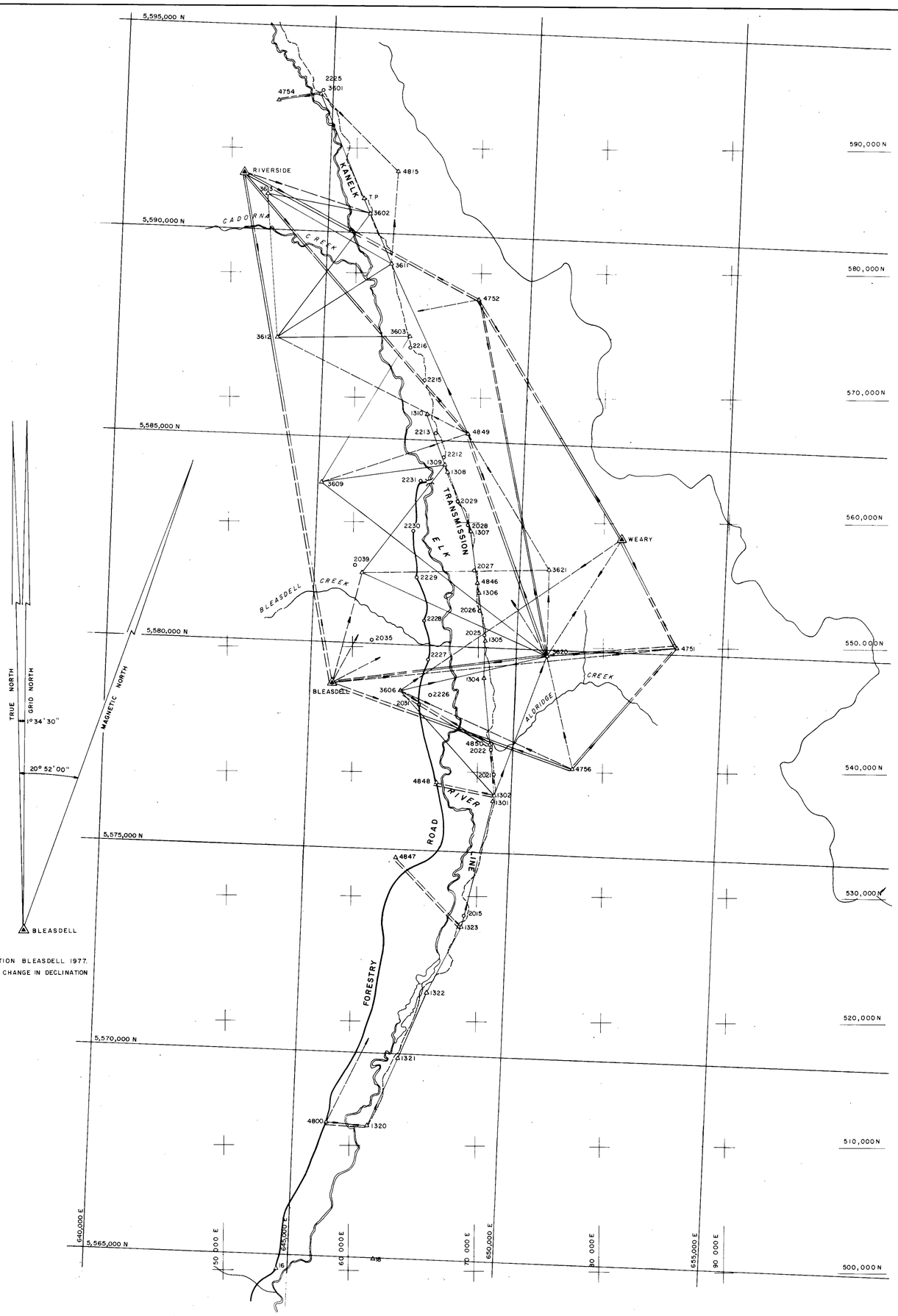
ELCO MINING LIMITED
ELK RIVER COAL PROJECT
Topographic Map
Sheet N73.0 - 78.0 E45.0 - 53.0 MOUNT VEITS

0 0.5 1km

Scale 1: 10 000

Number of Map

276
K-ELK RIVER 77(2) B



RELATIONSHIP AT STATION BLEASDELL 1977.
APPROXIMATE ANNUAL CHANGE IN DECLINATION
DECREASING 4.0'

CO-ORDINATE TABLE

STATION	NORTHING	EASTING	ELEVATION
1301	5,576,264.13	649,564.56	1529.30
1302	5,576,395.14	649,595.83	1528.94
1304	5,579,247.66	649,228.43	
1305	5,580,170.98	649,224.76	1578.77
1307	5,582,811.09	648,773.43	1621.11
1310	5,585,631.27	647,606.92	1589.84
1322	5,571,507.45	648,115.93	
1323	5,573,146.20	648,904.45	1504.68
3601	5,593,377.94	644,705.25	1644.61
3602	5,590,498.13	646,030.30	1677.01
3603	5,587,528.58	647,099.45	1617.82
3606	5,578,866.70	647,207.98	1718.92
3609	5,583,902.98	645,084.45	1906.52
3610	5,581,716.66	646,163.74	1850.50
3611	5,589,299.10	646,590.28	1673.93
3612	5,587,385.63	643,878.13	1911.25
3613	5,590,885.97	643,518.26	1885.04
3620	5,579,843.55	650,751.84	2115.77
3621	5,581,947.31	650,709.19	2225.07
BLEASDELL	5,579,003.40	645,546.10	2590.19
RIVERSIDE	5,591,387.27	642,929.77	2339.61
4752	5,588,493.87	648,758.55	2355.40
WEARY	5,582,773.13	652,447.39	2626.00
4751	5,580,137.93	653,896.21	2173.71
4756	5,577,112.99	651,458.88	2164.51
4850	5,577,632.68	649,438.27	1519.21
4849	5,585,220.47	648,607.44	1916.46
4815	5,591,549.65	646,682.52	2012.96
4848	5,576,661.75	648,174.53	1548.02
4846	5,581,582.03	648,975.36	1594.10
4847	5,574,780.79	647,256.69	1522.26
4900	5,568,277.74	645,802.28	1470.66
4754	5,593,202.87	643,684.33	1837.27
1320	5,568,199.74	646,788.31	1453.16
1321	5,569,871.97	647,487.57	
16	5,564,658.74	644,703.20	1405.68
18	5,564,977.08	647,058.87	2265.03
5198	5,584,404.50	648,116.86	1624.31

EMGS CO-ORDINATES

BEARINGS ARE REFERRED TO THE CENTRAL MERIDIAN OF U.T.M. ZONE 11, 117° 00' 00" W.

THE ORIGIN OF THE CO-ORDINATES IS THE FEDERAL GOVERNMENT CO-ORDINATE FOR MT. BLEASDELL WHICH IS CLASSIFIED BY THE GOVERNMENT AS FOURTH ORDER AND MAY BE SUBJECT TO READJUSTMENT AT A LATER DATE.

DISTANCES ARE REDUCED TO 1500 M. DATUM AND THE CO-ORDINATES ARE IN METERS.

LEGEND

- ▲ FEDERAL GOVERMENT CONTROL
- △ HORIZONTAL CONTROL
- o BENCH MARK
- ——— INDICATES DISTANCE MEASURED FROM BOTH END STATIONS
- ═══ INDICATES DISTANCE MEASURED FROM LEFT END ONLY
- —— INDICATES DIRECTION OF ANGULAR MEASUREMENT

K-ELK RIVER 77 (2) B.

ELCO MINING LIMITED

PLAN
SHOWING SURVEY OF
HORIZONTAL CONTROL
IN THE
ELK RIVER VALLEY
BRITISH COLUMBIA
1976

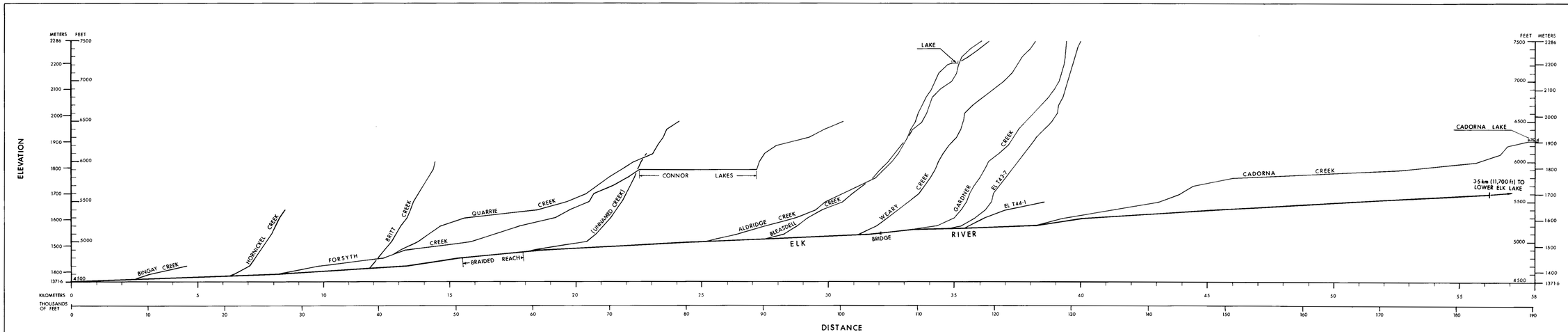
276

Revised: March 13, 1978

Scale: 1:50,000
McElhanney Surveying & Engineering Ltd.
631 - 7th Avenue S.W., Calgary - Alberta

Job No. 200016
December 31, 1976

Ref. No. - 08339 - 0



276

K-ELK RIVER 1 (10) B

ELCO MINING LIMITED

PROFILE OF ELK RIVER AND TRIBUTARIES

DEC. 1976 | FIGURE 1

TECHMAN LTD.

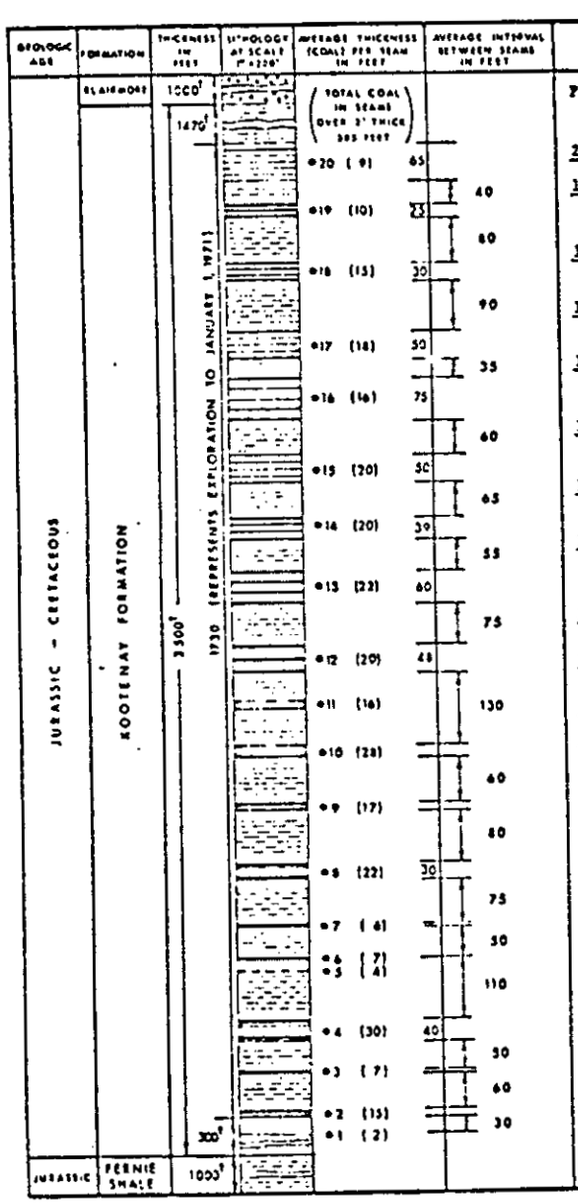
DWG. NO. 1951

REF. TM-172-1

276

FIGURE 2

K-ELK RIVER 77(10 B



REMARKS	
Pebble conglomerate where observed in the field.	
Kootenay Formation above Seam 20 not explored--may contain additional coal.	
20 COAL SEAM	Possibly 6 seams from 1-6 feet thick over a stratigraphic interval of 65 feet.
19 COAL SEAM	From 2-5 seams ranging from 1-6 feet thick over a stratigraphic interval estimated to average 25 feet thick.
18 COAL SEAM	About four (4) seams 1-11 feet thick over a stratigraphic interval estimated to average 30 feet thick.
17 COAL SEAM	One (1) to seven (7) seams ranging from 1-9 feet thick over a stratigraphic interval estimated to be 50 feet thick.
16 COAL SEAM	About 5 seams from 1-5 feet thick over a stratigraphic interval estimated to be 75 feet thick.
15 COAL SEAM	About 5 coal seams 1-5 feet thick over a stratigraphic interval of about 50 feet.
14 COAL SEAM	Six coal seams ranging from about 1-7 feet thick over a stratigraphic interval up to 65 feet thick.
13 COAL SEAM	In south part of field four or more seams from 1-12 feet thick with shale splits over a stratigraphic interval of approximately 65 feet, merges into thick single seam to north.
12 COAL SEAM	Appears to range from about 12-28 feet thick with shale splits ranging from 5-15 feet thick.
11 COAL SEAM	Seam appears to merge with seam 12 near Station 255 + 00.
10-10A COAL SEAM	Varies from about 14 feet thick in south part of field to 35 feet thick north of Weary Creek.
9 COAL SEAM	Lateral continuity and thickness of seam persistent. Thickness varies from about 14-19 feet. May split into two (2) seams between Stations 240 + 00 and 270 + 00.
8-8A COAL SEAM	Varies from 17-26 feet thick, contains shale split which varies from 4-25 feet.
7 COAL SEAM	Varies from 4-9 feet thick, splits into two seams north of Station 295 + 00.
6 COAL SEAM	Average thickness 4 feet ranges up to 12 feet and splits into 2-3 seams in the area of Weary Creek.
5 COAL SEAM	Usually only a trace but does reach 3 feet thickness in several places.
4-4A COAL SEAM	Varies in thickness from about 20-37 feet; average thickness 27 feet.
3 COAL SEAM	Varies in thickness from about 4-15 feet; average about 7 feet.
2 COAL SEAM	Varies in thickness from about 8-29 feet; average thickness 15 feet.
1 COAL SEAM	A 1-2 foot shaly coal seam within basal sandstone member.
Basal sandstone member, estimated 300 feet thick.	
Marine shale, estimated 500-1000 feet thick	

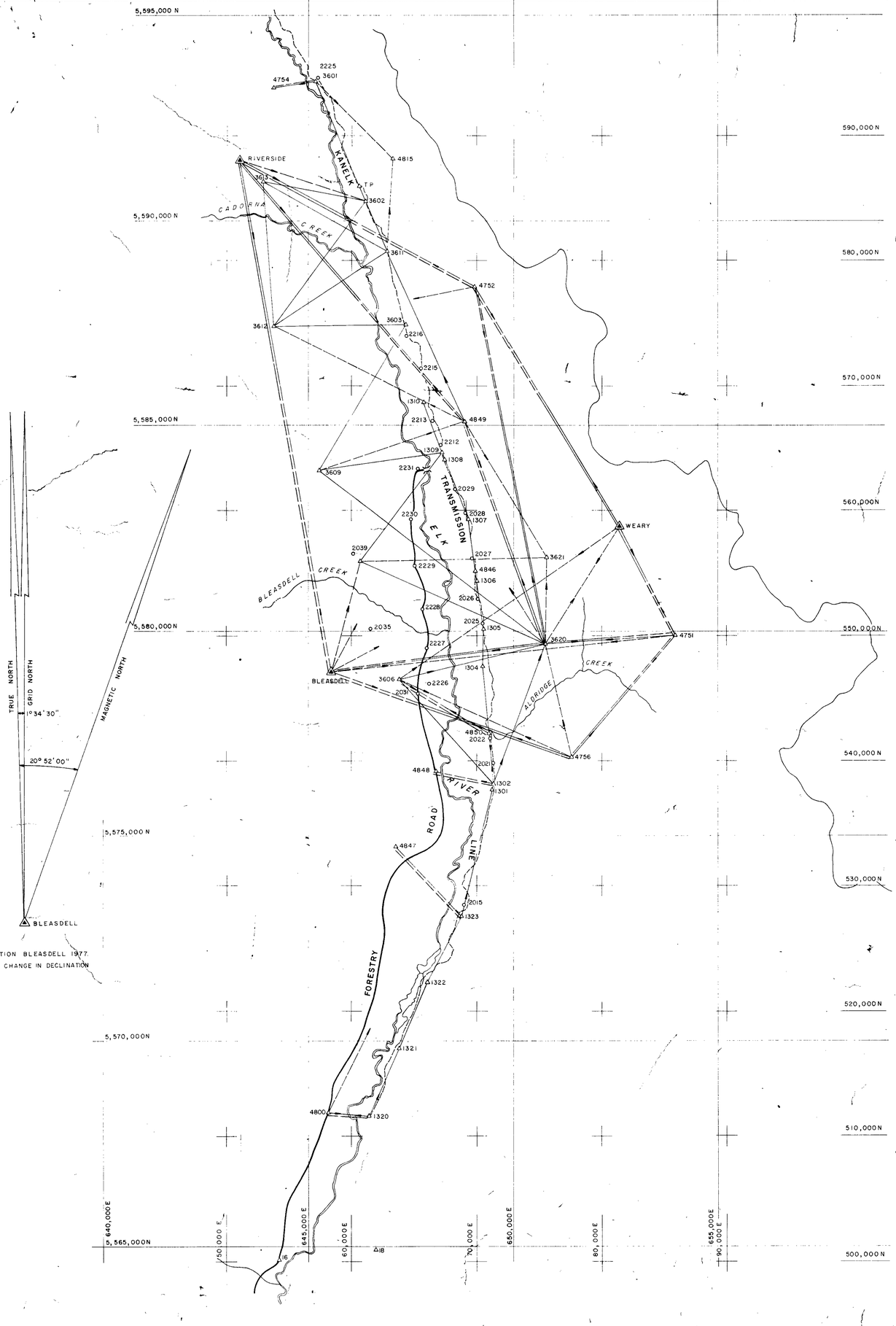
† Thickness estimated from published information and geologic relationships in Elk River Valley.

GENERALIZED COMPOSITE STRATIGRAPHIC SECTION

INITIAL STUDY AREA
ELK RIVER COAL FIELD

A-II-6.2.2-MT

U-493



RELATIONSHIP AT STATION BLEASDELL 1977
APPROXIMATE ANNUAL CHANGE IN DECLINATION
DECREASING 4.0'

CO-ORDINATE TABLE

STATION	NORTHING	EASTING	ELEVATION
1301	5,576,264.13	649,564.56	1529.30
1302	5,576,395.14	649,595.83	1528.94
1304	5,579,247.66	649,228.43	
1305	5,580,170.98	649,224.76	1578.77
1307	5,582,811.09	648,773.43	1621.11
1310	5,585,631.27	647,606.92	1589.84
1322	5,571,507.45	648,115.93	
1323	5,573,146.20	648,904.45	1504.68
3601	5,593,377.94	644,705.25	1644.61
3602	5,590,498.13	646,030.30	1677.01
3603	5,587,528.58	647,099.45	1617.82
3606	5,578,866.70	647,207.98	1718.92
3609	5,583,902.98	648,084.45	1906.52
3610	5,581,716.66	646,163.74	1850.50
3611	5,589,299.10	646,590.28	1673.93
3612	5,587,385.63	643,878.13	1911.25
3613	5,590,885.97	643,518.26	1885.04
3620	5,579,843.55	650,751.84	2115.77
3621	5,581,947.31	650,709.19	2225.07
BLEASDELL	5,579,003.40	645,546.10	2590.19
RIVERSIDE	5,591,387.27	642,929.77	2359.61
4752	5,588,493.87	648,758.55	2355.40
WEARY	5,582,773.13	652,447.39	2626.00
4751	5,580,137.93	653,896.21	2173.71
4756	5,577,112.99	651,458.88	2164.51
4850	5,577,632.68	649,438.27	1519.21
4849	5,585,220.47	648,607.44	1916.46
4815	5,591,549.65	646,682.52	2012.96
4848	5,576,661.75	648,174.53	1548.02
4846	5,581,582.03	648,975.36	1594.10
4847	5,574,780.79	647,256.89	1522.26
4800	5,568,277.74	645,802.28	1470.66
4754	5,593,202.87	643,694.33	1837.27
1320	5,568,199.74	646,788.31	1453.16
1321	5,569,871.97	647,487.57	
16	5,564,658.74	644,703.20	1405.68
18	5,564,377.08	647,058.87	2265.03
5198	5,584,464.50	648,116.86	1624.31

EMGS CO-ORDINATES

BEARINGS ARE REFERRED TO THE CENTRAL MERIDIAN OF U.T.M. ZONE 11, 117° 00' 00" W.

THE ORIGIN OF THE CO-ORDINATES IS THE FEDERAL GOVERNMENT CO-ORDINATE FOR MT BLEASDELL WHICH IS CLASSIFIED BY THE GOVERNMENT AS FOURTH ORDER AND MAY BE SUBJECT TO READJUSTMENT AT A LATER DATE.

DISTANCES ARE REDUCED TO 1500 M. DATUM AND THE CO-ORDINATES ARE IN METERS.

LEGEND

- ▲ FEDERAL GOVERMENT CONTROL
- △ HORIZONTAL CONTROL
- ○ BENCH MARK
- ═══ INDICATES DISTANCE MEASURED FROM BOTH END STATIONS
- = = = INDICATES DISTANCE MEASURED FROM LEFT END ONLY
- ——→ INDICATES DIRECTION OF ANGULAR MEASUREMENT

SCALE: 1:50,000

preliminary?

K ELK RIVER 77 (2) B 276

ELCO MINING LIMITED

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

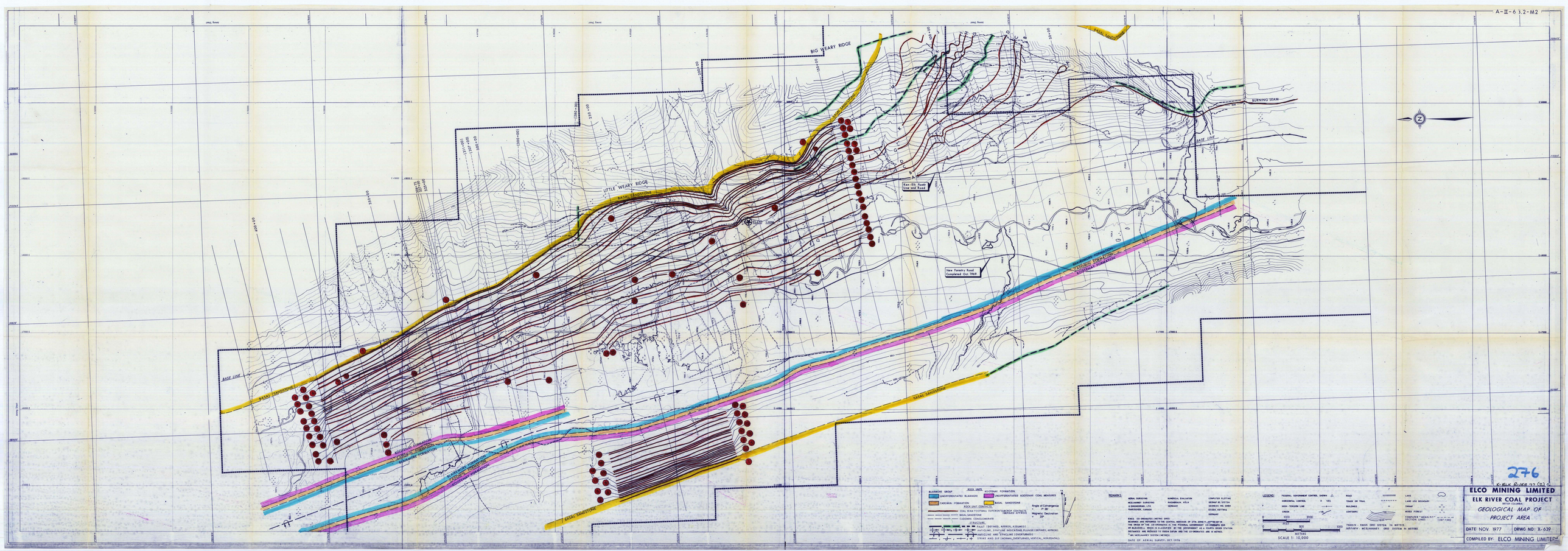
PLAN SHOWING SURVEY OF HORIZONTAL CONTROL IN THE ELK RIVER VALLEY, BRITISH COLUMBIA 1976

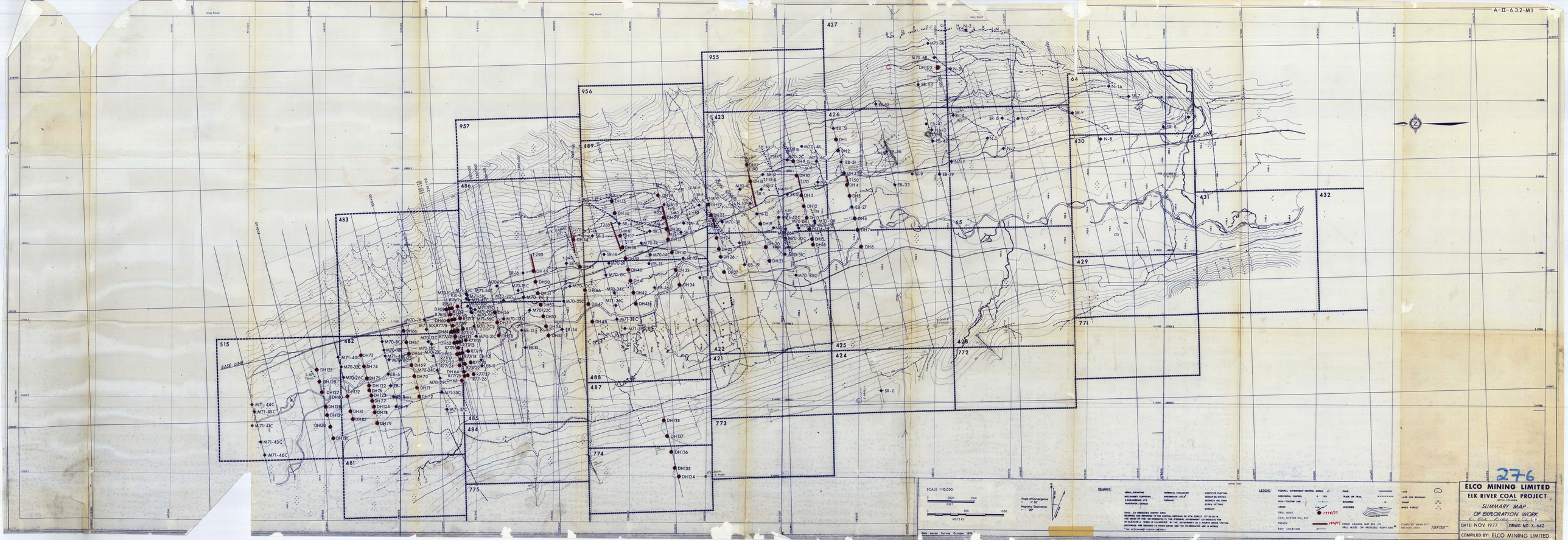
DATE: OCTOBER, 1977 | DRWG NO: U-493

COMPILED BY: Mc ELHANNEY

Ref. No. 08338

A-II-6 3.2-M2


BIG WEARY RIDGE
LITTLE WEARY RIDGE
BASAL CONGLOMERATE
BASAL SANDSTONE
BASE LINE
BURNING SEAM
GATE LINE
Kan-Elk Power Line and Road
New Forestry Road Completed Oct 1969
ELCO Camp
KOOTENAY FORMATION
UPPER COAL MEASURES
MIDDLE COAL MEASURES
LOWER COAL MEASURES
CASCADIA FORMATION
ROCK UNITS
BLAIRMORE GROUP
UNDIFFERENTIATED BLAIRMORE
CASCADIA FORMATION
ROCK UNIT CONTACTS
COAL SEAM (OUTCROP) (SUBCROP) (SECTOR CONTACTS)
BASAL SANDSTONE
CASCADIA CONGLOMERATE
STRUCTURE
FAULT (DEFINED, APPROX, ASSUMED)
ANTICLINE, SYNCLINE INDICATING PLUNGE (DEFINED, APPROX)
ANTICLINE AND SYNCLINE CONTOURS(DEG)
STRIKE AND DIP (NORMAL,OVERTURNED, VERTICAL, HORIZONTAL)
UNDIFFERENTIATED KOOTENAY COAL MEASURES
BASAL SANDSTONE
Angle of Convergence 1° 38'
Magnetic Declination 29°
(REFERENCE APPROX)
REMARKS
AERIAL SURVEYING
MICLAMMAT SURVEYING & ENGINEERING, LTD VANCOUVER, CANADA
NUMERICAL EVALUATION
KUCERA & KOLA SERVICES GERMANY
COMPUTER PLOTTING
GEOMAP AC SYSTEM GEOMETA INC. SWEDEN & KOSTAL MUNICH GERMANY
RANGE GO-ORDINATES (METRIC GRID)
REMARKS ARE REFERRED TO THE CENTRAL MERIDIAN OF UTM ZONE 11 (117°00' W.)
THE DATUM USED IS NORTH AMERICAN DATUM 1927 (CLARKE 1866 ELLIPSOID) AS ADJUSTED IN 1974 BY THE GEODETIC SURVEY OF CANADA, DEPT. OF ENERGY, MINES & RESOURCES, WHICH IS CLASSIFIED BY THE GOVERNMENT AS A PRIMARY HORIZONTAL CONTROL STATION.
DISTANCES ARE REDUCED TO THIS DATUM AND THE CO-ORDINATES ARE IN METRES
UNIVERSAL TRANSVERSE MERCATOR (U.T.M.) GRID SYSTEM (METRIC)
DATE OF AERIAL SURVEY: OCT. 1976
LEGEND:
FEDERAL GOVERNMENT CONTROL SHOWN
HORIZONTAL CONTROL
HIGH-TENSION LINE
CREEK
ROAD
TRACK OR TRAIL
BUILDINGS
CONTOURS
LAKE
LAKE (DRY BOUNDARY)
SWAMP
WOOD FOREST
COMPUTER "MEAN PLY" SECTION LINES (357-F-00)
750000 N - RANGE GRID SYSTEM IN METRES
MERCATOR - MERCHANNEY GRID SYSTEM IN METRES
METRES
SCALE 1: 10,000
276
K-ELK RIVER 93 (93 G)
ELCO MINING LIMITED
ELK RIVER COAL PROJECT
BRITISH COLUMBIA
GEOLOGICAL MAP OF PROJECT AREA
DATE: NOV. 1977
DRWG NO.: X-639
COMPILED BY: ELCO MINING LIMITED


BASE LINE
SR-1
SR-2
SR-3
SR-4
SR-5
SR-6
SR-7
SR-8
SR-9
SR-10
SR-11
N-1
N-1A
N-2
N-3
N-4
N-5
N-6
N-7
N-8
N-9
N-10
N-11
N-12
EB-1
EB-2
EB-3
EB-4
EB-5
EB-6
EB-7
EB-8
EB-9
EB-10
EB-11
EB-12
EB-13
EB-14
EB-15
EB-16
EB-17
EB-18
EB-19
EB-20
EB-21
EB-22
EB-23
EB-24
EB-25
EB-26
EB-27
EB-28
EB-29
EB-30
EB-31
EB-32
EB-33
EB-34
EB-35
EB-36
EB-37
EB-38
EB-39
EB-40
EB-41
EB-42
EB-43
EB-44
EB-45
EB-46
EB-47
EB-48
EB-49
EB-50
EB-51
EB-52
EB-53
DH1
DH2
DH3
DH4
DH5
DH6
DH7
DH8
DH9
DH10
DH11
DH12
DH13
DH14
DH15
DH16
DH17
DH18
DH19
DH20
DH21
DH22
DH23
DH24
DH25
DH26
DH27
DH28
DH29
DH30
DH31
DH32
DH33
DH34
DH35
DH36
DH37
DH38
DH39
DH40
DH41
DH42
DH43
DH44
DH45
DH46
DH47
DH48
DH49
DH50
DH51
DH52
DH53
DH54
DH55
DH56
DH57
DH58
DH59
DH60
DH61
DH62
DH63
DH64
DH65
DH66
DH67
DH68
DH69
DH70
DH71
DH72
DH73
DH74
DH75
DH76
DH77
DH78
DH79
DH80
DH81
DH82
DH83
DH84
DH85
DH86
DH87
DH88
DH89
DH90
DH91
DH92
DH93
DH94
DH95
DH96
DH97
DH98
DH99
DH100
DH101
DH102
DH103
DH104
DH105
DH106
DH107
DH108
DH109
DH110
DH111
DH112
DH113
DH114
DH115
DH116
DH117
DH118
DH119
DH120
DH121
DH122
DH123
DH124
DH125
DH126
DH127
DH128
DH129
DH130
DH131
DH132
DH133
DH134
DH135
DH136
DH137
DH138
T290
T270
T250
T230
T210
T190
T170
T150
T130
T110
T90
T70
T50
T30
M70-1B
M70-1C
M70-2C
M70-3C
M70-4C
M70-5C
M70-6C
M70-7C
M70-8C
M70-9C
M70-10C
M70-11C
M70-12C
M70-13C
M70-14C
M70-15C
M70-16C
M70-17C
M70-18C
M70-19C
M70-20C
M70-21C
M70-22C
M70-23C
M70-24C
M70-25C
M70-26C
M70-27C
M70-28C
M70-29C
M70-30C
M70-31C
M70-32C
M70-33C
M70-34C
M70-35C
M70-36C
M70-37C
M70-38C
M70-39C
M70-40C

ELCO MINING LIMITED

276

Manager Elk River Coal Project

2800 Scotia Centre
700 - 2nd Street S.W.
CALGARY, ALBERTA, CANADA T2P 2W2
Phone (403) 265-0520
Telex 03-825733

February 23rd, 1978

1142

The Department of Mines and
Petroleum Resources,
Parliament Buildings,
Victoria, B.C.
V8V 1X4

FEB 27 78 PM

DEPT. OF MINES
AND PETROLEUM RESOURCES

Attention : Mr. A.R. Corner,
Administrator for Coal

Dear Sir:

RE: Addendum to 1976/77 Report on Exploration and Coal Testwork

Attached is a memo indicating certain changes that were made in seam correlation during the 1976/77 exploration program. These changes were made as a result of the more detailed drilling carried out in areas where inadequate data had been obtained in previous programs and which consequently resulted in mis-identification of certain seams and seam groups. You will find this data necessary to correctly correspond between this report and the reports previously submitted.

If you should have any questions regarding these correlation changes please do not hesitate to contact us.

Yours truly,

ELCO MINING LIMITED

H. Gruss
Manager, Exploration

G. Lawrence
Senior Geologist

FORWARDED TO	DATE	INITIAL
C.G.C.		
D.C.G.C.		
G.C.		
FILE NO.		
FILING CLERK		

ENCL.

GL/pva

INTER-OFFICE MEMORANDUM

ELCO MINING LIMITED

TO H. Gruss DATE May 5th 1977

FROM D. McKelvie

SUBJECT CHANGES IN SEAM CORRELATION DUE TO 1976 - 1977 DRILLING PROGRAM

Several discrepancies in seam correlation have been discovered as a result of the additional detailed drilling information acquired during the recently completed diamond drilling program. Inadequate data from previous programs resulted in mis-identification of certain seams or seam groups.

The most significant changes occur south of section 260 + 00. North of this section the changes are relatively minor and result mainly from a difference of grouping small coal splits into major seam units. South of 260 + 00 the major discrepancy results from the incorrect grouping of seams 12, 13 and 14 into one seam (No. 13) in trench T-16.

Other minor miscorrelations occur in the upper seams, i.e. higher than seam 17, because of the difficulty in grouping individual seam splits into correlatable seam units.

A list of the changes in seam numbering resulting from the new data follows.

Section	Hole or Trench	Pre Oct. 1976	Post Oct. 1976
380	26 C	upper split seam 8	9
"	"	9	10
360	48 C	upper split seam 8	9
"	"	9	10
"	11 C	11	12
"	"	10	11
"	"	9	10
"	"	upper split seam 8	9
320	EB 11	20	21
"	"	19	20
300	EB 13	20	21
"	"	upper split 19	20
280	25 C	bottom split 15	upper split 14
260	34 C	two upper splits 16	two lower splits 17
"	15 C	15	14
"	"	14	13
"	"	13	12
"	"	12	11
"	2 R	12	11

...../2

Section	Hole or Trench	Pre Oct. 1976	Post Oct. 1976
250	SR-4	7	bottom split 8
"	"	6	7
"	"	5	6
240	14 C	14	13
"	"	13	12
"	"	12	11
"	EB-15	bottom 2 splits 15	14
"	"	14	13
"	"	13	12
"	EB-16	bottom 2 splits 15	14
220	SR-13	12	11
"	"	13	12
"	T-70-1	12	11
"	SR-10	16	17
"	"	bottom 2 splits 13	12
"	EB-17	top 2 splits 17	bottom 2 splits 18
"	"	top 3 splits 16	bottom 3 splits 17
210	3R	12	11
"	"	bottom 3 splits 13	12
"	"	top 3 splits 13	14
"	T-16	12	11
"	"	13 G	12
"	"	13 H	
"	"	13 I	
"	"	13 A	14
"	"	13 B	
"	"	13 C	
"	"	14	15
"	"	14 A	
"	"	14 B	
"	"	15	16
"	"	15 A	
"	"	16	17
"	"	16 A	
"	"	17	18
"	"	17 A	17
"	"	17 B	
200	3 R	bottom 3 splits 13	12
"	"	top 3 splits 13	14
"	"	12	11
"	EB-18	16	17
"	"	15	16
"	"	top 2 splits 14	13
"	"	bottom split 14	12

...../3

Section	Hole or Trench	Pre Oct. 1976	Post Oct. 1976
200	EB-19	18	21
"	"	17	20
"	"	16	19
190	N-12	top 4 splits 13	14
"	"	bottom 3 splits 13	12
"	"	12	11
"	N-10	13	12
"	"	top split 12	11
"	"	bottom split 12	top split 10
150	EB-27	14	18
"	"	13	18
"	"	12	17
"	"	top split 10	bottom split 17
"	"	middle split 10	coal member in RK unit 66.1
"	"	bottom split 10	16
"	"	9	15
"	EB-31	top split of 10	11
"	"	bottom split of 10	top split of 9
"	"	top split of 8	bottom split of 9
"	"	bottom split of 8(8a)	top split of 8
"	"	7	bottom split of 8
"	"	seam 3 or 4 ?	4
"	EB-51	7	4
"	"	6	3
"	"	3 or 4	2

G. Lawrence

/dc

ELCO MINING LIMITED

276

Manager Elk River Coal Project

2800 SCOTIA CENTRE
700 - 2ND STREET S.W.
CALGARY, ALBERTA, CANADA T2P 2W2
PHONE (403) 265-0520
TELEX 03-825733

April 7th, 1978

APR 10 '78 PM

The Department of Mines
and Petroleum Resources,
Parliament Buildings,
Victoria, B.C.
V8V I4X

2046

DEPT. OF MINES
AND PETROLEUM RESOURCES

Attention: Mr. A.R. Corner,
Administrator for Coal

Dear Sir:

RE: Preliminary Copies of Appendixed Maps A-II-6.2.2 - M1
" Plan Showing Horizontal Control in the Elk Valley", and
A-II-6.2.2 - M2 "1:10,000 Series Topography" to the
1976/77 Report on Exploration and Coal Quality Testwork.

Further to our letter of February 21, 1978, please find enclosed the final drafts of the above captioned maps. No further references should be made to the preliminary drafts submitted earlier.

Enclosures Forwarded To Geol Div.

If you have any questions please do not hesitate to contact us.

Yours truly,

ELCO MINING LIMITED

G.F. Lawrence
Senior Geologist

M. Hatzfeld,
Manager Engineering

GEOLOGICAL DIV
ATT. ALEX MATHESON.

ENCL.

GL/pva

FOR FILING WITH LATEST REPORT OF WORK.

REFERRED TO		DATE	INITIAL
C.G.C.			
D.C.G.C.	✓		
G.C.			
P.H.		Oct 17/4	
FILE NO.			
FILING CLERK			