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Report on

The 1978/79 Development Work
carried out on the
Elk River Coal Project

K-ELK RIVER 79(1)A

278

ELCO MINING LIMITED

K-ELK RIVER 79(1)A.

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Report on

The 1978/79 Development Work
carried out on the
Elk River Coal Project

K-ELK RIVER 79(1)A.

Coal Licence Numbers 64, 65
421-434 incl., 481-489 incl.,
515, 771-779 incl., 951-957 incl.

NTS Map: MOUNT HEAD 82J/7W

Submitted to the

Ministry of Energy, Mines and Petroleum Resources

[redacted] December 5, 1979

G. F. Lawrence,
Chief Geologist

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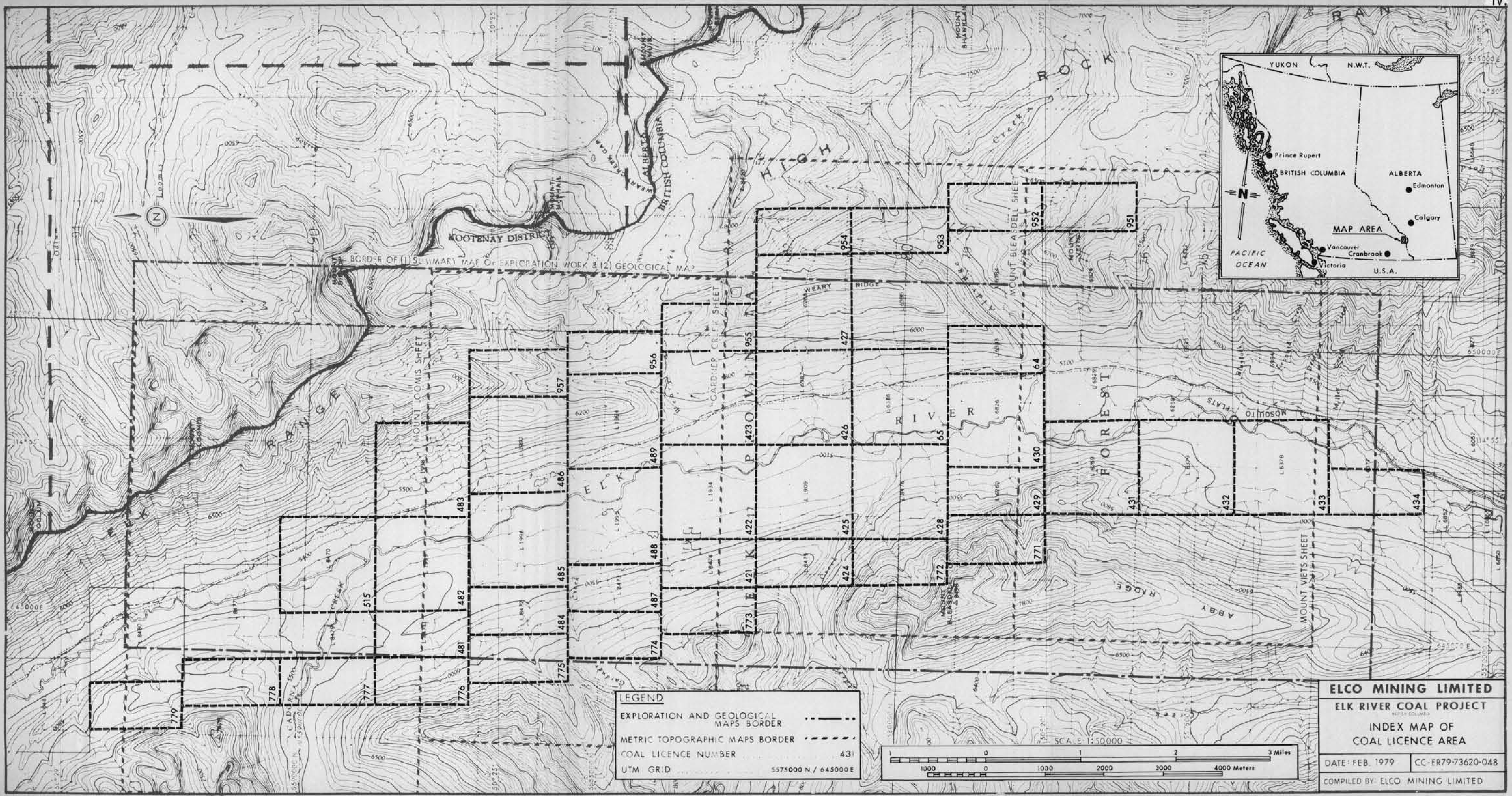
ELCO MINING LIMITED
ELK RIVER COAL PROJECT
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COAL LICENCE AREA
DATE: FEB. 1979
CC-ER79-73620-048
COMPILED BY: ELCO MINING LIMITED
LEGEND
EXPLORATION AND GEOLOGICAL MAPS BORDER
METRIC TOPOGRAPHIC MAPS BORDER
COAL LICENCE NUMBER 431
UTM GRID 5575000 N / 645000 E
SCALE 1:50000
3 Miles
4000 Meters
BORDER OF (1) SUMMARY MAP OF EXPLORATION WORK & (2) GEOLOGICAL MAP
KOOTENAY DISTRICT
ALBERTA
BRITISH COLUMBIA
HIGH ROCK RAN
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WEARY RIDGE
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INTRODUCTION

This report is a summary of project development work carried out by Elco Mining Limited during the 1979 Term of Licence on the Elk River Coal Project. The report is based on work expenditures made between November 1, 1978 and October 31, 1979 rather than between the actual anniversary dates of December 5 each year. This procedure is followed because Elco's November month-end statement would not be completed in time for a December 5 report.

Field work such as geological mapping, aerial photography, ground control surveying, and environmental studies was carried out during this term. Because this work was usually a segment of a larger task, it has not been broken out of the main cost accounts and separately itemized on the "Application to Extend Term of Licence" forms as "On-Property" work. These work costs are included with the "Off-Property" costs.

EXPLORATION SUPPORT WORK

Mapping and Surveying

Establishment of Project Mapping System and Mine Grid System

The Elk River Project has seen many different surveys, map grids, exploration grids and mine grids established during the last ten years or so. Elco was at the stage where, for project development purposes, one overall mapping system and one adequate local mine reference grid system was required. A historical review of past systems in the form of a report has been established and is appended (see Appendix 1.0).

A UTM based Elco Mining Grid System for overall mapping purposes was adopted. Since previous exploration and mine grid systems proved inadequate for Elco's future mining operation, a new metric mine grid system, which would be tied into the existing survey system, was devised.

Phase Ib-3 Survey Planning

A Phase Ib-3 (1980 engineering phase) surveying work scope was planned and produced during the 1979 term. In general, this was a detailed outline of possible ground surveys which would be required to support the Phase Ib-3 geotechnical investigations and the follow-up preliminary design work.

The following surveys were planned for:

- A high order control network to be established between Elkford and the mine site.
- A mine operations control network.
- Ground surveys for all on-site and infrastructure development items.

Aerial Mapping of Access Road and Railway Routes

It was estimated that the amount of ground surveying, originally thought necessary for preliminary design work on the access road and railway routes, could be possibly reduced by updated and well controlled aerial mapping.

In order to verify this possibility, aerial photography was carried out along the routes in May 1979. From this, it was found that preliminary design work could be carried out for most of the access road and railway routes on the new aerial mapping. Elco then commissioned Underhill Engineering Ltd. to establish the necessary ground control. This work was completed during October 1979. The network established between the Elco mine site and Elkford is a high order control system and will be strong enough to control the future engineering work. The control diagram for this survey was appended to this report as Appendix 2. Strip mapping of the railway and access road routes, however, will not be undertaken until after March 1980 at the earliest.

Geological Assessment and Field Work

Mine Planning Support

With the establishment of a new metric mine grid system (as reported earlier), a mine bench plan system referenced to this grid was established. Elco geologists are now in the process of transferring the geological data onto these plans for subsequent mine engineering purposes.

In preparation for the transfer of geological data to the bench plans, considerable time has been spent conducting detailed studies of the geophysical borehole logs. In addition to checking seam correlations, other such mine related information as detailed lithology, aquiferous zones, and rock porosity which is related to rock fabric and in turn to rock mineability, are being obtained.

Investigations into Contemporary Sample Analysis and Geological Data Processing Techniques

Investigations have been carried out on a new technique known as "neutron activation analysis" for coal and mineral samples of unknown composition. This technique is particularily useful for trace element analysis. Elco is interested in whether this analysis could be useful for seam correlation purposes on its multi-seam deposit. Furthermore Elco has investigated the capabilities of a geological and mine planning data control system known as the "Multi-Seam Coal Deposit Evaluation System" (MSCDES). This system was originally designed for thermal coal deposits, but additional programs are being developed to handle coking coal quality and washability data.

Geological Mapping

Past geological mapping for the Elk River Coal Project was restricted to the central coal licence area. Recent developments required Elco to investigate the general geology in the southwest of its licence area.

Elco geologists began further investigations with an air photo study of the southern portion of the Elk River coal licences which, to date, have not been mapped. This photo study was extended south to the Forsyth Creek and Greenhills areas. Success at identifying the main boundaries of the Kootenay Formation in these areas, however, was mainly restricted to the east side of the Elk River.

In preparation for a possible exploration program in the Bleasdell Creek area on the west flank of the Elk River valley, Elco geologists extended their photo mapping to this part of the licence area.

The photo mapping was followed up by a field mapping program late in October 1979. The objectives of this program were:

1. To obtain more detailed information on the structures of the west flank area, and in particular, a "thrust" zone, where a large tectonically thickened outcrop of coal has been observed.

2. To trace the main boundaries and structures of the Kootenay Formation in the southern licence area to tie in with geological information produced by the Fording Coal Co. Ltd.

Results of the field work are being prepared on 1:10,000 scale maps and was appended to this report as Appendix 3.0.

<u>Geotechnical Planning</u>

Preliminary geotechnical planning, which was started at the close of the 1978 report period, was expanded into detailed planning in 1979. Geotechnical investigations have been broken into two separate areas. These are:

<u>Mine Related Rock Slope Investigations</u> - four to five months of work have been planned. This work would include pump tests and piezometric monitoring of the Kootenay Basal Sandstone which forms the footwall of the planned open

pit. Should previous cores provide insufficient data, then additional diamond core drilling will be carried out. Core studies will provide rock strength and bedding plane joint fracture information. Also, detailed structural field mapping will be carried out throughout the entire mine area. The data collected during this work phase will provide the information necessary for final pit design.

Other Geotechnical Investigations - nearly five months field work is involved here. This work includes detailed foundation and ground water regime investigations on the following:

- railway,
- access road/Forest Service bypass road,
- river diversion channel and dams,
- waste dumps,
- settling poinds,
- tailings ponds,
- plant site.

The results of these investigations will provide the information necessary for final engineering design.

Exploration Reclamation

The previous exploration reclamation work was evaluated in the field during this term. The reclamation maintenance work carried out on two trenches last fall has taken care of the erosion problems. Agronomic species cover is good and there is significant colonization by native species.

Reclamation Permit C-49 was renewed by the Department of Mines and Petroleum Resources this year.

Work on the Stage III Reclamation Programme is described later.

Exploration Permits and Government Work

Time was spent in 1979 on exploration permit acquisition and government report preparation. The following is a list of these activities:

- renewal of Free Miner's Certificate (MEMPR)
- extending term of coal licences (MEMPR)
- annual exploration and development work report (MEMPR)
- annual summary of exploration work (MEMPR)
- annual reserve estimate report (EMR)
- status report on exploration adits and drill holes (MEMPR)
- annual reclamation report (MEMPR)

In addition to the above annual reporting activities, time was spent on the following:

Proposed Amendments to the B.C. Coal Act Regulations - the proposed amendments were reviewed and a brief was prepared for the Coal Association which, in turn, conveyed to the Ministry of Mines opinions of the B.C. coal industry in general.

Coal Lease - Section 26, Coal Act - preliminary investigations into the requirements and procedures for the application of a coal lease were begun, however this has not been pursued any further since it was determined that the Section 7 (CMRA) Mine Work Permit should be obtained first.

Mine Work Permit - Section 7, Coal Mines Regulations Act - an investigation was carried out in order to prove that the proposed surface installations would not sterilize coal reserves.

Notice of Work - was filed with the B.C. Department of Mines and other appropriate ministries for the purpose of conducting a small drilling and trenching program in the Bleasdell Creek area. This work will be carried out after approval by Elco's shareholders.

PROJECT APPROVAL AND DEVELOPMENT WORK

Project Approval Work

Stage II Report Processing and Follow-up

Having submitted the Stage II report on the Elk River Coal Project on August 28, 1978, Elco carried out a significant amount of additional work at the request of reviewing government agencies during the last two months of 1978 and during the 1979 term. Additional information was presented to the sub-committees of the Coal Guidelines Steering Committee.

Major presentations were:

1. A technical presentation relative to Section 7 of the Coal Mines Regulations Act to the Mines Inspection and Mines Reclamation Branches of the Department of Mines and Petroleum Resources on January 17, 1979. The presentation covered the following topics:

   - technical necessities for river/creek diversions,
   - rationale for rejecting underground mining,
   - possible sterilization of coal reserves by overlying facilities,
   - feasibility of the proposed pit boundaries with regard to the slope stability,
   - justification to place coarse plant rejects in mine waste disposals,
   - maximization of coal recovery by the proposed mining procedure.

2. At the request of the Coal Guidelines Steering Committee, community consultation programs were conducted for the purpose of obtaining public opinion on the Elk River Project from the Elk Valley communities of Elkford, Sparwood, Fernie and Cranbrook.

   A public information brochure describing the Elk River Coal Project in some detail was distributed to all interested parties in the above communities.

3. After Elco received its Stage II approval-in-principle, the draft report was amended as required for the approval and the report printed and placed in the public domain.

Stage III Permit Work

On February 22, 1979 the Environment and Land Use Committee of the B.C. Cabinet gave approval-in-principle to the Elk River Coal Project. Subject to the approval-in-principle, an additional programme of Stage III work was agreed to by Elco Mining Limited and B.C. Government agencies. To date progress was made as follows:

1. Elco retained Kerr, Wood and Leidal Associates of Vancouver to produce a conceptual river diversion design for the Elk River. The design was concentrated on fish migration, fish spawning, fish rearing and siltation suppression. The design was reviewed and approved by the Mine Site Design Advisory Committee subject to concurrence by the Fish and Wildlife Branch.

2. A literature review of fish habitat preferences was completed.

3. An in-stream "swim survey" of fish habitats was made in the Elk River during the fall by T.E.C. Ltd. of Richmond, B.C.

4. To resolve the town site selection problem, a cost/benefit analysis assessment on the expansion of Elkford versus new town construction was jointly carried out by Elco and two government subcommittees.

Various Stage III permits were prepared and filed with the B.C. Government during this term of licence. These were as follows:

1. Pollution Control Branch Discharge Permits - discussions with PCB staff in December 1978 established the consensus relative to the format for Elco's applications, the preproduction and production monitoring for discharges to air and water, and the discharge limits that could be applied for. Several technical questions were

investigated by Elco relative to preparation plant effluent, tailings pond seepage, whether or not non-potable water could be obtained from the mine water settling pond, the discharge of plant site sewage to the tailings pond, and tailings disposal should the tailings thickener malfunction during winter operations.

Having resolved these questions, Elco completed the applications and filed them with the Director, Pollution Control Branch on May 25, 1979. The required postings were made in the field on the same date.

2. <u>Section 8, Coal Mines Regulation Act - Reclamation Programme</u> - the application was filed with the Ministry of Energy, Mines and Petroleum Resources in April 1979. Approval-in-principle was subsequently received.

3. <u>Section 7, Coal Mines Regulation Act - Work System Permit</u> - as a follow-up to the January 17, 1979 Elco presentation to the Mines Inspection and Reclamation Branches, a formal application for approval of a Working System was made in April 1979. Following the application, the Chief Inspector of Mines requested more information on the following:

   - planning of geotechnical investigations to assess the stability of the footwall,
   - full details on method of support of the footwall,
   - method of protection from avalanches, falling rocks and drainage of the footwall,
   - full details of the proposals for the Elk River diversion including provisions to ensure that there can be no danger to persons working in the mine resulting from the diversion,
   - construction and stability of the waste disposals and tailings ponds.

   Answers to these questions, based on present knowledge and on planned geotechnical investigations, were forwarded to the Chief Inspector of Mines in July 1979.

Response from the Ministry of Energy, Mines and Petroleum Resources has indicated that the approval of the "Work System" would only be given after Elco's planned geotechnical investigations had been carried out and incorporated into the proposed "Work System".

4. Water Sector Permits - preparations of the applications for these permits began in May 1979, but had to be suspended due to the extra work load created by the townsite selection question. These activities will be renewed at the end of 1979.

Engineering Development Work

Mine

The majority of the work carried out in this area involved the Section 7 Coal Mines Regulations Act permit application and, budgeting and scheduling, which is described later in this report.

There was, however, other work performed in this area. This included:

1. The updating of cost and performance data used during the Feasibility Study. The main manufacturers for heavy equipment were contacted for this data.

2. An alternative solution to the proposed Weary Creek diversion was investigated. The matter will be discussed further with the Mines Inspection Branch.

3. A scope of work, including costs and schedules for the investigation of a coal operation on the West Flank of the Elk River Valley was prepared.

Coal Preparation

The majority of the work in this area involved investigations for PCB permit applications and for 1980 budgets and schedules.

Other work, however, did include the completion of flotation tests, and an investigation for the recovery of coal from middlings by crushing, on Fording Coal Ltd. coal samples at Rohstofftechnologie, Overseas Engineering GmbH in Berlin, West Germany.

Railway

Discussions were held with CP Rail's Department of Special Projects in order to obtain reliable information on:

- time and work requirements for the railway permit and application procedures,
- time requirements for construction work.

The location of the Elco spur line was discussed with neighbouring mine operators.

Port

Investigations were carried out on alternative terminal options open to Elco for its future coal shipments.

Off-site Power Supply

The increasing demand for power in the East Kootenay region relative to the delayed development of the tie between Calgary Power and B.C. Hydro is a subject of great concern and required substantial attention.

Town Site

A significant programme of analytical studies was completed relative to the town site selection problem, including helicopter commuting, financial feasibility, economic effects and turnover rates.

Stream Gauging

Elco continued stream gauging for the Elk River Project at five locations. An intensive monitoring programme was carried out from May 29 through June 11, 1979 for the spring high flow period. A summary report covering April 1977 to December 1978 was forwarded to interested government agencies.

Climatic Monitoring

Elco contracted the MEP Co. to install two climatic monitoring stations during May 1979 at locations agreed to with the Pollution Control Branch. MEP will also operate, maintain and undertake data abstraction for Elco.

Dustfall Monitoring

As requested by the Pollution Control Branch, monthly monitoring of eight dustfall stations commenced in June 1979.

Project Planning and Development

The main objectives of Elco Mining Limited during the past year were:

- Acquire Stage II approval and secure Stage III permits,
- Negotiate and secure contract arrangements with shippers and the general contractors,
- Discuss with government, various tax and assistance benefits,
- Plan and budget the next engineering work phase (Phase Ib-3, 1980),
- Plan and evaluate various development and production schedules,
- Carry out project promotion with potential new customers and partners.

Negotiations and Government Liaison Work

Elco, with help from consultants, continued amendment work on the Service Agreements and the fixation of the construction fee in preparation for the forthcoming contract negotiations with Morrison-Knudsen.

Intense negotiations were carried out between Elco and consultants and CP Rail in order to establish a final freight rate and future escalation formulas for the transport of Elk River coal to port.

Discussions continued with the Federal Government to seek potential government financial support in the form of infrastructure cost sharing, grants and tax concessions.

In compliance with FIRA regulations, a project update was completed.

Studies were made to determine the net effect that the November 16, 1978 federal budget would have on the Elk River Coal Project.

Scheduling and Progress Control

Phase Ib-3 - detailed planning of this work phase began in March 1979. A list of all foreseeable work activities up to the beginning of construction were identified. Detailed work proposals, time requirements and cost estimates were obtained from representative contractors and consulting firms. A network plan and bar charts showing work interfaces and milestones were established. This network plan was the basis for the establishment of Elco's next budget.

Project Presentations and Marketing Promotions

Elco made four presentations of the Elk River Coal Project to visiting potential coal customers and/or potential Joint Venture Partners during this term of licence. Coking coal quality and thermal coal potential were emphasized.

Other

Elco participated in the East Kootenay Community College Advisory Committee, whose task is related to the definition of training requirements and programs for the existing and planned coal mines in the region.

Appendix 1.0

A REPORT ON

THE ELK RIVER GRID/BASELINE SYSTEMS

G. F. Lawrence

G. F. Lawrence,
Chief Geologist.

April, 1979.

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(Text)

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INTRODUCTION

The Elk River Coal Project, like many other mining properties, has accumulated various mapping systems and baseline control systems throughout the exploration stage(s). Also, like many other properties after which feasibility studies have proven the viability of the deposit, accurate mine mapping and baseline control systems on which detailed planning and operations control can be carried out must be established.

In some cases, mapping and baseline systems established during the exploration stage(s) could be adopted as the mine control systems. This is only the case where the following conditions are met:

1. The original mapping system has sufficient ground control and can produce maps with the required accuracy.

2. The exploration baseline system is orientated parallel to structural strike and also today, where data bases are increasingly used to store and evaluate geological data, it is advantageous to locate the baseline such that all measurements are positive, that is, in northerly and easterly directions.

In the case of the Elk River Project, these conditions were not met and consequently additional, more up-to-date aerial mapping was carried out in late 1976 when Elco Mining Limited began a major feasibility study and exploration program on this property. During the feasibility study, a new metric Mine Baseline System was designed for the purpose of developing a bench map system and providing future mine operations control.

Purpose of this Report

Due to the lack of readily accessible, detailed information on the different Elk River grid and baseline systems, it became the purpose of this report to make available a current detailed chronicle and information document from which future references could be made.

The sources for this report include the following:

- *personal conversations and correspondence with* the service companies that had been involved in this work,
- old files of letters and telexs dealing with the subject,
- Elco's Elk River Feasibility Report.

Objectives of the Study

There are two main objectives for this study:

1. The first is to prepare a detailed documentation of the various survey and map systems that have been developed and planned for the Elk River Project to date.

2. The second is to examine the first metric Mine Baseline System design, and, because of certain problems encountered with that design, recommend an alternate system which would incorporate both the corrections required on the first design and, cover all future requirements within the total licence area.

Review of Mapping and Survey Control System Development

Mapping and control was first established for the Elk River coal licences in 1968 when the North American Coal Company optioned the licences from Scurry-Rainbow Oil Ltd. Aerial photography was completed by Spartan Air Services and a base map at 1 inch = 1000 feet with 20 foot contours of the property was prepared. An exploration baseline system was devéloped on which field work could be referenced.

In 1969, when North American did not extend its option, Scurry-Rainbow continued exploration. A control network and grid system, known as the MSEL Grid System, was extended to the Elk River licences from the Fording Coal Ltd. operation by McElhanney Surveying and Engineering Ltd. McElhanney updated and enlarged the 1968 base map to cover the entire licence area at a scale of 1 inch = 1000 feet with a 20 foot contour interval. A portion of Scurry's envisioned mine area was mapped at 1 inch = 200 feet with a 5 foot contour interval. Field work was referenced to the North American "Exploration Baseline".

In December 1969, Emkay Canada Natural Resources Ltd., a wholly owned subsidiary of Morrison-Knudsen Company Inc., acquired one-half interest of the Scurry-Rainbow licences. Exploration under the direction of Emkay resumed in July 1970. The mapping prepared by McElhanney in the 1969 exploration program was used in the Emkay program. Additional aerial photography and ground surveys were carried out for mapping of the proposed railway spur location south to Sparwood. Strip maps at scale of 1 inch = 1000 feet with a 20 foot contour interval were prepared. In 1970, McElhanney ran a vertical control survey up the Elk River Valley, beginning at Geodetic Bench Mark No. 115-D, located on the Canadian Pacific Railway bridge over Michel Creek. Bench marks were placed at approximately one mile intervals, running north along the road on the west side of the Elk River. During this program Emkay's field work was referenced to both the Exploration Baseline and the MSEL grid system. At this time MSEL grid values were determined for the Exploration Baseline Stations.

In December 1973, Exploration und Bergbau GmbH (E and B) of Duesseldorf, West Germany, acting on behalf of a group of European steel mills, commenced negotiations to purchase Morrison-Knudsen's interest in the Elk River Coal Project. Negotiations were concluded in May 1975, when an agreement to acquire Morrison-Knudsen's 50% interest was reached. During the negotiations period, E and B contracted Techman Ltd. to carry out mining evaluations of the property. Requiring a good base map on which various mining schemes could be tested, Techman in turn contracted McElhanney to prepare a base map at a scale of 1 inch = 400 feet with a 10 foot contour interval. The main axis of the map was set parallel to a mine baseline which Techman had established for their evaluation work.

In July 1975, E and B undertook an exploration program (prefeasibility study), designed to evaluate the coal quality and the reserve potential of the Elk River deposit, in order to determine if these parameters met the requirements of the European steel mills. All field work was referenced to the Exploration Baseline and recorded on the 1 inch = 1000 feet base maps. Burnett Resource Surveys Ltd. and McElhanney Surveying & Engineering Ltd. were contracted to carry out the field surveying, however, there were ten exploration drill holes that did not receive final surveys.

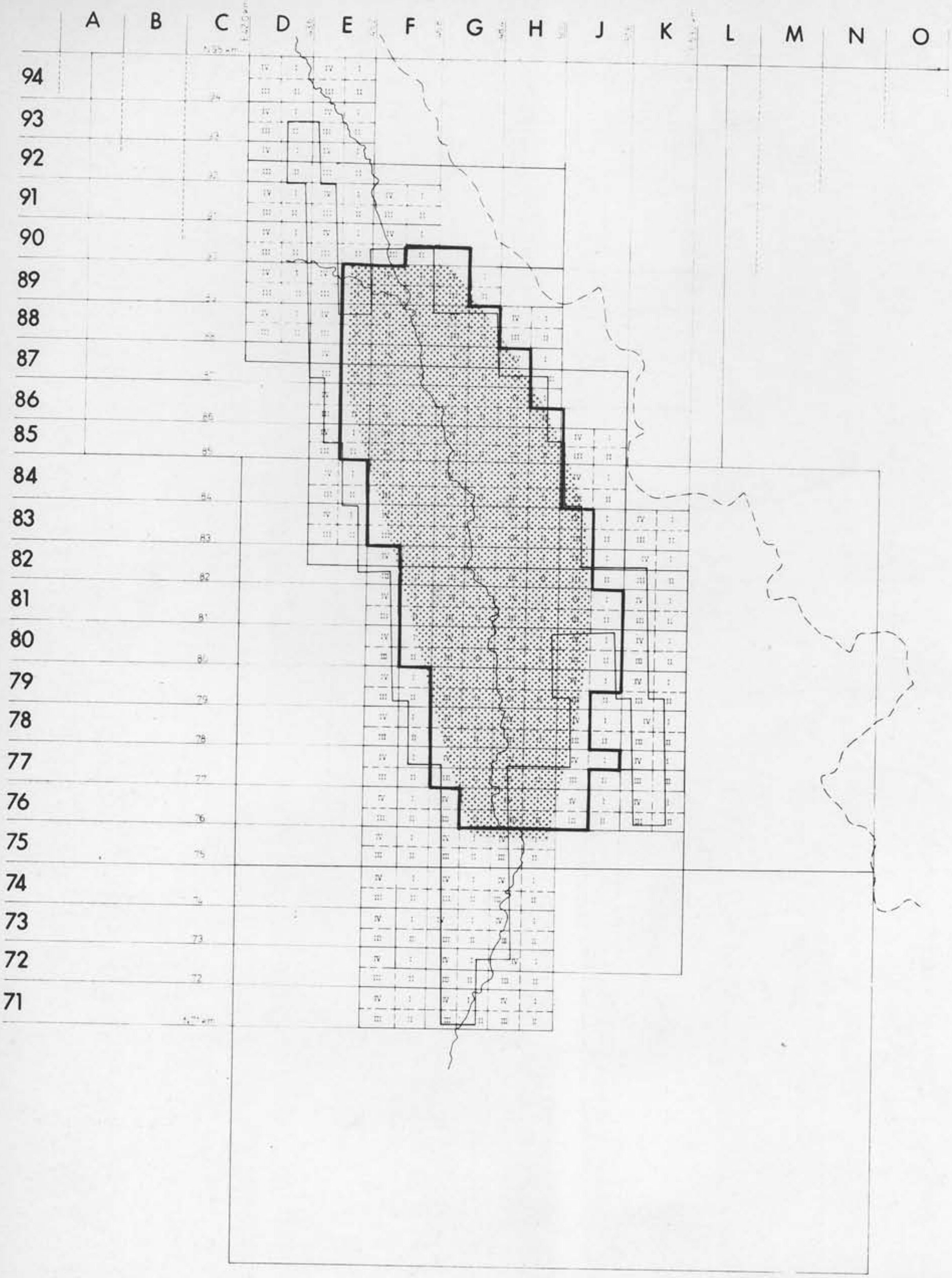
In June 1976, a Joint Venture Agreement was finalized between Elco Mining Limited, a Canadian company formed to represent the European steel mills, and three other Canadian companies, Home Oil Limited, Scurry-Rainbow Oil Limited and Steel Company of Canada Limited. Elco Mining Limited would be the Project Manager.

In October 1976, a major feasibility study and exploration program was begun by Elco. A new metric control network and grid system, known as the Elco Mining Grid System (EMGS) was developed along with new metric base maps. The EMGS was tied to both local Federal Government UTM control and the earlier MSEL control. This enabled the coordinates from the earlier systems to be converted to the new metric system. The new metric base maps were prepared at the following scales:

1:1000	with 2 meter contour intervals
1:2000	with 5 meter contour intervals
1:5000	with 10 meter contour intervals
1:10000	with 25 meter contour intervals
1:20000	with 50 meter contour intervals

These maps, however, did not cover the entire licence area. The eastern, western, northern and southern portions of the licence area remain unmapped at these scales, see Figures 1.0 to 5.0 inclusive. Additional strip maps, at 1 inch = 1000 feet with a 20 foot contour interval were prepared for the potential railway lines, one of which Elco would select as the best possible route. Total 1 inch = 1000 feet mapping to date is shown on Figure 6.0 ,page 10.

The aerial photography, network control surveying, field surveying, and the initial aerial triangulation was carried out by McElhanney. Final aerial triangulation was performed by Rheinische Braunkohlenwerke AG



ELCO MINING LIMITED

ELK RIVER COAL PROJECT

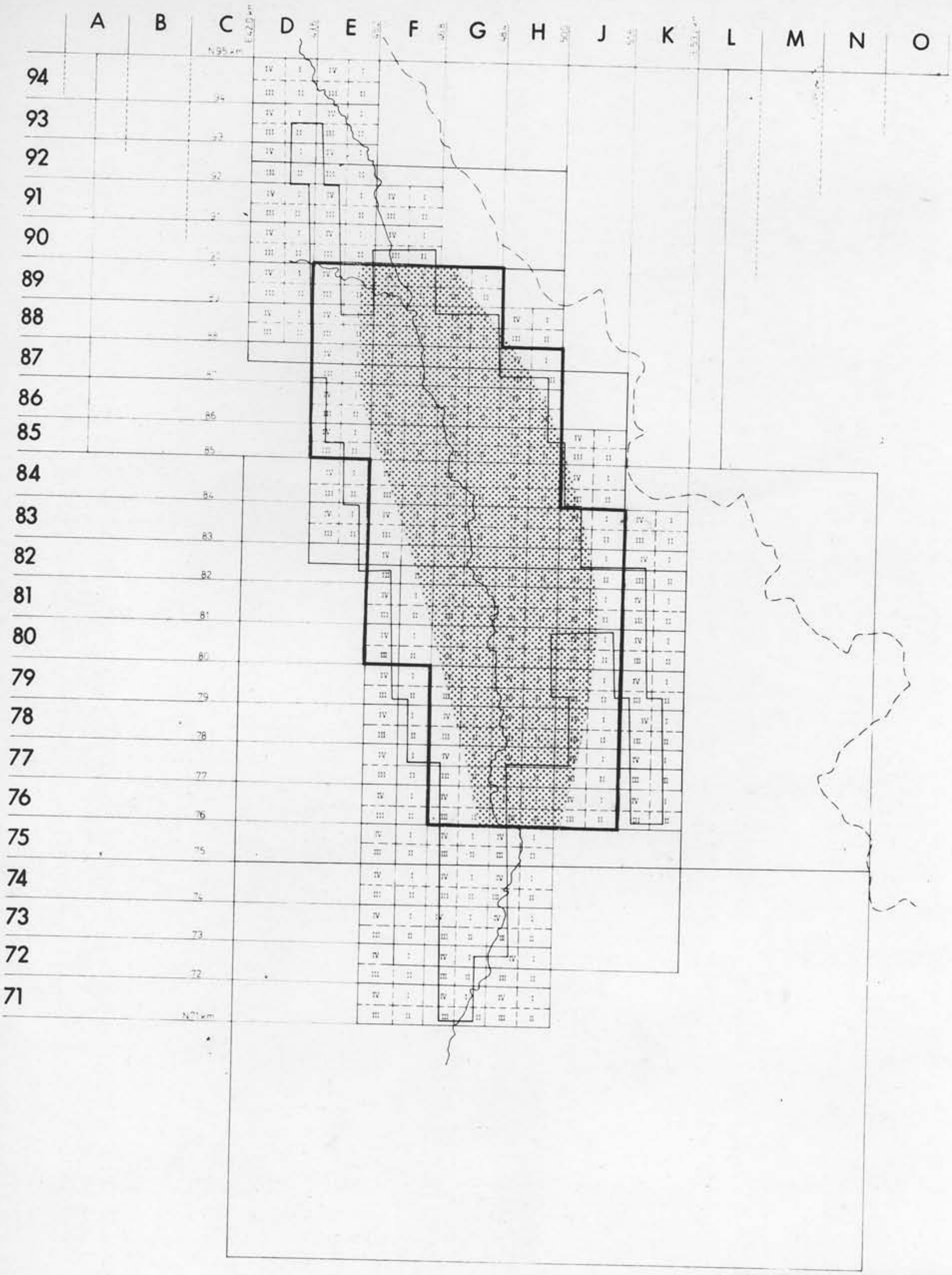
BRITISH COLUMBIA

FIGURE 1.0

AREA OF 1:1000 TOPOGRAPHIC MAP COVERAGE

DATE: AUG., 1977 DRWG NO: SK700-144

COMPILED BY: ELCO MINING LIMITED



TOPOGRAPHIC MAP COVERAGE

ELCO MINING LIMITED

ELK RIVER COAL PROJECT

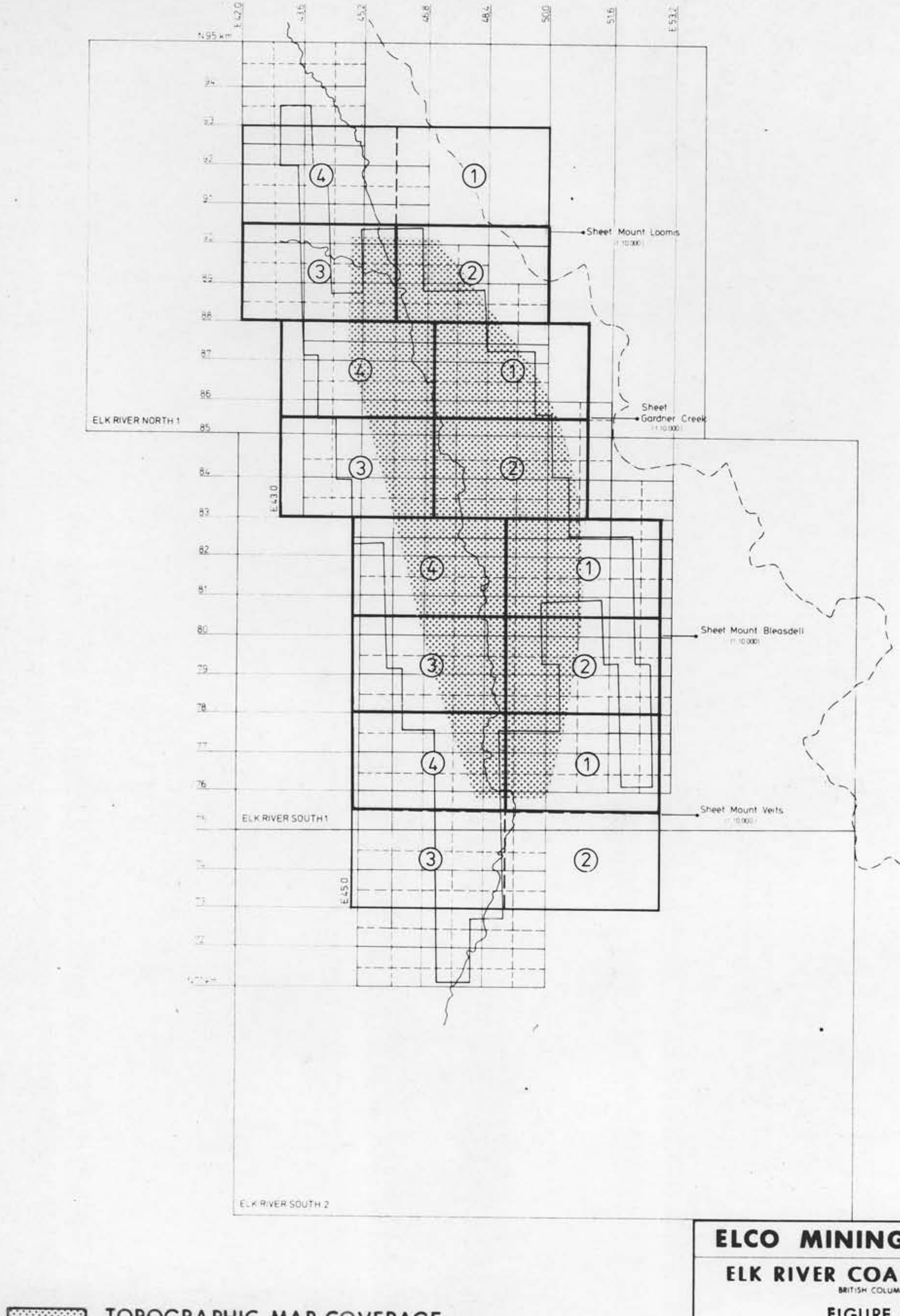
BRITISH COLUMBIA

FIGURE 2.0

AREA OF 1:2000 TOPOGRAPHIC MAP COVERAGE

DATE: AUG., 1977	DRWG NO SK700-145
COMPILED BY: ELCO MINING LIMITED	

Date March 1977 | Supplement



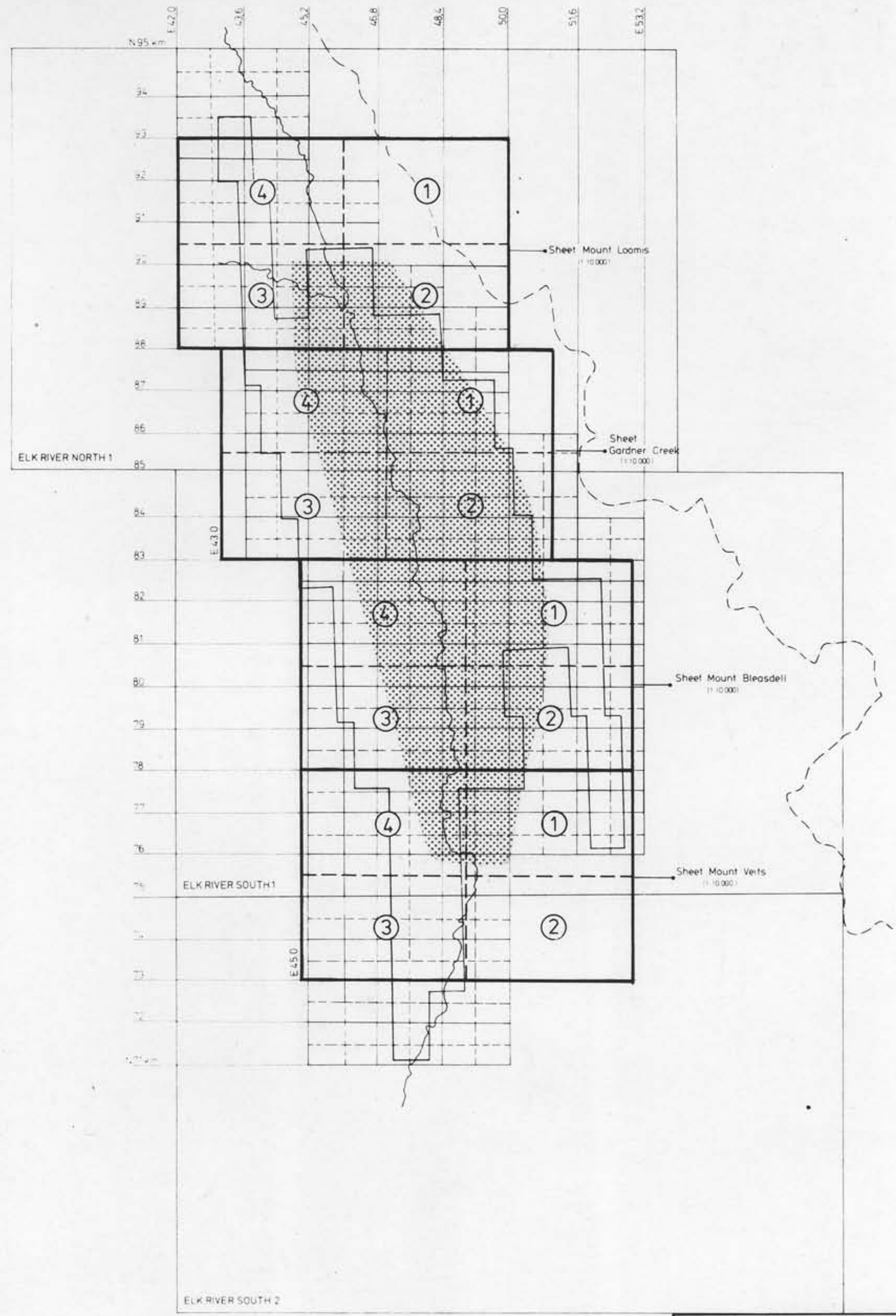
ELCO MINING LIMITED

ELK RIVER COAL PROJECT
BRITISH COLUMBIA

FIGURE 3.0
AREA OF 1: 5000 TOPOGRAPHIC MAP COVERAGE

DATE: AUG., 1977	DRWG NO: SK700-146

COMPILED BY: ELCO MINING LIMITED



TOPOGRAPHIC MAP COVERAGE

ELCO MINING LIMITED

ELK RIVER COAL PROJECT

BRITISH COLUMBIA

FIGURE 4.0

AREA OF 1: 10000 TOPOGRAPHIC MAP COVERAGE

DATE: AUG., 1977	DRWG NO: SK700-147
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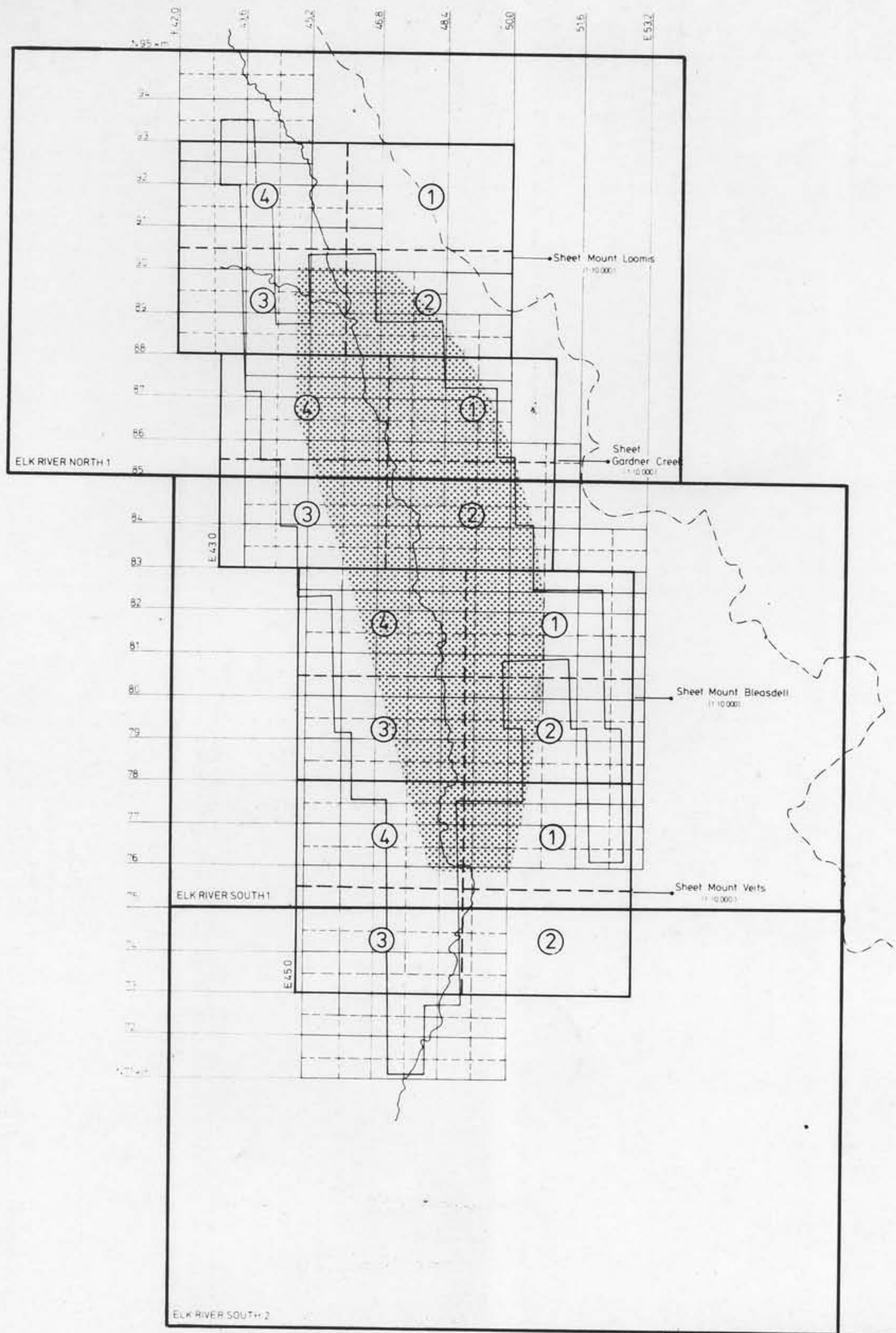


TOPOGRAPHIC MAP COVERAGE

ELCO MINING LIMITED

ELK RIVER COAL PROJECT

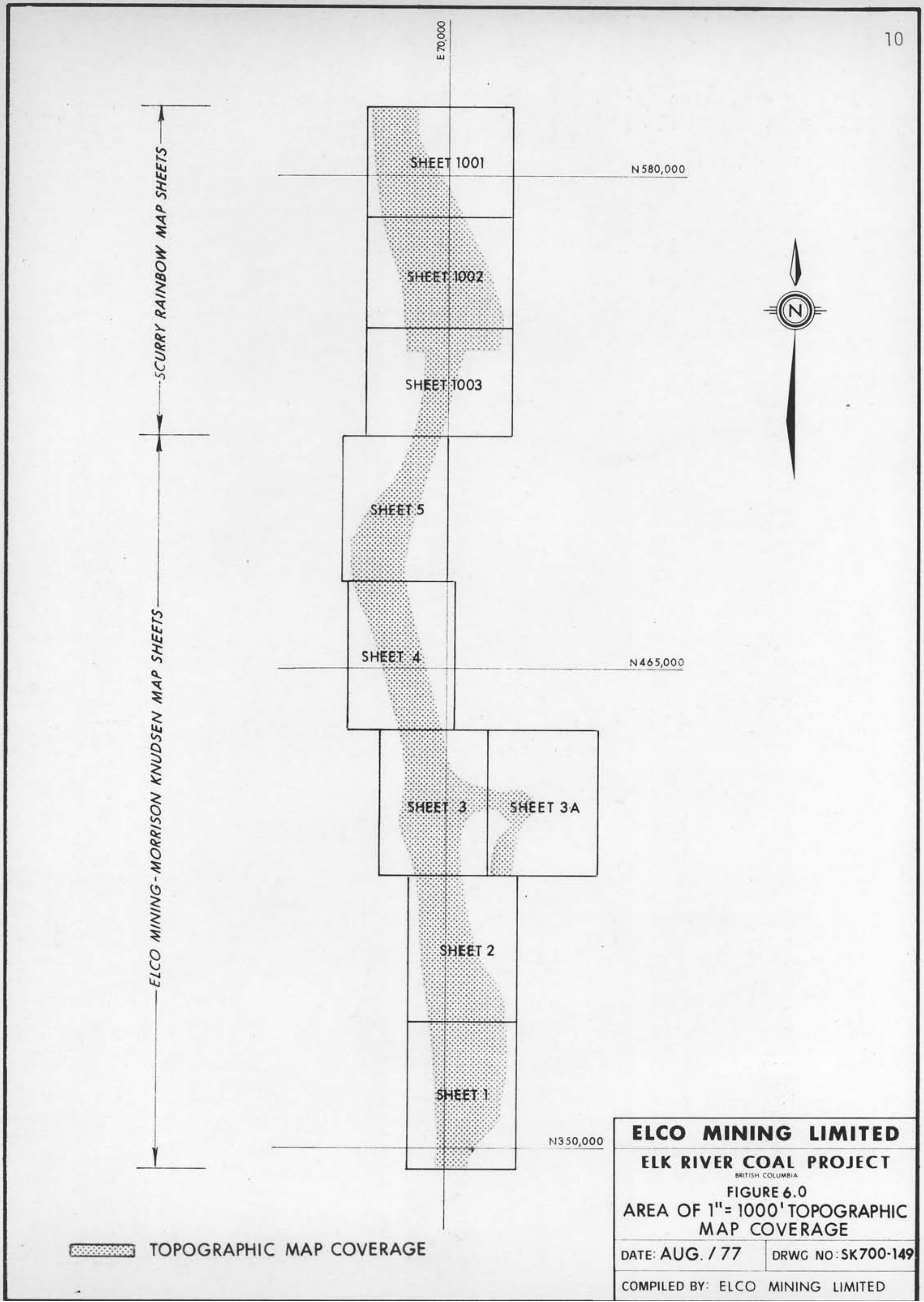
BRITISH COLUMBIA

FIGURE 5.0

AREA OF 1: 20000 TOPOGRAPHIC MAP COVERAGE

DATE: AUG., 1977	DRWG NO: SK700-148

COMPILED BY: ELCO MINING LIMITED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SCURRY RAINBOW MAP SHEETS
ELCO MINING - MORRISON KNUDSEN MAP SHEETS
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SHEET 1003
SHEET 5
SHEET 4
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SHEET 3
SHEET 3A
SHEET 2
SHEET 1
N 350,000
N
TOPOGRAPHIC MAP COVERAGE
ELCO MINING LIMITED
ELK RIVER COAL PROJECT
BRITISH COLUMBIA
FIGURE 6.0
AREA OF 1" = 1000' TOPOGRAPHIC MAP COVERAGE
DATE: AUG. / 77
DRWG NO: SK700-149
COMPILED BY: ELCO MINING LIMITED

of West Germany, after McElhanney failed to complete this work on time. The metric base maps were also prepared in West Germany by Geomess Ing. GmbH. The imperial scale strip maps were prepared by McElhanney.

In addition to the metric base map preparation, Geomess was also contracted to develop a geological data base which could undertake specific evaluations and map plotting for geology and mine planning. A metric Mine Baseline System was planned from which mine bench plans could be developed and geological bench surveying could be carried out during future mining operations, see Map 1.0, page 12.

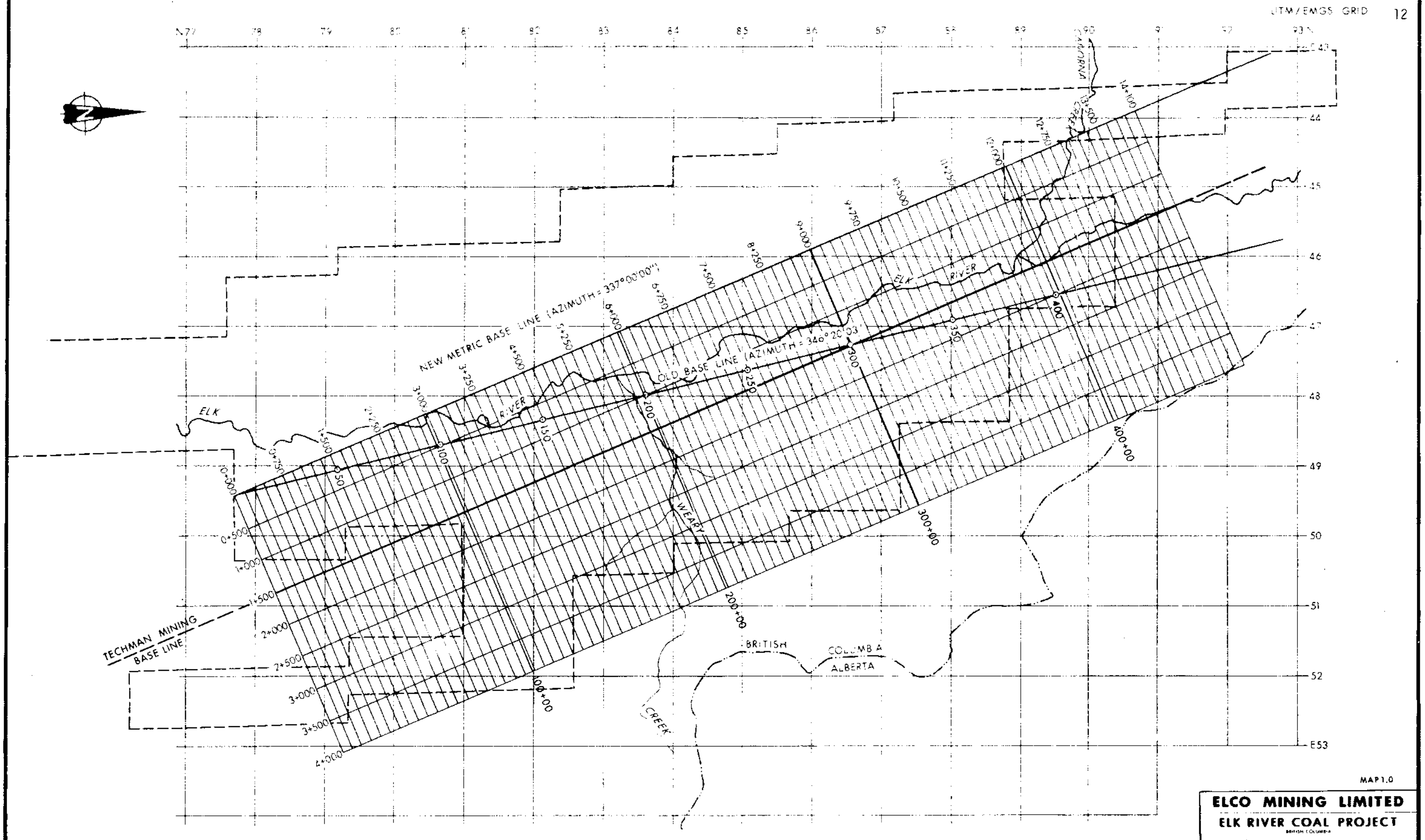
THE ELK RIVER GRID/BASELINE SYSTEMS

The MSEL Grid System

The MSEL System, extended into the Elk River Valley in 1969, is a plane rectangular system with an origin (a point considered to be error-free) at survey monument "712", located in the Fording River Valley. Bearings are referred to the meridian running through the Alberta-British Columbia border monument, "5F". Distances are reduced to the 5200 foot datum. The longitude of "5F" is 114°42' West.

The MSEL grid was developed for other users to the south of the Elk River Project and was extended into the Elk River Valley from a survey carried up from the south. A series of control points were established, including ties made to the Geodetic Survey of Canada stations "Bleasdell" and "Riverside". MSEL coordinate values were then established for these Geodetic stations from which a bearing and grid distance was derived as follows:

MSEL Coordinates for Station "Bleasdell": 547,113.7 ft N, 58,370.3 ft E
MSEL Coordinates for Station "Riverside": 587,990.3 ft N, 51,053.1 ft E
"Bleasdell" to"Riverside" bearing and grid distance: 349°51'04", 41,526.35 ft (12,657.23 m).



ELCO MINING LIMITED

ELK RIVER COAL PROJECT

BRITISH COLUMBIA

LAYOUT OF NEW BASE LINE
(Metric System)
SCALE: 1:50,000

DATE: Dec., 1977	DRWG NO: N-700
COMPILED BY: ELCO MINING LIMITED	

The Exploration Baseline System

The Exploration Baseline System was established in 1968 by McElhanney for North American Coal Corporation for the purpose of controlling an exploration drilling, trenching and adit driving program. Stations were set at 1000 foot intervals. In 1970, McElhanney established MSEL coordinates for the baseline stations. Station 0+00, located on the south bank of Aldridge Creek near the Kanelk transmission line, had MSEL coordinates of 542,197.00 ftN, 71,117.30 ftE, and Station 400+00, located in the northern licence area had MSEL coordinates of 581,339.4455 ftN, 62, 879.0382 ftE.

An inverse calculation of these MSEL coordinates rotates the Exploration Baseline $11^{\circ}53'07.8''$ west of the MSEL Grid North.

The Techman Mine Baseline System

The Techman Mine Baseline System was established in 1974 for Exploration und Bergbau GmbH of West Germany. This baseline was orientated such that it was parallel to the overall structural strike of the deposit. A central location in the potential mine area, Station 300+00 on the Exploration Baseline, was selected as the point of origin. Baseline coordinate, 300+00 N, 0+00 E, the same as the Exploration Baseline coordinate, was assigned to the point of origin. Stations were laid out in 500 foot intervals in both directions from Station 300+00.

The bearing of the Techman Baseline was determined from many strike measurements that had been made in both directions from Exploration Baseline Station 300+00. It was found that for a 1000 foot run along, or parallel to the Exploration Baseline, strike passed through a point on a line tangent to the baseline at an average distance of 165 feet from the baseline, see Figure 7.0 below.

Using an inverse tangent calculation, the Techman Baseline rotates $9^{\circ}22'09.8''$ west of the Exploration Baseline North. Relative to the MSEL Grid, the Techman Baseline rotates $11^{\circ}53'07.8'' + 9^{\circ}22'09.8'' = 21^{\circ}15'17.6''$ west of the MSEL Grid North.

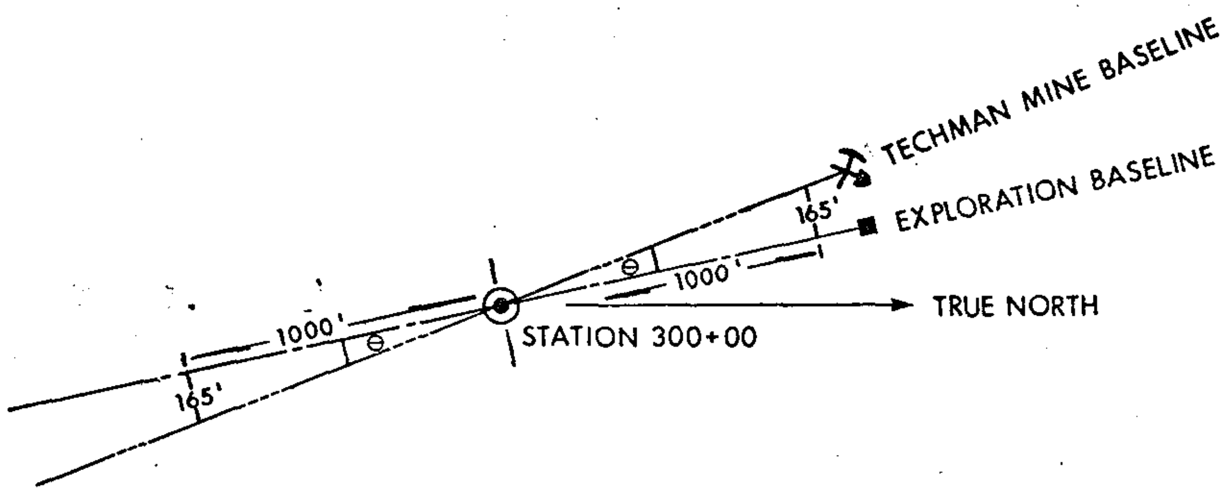


Figure 7.0: Development of Techman Mine Baseline

The Elco Mining Grid System (EMGS)

The Elco Mining Grid System, known as the EMGS system, was established in October 1976. This is a slightly modified UTM plane rectangular system. Its origin (considered an error-free point) is the Geodetic Survey of Canada station "Bleasdell". The central meridian is $117^{o}00'00''$, the same for UTM Zone 11. Distances are reduced to a convenient ,local datum of 1500 meters. The published government coordinate values for station "Bleasdell", 5,579,003.40 mN, 645,546.10 mE were adopted.

A tie was made to the Geodetic Survey of Canada station "Riverside". The published coordinate values for Riverside are 5,591,401.9 mN, 642,926.7 mE, and an inverse computation using the published coordinate values, gives a bearing and grid distance from "Bleasdell" to "Riverside" of $348^{o}04'14.5$ and 12,672.18 meters respectively.

The same inverse computation, only using MSEL coordinate values, gives a bearing and grid distance from "Bleasdell" to "Riverside" of $349^{o}51'04''$ and 12,657.23 m respectively. When the obvious discrepancy between the two surveys was discovered, weather conditions were such that further field checks could not be made at that time of year. The Department of Mines and Technical Surveys, who are responsible for geodetic surveys, were informed. They were, quote, "not surprised with the discrepancy since "Bleasdell" and "Riverside" were only classed as fourth order control stations".

For the purpose of establishing the EMGS grid the following decisions were made:

1. Use the bearing from "Bleasdell" to "Riverside", as derived from the GSC published values for those stations, and, which by definition is error free;
2. Use the grid distance from "Bleasdell" to "Riverside" as derived by the EMGS survey;
3. Using the above two values, EMGS coordinates for "Riverside" were established as 5,591,387.28 mN, 642,929.79 mE. Because of this arrangement, McElhanney who conducted the survey made the following recommendation:

"Since our survey tie consists of only one station in the vicinity of the mine development area, the transformation of coordinates should be confined to that area. Any transformation of coordinates from other surveys should not be undertaken until additional ties are made to the triangulation system".

Having the MSEL grid and the EMGS grid both tied to Mount Bleasdell and the MSEL grid tied to the Exploration Baseline at Station 0 + 00 it was then possible to complete coordinate conversion computations between the three systems. This will be described in detail in a later section.

The Metric Mine Baseline System

The Metric Mine Baseline System was developed in mid-1977 during Elco's feasibility study, see Map 1.0, page 12. This system, which has not been established in the field, was developed concurrently with a geological data base. The initial purpose of this system was to provide a reference grid by which mine bench plans could be developed from the data base.

The origin for the Metric Mine Baseline was coincident with the origin for the Exploration Baseline, Station 0 + 00. The orientation of the Metric Mine Baseline was to be parallel with the Techman Mine Baseline in order to keep new mine planning complementary with the Techman Mine planning, upon which the feasibility study was based. This placed the location of the Mine Baseline to the west and outside of the open pit area. All measurements into the initial thirty-six year pit would therefore be positive.

At first glance the metric Mine Baseline System seemed to be a fairly workable system, however, when an attempt was made to develop a co-ordinate conversion program for this system, problems were encountered. The baseline azimuth is not a true north azimuth, the baseline is not exactly parallel with the Techman Baseline and its location is not strategically well placed. It is a simple matter to correct the azimuth and set the baseline parallel to the Techman Baseline, but its location and its overall coverage of the entire licence area, with respect to future considerations, is not easily improved without major changes. An alternative system has therefore been devised.

Grid Convergence

When using "azimuth" directions it is appropriate to indicate the reference meridian from which the azimuth angle is rotated. In the situation where there are various grid/baseline systems existing it is adviseable to only use azimuth angles that are referenced to the True North Meridian. The Elk River Project has two rectangular grid systems, the MSEL and EMGS, both of which have central or reference meridians located at great distances from the licence area. When a plane rectangular grid system is extended over long distances, corrections for grid convergence with a known local meridian must be made. The GSC station "Bleasdell" has published longitude and latitude values and since both the MSEL and EMGS grids are tied to this station grid convergence can be calculated for both systems. The following method is used to perform this calculation:

"Convergence = (Meridian Longitude-Station Longitude) x Sine Station Latitude".

EMGS Convergence at Station "Bleasdell"

1. EMGS is referenced to central meridian $117^{o}00'00"$
2. Longitude of Station "Bleasdell" = $114^{o}57'15.69"$
3. Latitude of Station "Bleasdell" = $50^{o}20'49.48"$
4. EMGS convergence = $(117^{o}00'00" - 114^{o}57'15.69") \times$ Sine $50^{o}20'49.48"$
   = $N1^{o}34'30"$ E or $1^{o}34'30"$ True North Azimuth

MSEL Convergence at Station "Bleasdell"

1. MSEL is referenced to the meridian $114^{o}42'00"$ through monument "5F".
2. Longitude of Station "Bleasdell" = $114^{o}57'15.69"$
3. Latitude of Station "Bleasdell" = $50^{o}20'49.48"$
4. MSEL convergence = $(114^{o}42'00" - 114^{o}57'15.69") \times$ Sine $50^{o}20'49.48"$
   = $N0^{o}\ 11'45"$ W or $359^{o}48'15"$ True North Azimuth

N 0^{o} 11'45" W, however, is not the correct MSEL grid convergence. It has been established that a systematic error has been carried through the MSEL system. This can be identified as follows:

1. The convergence at "Bleasdell" in the EMGS system amounts to N $1^{o}34'30"$ E. This must be applied to the EMGS grid azimuth $348^{o}04'14.5"$ from "Bleashell" to "Riverside", which by definition is error free, (see EMGS Grid System, page 14).

$$348^{o}04'14.5^{o} + 1^{o}34'30" = 349^{o}38'44.5"$$

2. The convergence at "Bleasdell" in the MSEL system amounts to N $0^{o}11'45"$ W. This must be applied to the MSEL grid azimuth $349^{o}51'04"$ from "Bleasdell" to "Riverside", which is not error free, (see MSEL Grid System, page 11).

$$349^{o}51'04" - 0^{o}11'45" = 349^{o}39'19.0"$$

3. The actual survey error is the convergence applied MSEL azimuth ("Bleasdell" to "Riverside"), minus the convergence corrected, EMGS error free azimuth ("Bleasdell" to "Riverside").

$$349^{o}39'\ 19.0" - 349^{o}38'44.5" = N0^{o}\ 00'34.5"\ W.$$

The correct MSEL grid convergence therefore =

N0°11'45" W + N0°00'34.5" W = N°012'19.5"W or 359°47'40.5 True North Azimuth

In order to avoid further confusion on azimuths the True North azimuths have been calculated for each Elk River grid and baseline system and are listed below. In addition a "Grid/Baseline Orientation Diagram", see Figure 8.0, page 19, has been prepared which shows the correct True North azimuth for each system as it passes through GSC station "Bleasdell". The rotation angles between each system are also shown. These must be known in order to perform coordinate conversions from one system to the next. The True North azimuths for average strike, as used in the data base, and magnet north, for the year 1976, are also shown.

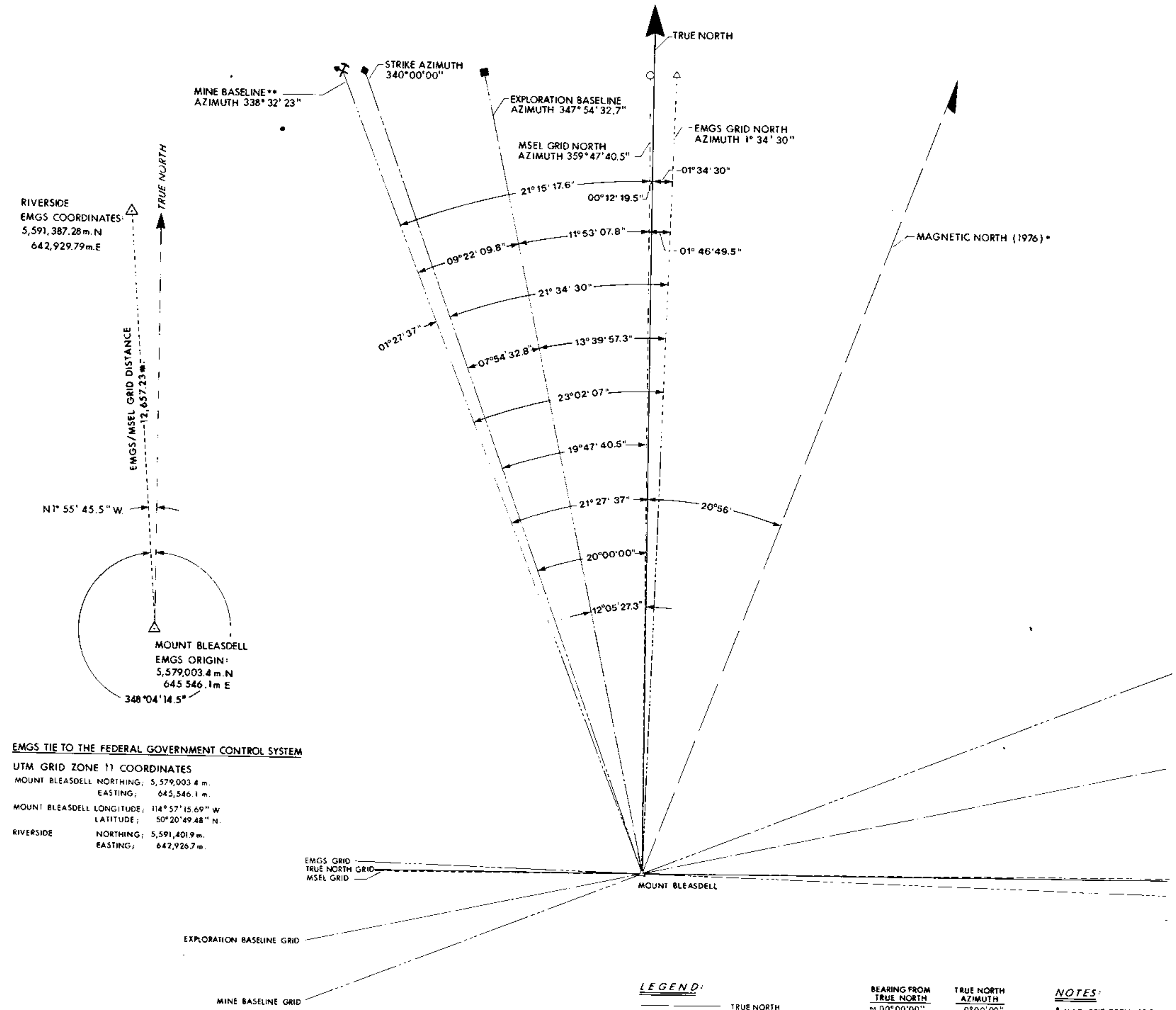
System	Bearing from True North	True North Azimuth
MSEL	N 0°12'19.5" W	359°47'40.5"
Exploration Baseline	N 12°05'27.3" W	347°54'32.7"
EMGS	N 1°34'30" E	1°34'30"
Techman Baseline	N 21°27'37" W	338°32'23"
Metric Mine Baseline	N 21°27'37" W	338°32'23"

An Alternative Metric Mine Baseline System (MBLS)

An alternative location for the metric Mine Baseline has been selected by Elco. It is recommended that it be located through the GSC station "Bleasdell" which is the "tie" point for the EMGS and the MSEL grid systems, see Map. 2.0, page 20, "Alternative Metric Mine Baseline". In order that all locations within the licence area have positive coordinate values, Elco further recommends that station "Bleasdell" be assigned metric Mine Baseline coordinate values of:

10 + 000 m North, 2 + 000 m East.

This baseline system would have the same True North azimuth as the Techman Baseline System, 338°32'23", in order to maintain consistency with the Techman Alternative "D" mining plan and parallelism with structural strike. As shown on Map 2.0, the grid spacing is at 500 meter intervals in the



EMGS TIE TO THE FEDERAL GOVERNMENT CONTROL SYSTEM

UTM GRID ZONE 11 COORDINATES

MOUNT BLEASDELL	NORTHING;	5,579,003.4 m.
	EASTING;	645,546.1 m.
MOUNT BLEASDELL	LONGITUDE;	114° 57' 15.69" W
	LATITUDE;	50° 20' 49.48" N.
RIVERSIDE	NORTHING;	5,591,401.9 m.
	EASTING;	642,926.7 m.

LEGEND:

	BEARING FROM TRUE NORTH	TRUE NORTH AZIMUTH
TRUE NORTH	N.00°00'00"	0°00'00"
MSEL NORTH	N 00° 12' 19.5" W	359° 47' 40.5"
EXPLORATION BASELINE NORTH	N. 12° 05' 27.3" W	347° 54' 32.7"
STRIKE	N.20° 00' 00" W	340° 00' 00"
MINE BASELINE NORTH**	N.21° 27' 37" W	338° 32' 23"
EMGS NORTH	N 01° 34' 30" E	01° 34' 30"
MAGNETIC NORTH (1976)*	N 20° 56' 00" E*	20° 56' 00"*

NOTES:

* MAGNETIC DECLINATION= 20° 56' (1976) DECREASING 4.0' WEST ANNUALLY

** ALSO TECHMAN BASELINE

FIGURE 8.0

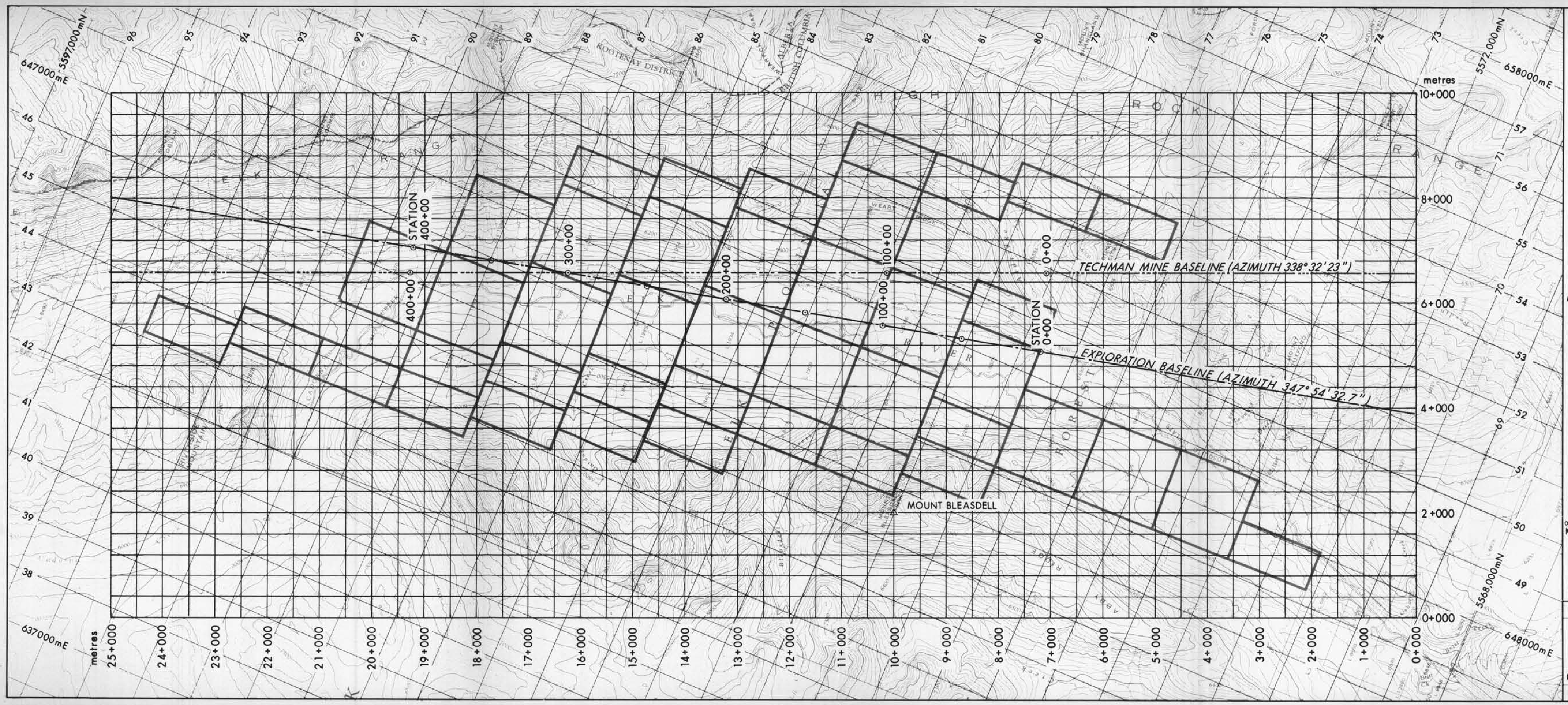
ELCO MINING LIMITED

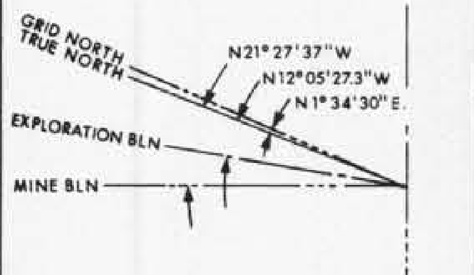
ELK RIVER COAL PROJECT

GRID/ BASELINE ORIENTATION DIAGRAM

DATE MAY 1/79 | BY: G. LAWRENCE

DWG NO: CC-ER79-73733-23





NOTE:

ALL BEARINGS AND AZIMUTHS ARE REFERENCED TO TRUE NORTH.

METRIC MINE BASELINE PARALLELS TECHMAN MINE BASELINE

0 500 1000 2000 3000

SCALE IN METRES
1:50,000

ELCO MINING LIMITED

ELK RIVER COAL PROJECT
BRITISH COLUMBIA
MAP 2.0
ALTERNATIVE
LAYOUT OF METRIC MINE BASELINE

DATE: MAY 4, 1979	BY: G.F. LAWRENCE

DWG. NO: DC-ER79-10000-121

north-south direction and 400 meter intervals in the east-west direction. This corresponds exactly with Elco's bench plan sheet size, 500 x 400 meters, at a 1:600 scale. For control purposes during construction and the later mine operations periods, either EDM* stations, or a baseline could be easily established along line 3 + 600 mE, between stations 1 + 400 mN and 1 + 800 mE. This portion of line 3 + 600 mE offers an excellent commanding view of the proposed plant and mine site area in the valley below and would closely parallel an existing access road located on or near the crest of the west flank ridge. There would be no risk of disturbance from construction and mining activities.

Coordinate Conversions

Coordinate conversions from one grid or baseline system to another grid or baseline system can be carried out when the following "tie" data between the systems is known:

1. The equivalent coordinate values of each system for the "tie" station, e. g. MSEL and EMGS coordinates for station Bleasdell;
2. The True North azimuth of each system at the "tie" station;
3. The angle of rotation between the True North azimuths of each system.

MSEL - EMGS Coordinate Conversions

1.	Tie Station: Mt. Bleasdell	
2.	MSEL Coordinates:	547,113.70 ft N, 58,370.30 ft E
3.	EMGS Coordinates:	5,579,003.40 M N, 645,546.10 M E
4.	MSEL True North Azimuth:	$359^{o}47'40.5''$
5.	EMGS True North Azimuth:	$1^{o}34'30''$
6.	Angle of Rotation:	$1^{o}46'49.5''$
7.	MSEL to EMGS Coordinate Conversion:	

(a) MSEL coordinates__________________ft N,________________ft E,

* - EDM: Electronic Distance Measuring

(b) Subtract: 547,113.70 ft N, 58,370.30 ft. E,

(c) Convert to polar coordinates , r & θ,

(d) Change "r" to meters, multiply by 0.3048,

(e) Rotate "θ" east (+) $1^{o}46'49.5"$,

(f) Convert to rectangular co-ordinates x & y,

(g) Add: 5,579,003.40 mN, 645,546.10 mE.

8. Inverse Conversion, EMGS to MSEL:

(a) EMGS coordinates: : ____________mN, ____________mE,

(b) Subtract 5,579,003.40 mN, 645,546.10 mE,

(c) Convert to polar coordinates , r & θ,

(d) Change "r" to meters, divide by 0.3048,

(e) Rotate "θ" west (-)$1^{o}46'49.5"$,

(f) Convert to rectangular coordinates , x & y,

(g) Add: 547,113.70 ft N, 58,370.30 ft. E.

<u>Exploration Baseline - MSEL Coordinate Conversions</u>

1. Tie Station: Station 0 + 00, Exploration Baseline Origin
2. Exploration Baseline coordinates : 00.0 ft. N, 00.0 ft. E
3. MSEL Coordinates: 542,197.0 ft. N, 71,117.3 ft. E
4. Exploration Baseline True North Azimuth: $347^{o}54'32.7"$
5. MSEL True North Azimuth: $359^{o}47'40.5"$
6. Angle of Rotation $11^{o}53'07.8"$
7. Exploration Baseline to MSEL Coordinate Conversion:
   (a) Exploration Baseline coordinates: ________ft N, _____ft E,
   (b) Convert to polar coordinates, r & θ,
   (c) Rotate "θ" east (+) $11^{o}53'07.8"$,
   (d) Convert to rectangular coordinates x & y,
   (e) Add: 542,197.0 ft. N, 71,117.3 ft. E.
8. Inverse Conversion, MSEL to Exploration Baseline:
   (a) MSEL coordinates __________ft. N, ________ft. E,
   (b) Subtract: 542,197.0 ft. N, 71,117.3 ft. E,
   (c) Convert to polar coordinates r & θ,
   (d) Rotate "θ" west (-) $11^{o}53'07.8"$,
   (e) Convert to rectangular coordinates x & y.

Exploration Baseline - EMGS Coordinate Conversions

1. Tie Station: Station 0 + 00, Exploration Baseline Origin
2. Exploration Baseline Coordinates: 00.0 ft. N 00.0 ft. E
3. EMGS Coordinates: 5,577,626.225 mN, 649,476.0703 mE
4. Exploration Baseline North Azimuth: 347°54'32.7"
5. EMGS North Azimuth: 1°34'30"
6. Angle of Rotation: 13°39'57.3"
7. Exploration Baseline to EMGS Coordinate Conversion:
   - (a) Exploration Baseline coordinate:________ft N,_______ft E,
   - (b) Convert to polar coordinates, r & θ,
   - (c) Rotate "θ" east (+) 13°39'57.3",
   - (d) Change "r" to meters, multiply by 0.3048,
   - (e) Convert to rectangular coordinates x & y,
   - (f) Add: 5,577,626.225 mN, 649,476.0703 mE.
8. Inverse Conversion, EMGS to Exploration Baseline:
   - (a) EMGS coordinates__________mN, __________ mE,
   - (b) Subtract: 5,577,626.225 mN, 649,476.0703 mE,
   - (c) Convert to polar coordinates, r & θ,
   - (d) Change "r" to feet, divide by 0.3048,
   - (e) Rotate "θ " west (-) 13°39'57.3",
   - (f) Convert to rectangular coordinates, x & y.

EMGS - Elco Proposed Metric Mine Baseline (MBLS) Coordinate Conversions

1. Tie Station: Mt. Bleasdell
2. EMGS Coordinates: 5,579,003.40 mN, 645,546.10 mE
3. Metric Mine Baseline Coordinates: 10 + 000.00 mN, 2 + 0000.00 mE
4. EMGS True North Azimuth: 1° 34'30"
5. MBLS True North Azimuty: 338° 32' 23"
6. Angle of Rotation: 23° 02' 07"
7. EMGS to Proposed MBLS Coordinate Conversion:
   - (a) EMGS coordinates:____________mN, _________mE,
   - (b) Subtract: 5,579,003.40 mN, 645,546,10 mE,
   - (c) Convert to polar coordinates r & θ,
   - (d) Rotate "θ" west (-) 23°02'07",

(e) Convert to rectangular coordinates x & y,

(f) Add: 10 + 000.0 mN, 2 + 000.0 mE.

8. Inverse Conversion, Proposed MBLS to EMGS Coordinates:

   (a) MBLS coordinates: __________mN,__________mE,

   (b) Subtract: 10 + 000.0 mN, 2 + 000.0 mE,

   (c) Convert to polar coordinates, r & θ,

   (d) Rotate "θ" east (+) $23^{o}02'07''$,

   (e) Convert to rectangular coordinates, x & y,

   (f) Add: 5,579,003.40 mN, 645,546.10 mE.

<u>MSEL - Elco Proposed Metric Mine Baseline (MBLS) Coordinate Conversions</u>

1. Tie Station: Mt. Bleasdell
2. MSEL Coordinates: 547,113.70 ft N, 58,370.30 ft. E
3. Metric Mine Baseline Coordinates: 10 + 000.00 mN, 2 + 000.00 mE
4. MSEL True North Azimuth: $359^{o}47'40.5''$
5. MBLS True North Azimuth: $338^{o}32'23''$
6. Angle of Rotation: $21^{o}15'17.5''$
7. MSEL to Proposed MBLS Coordinate Conversion:

   (a) MSEL coordinates: __________ft N,__________ft. E,

   (b) Subtract: 547,113.70 ft. N, 58,370.30 ft. E,

   (c) Convert to polar coordinates, r & θ,

   (d) Change "r" to meters, multiply by 0.3048,

   (e) Rotate "θ" west (-) $21^{o}15'17.5''$,

   (f) Convert to rectangular coordinates, x & y,

   (g) Add: 10 + 000.0 mN, 2 + 000.mE.

9. Inverse Conversion, Proposed MBLS to MSEL Coordinates:

   (a) MBLS coordinates: __________mN __________mE,

   (b) Subtract: 10 + 000.00 mN, 2 + 000.00 mE,

   (c) Convert to polar coordinates, r & θ,

   (d) Change "r" to feet, divide by 0.3048,

   (e) Rotate "θ" east (+) $21^{o}15'17.5''$,

   (f) Convert to rectangular coordinates, x & y,

   (g) Add: 547,113.70 ft. N, 58,370.30 ft. E.

Exploration Baseline - Elco Proposed Metric Mine Baseline (MBLS)
Coordinate Conversions

1. Tie Station: Mt. Bleasdell
2. Exploration Baseline Coordinates (calculated):
   74 + 36.614 ft. N, 114 + 61.096 ft. E
3. Metric Mine Baseline Coordinates: 10 + 000.0 mN, 2 + 000.0 mE
4. Exploration Baseline True North Azimuth: $347^{0}54'32.7''$
5. Metric Mine Baseline True North Azimuth: $338^{0}32'23''$
6. Angle of Rotation: $9^{0}22'09.7''$
7. Exploration Baseline to Proposed MBLS Coordinate Conversion:

   (a) Exploration Baseline Coordinates: __________ft. N,__________ ft. E,
   (b) Subtract: 74 + 36.614 ft. N, 114 + 61.09 ft. E,
   (c) Convert to polar coordinates, r & θ,
   (d) Change "r" to meters, multiply by 0.3048,
   (e) Rotate "θ" west (-) $9^{0}22'09.7''$,
   (f) Convert to rectangular coordinates, x & y,
   (g) Add: 10 + 000.0 mN, 2 + 000.0 mE.

8. Inverse Conversion, Proposed MBLS to Exploration Baseline Coordinates:
   (a) MBLS coordinates: __________mN,__________mE,
   (b) Subtract: 10 + 000.0 mN, 2 + 000.0 mE,
   (c) Convert to polar coordinates, r & θ,
   (d) Change "r" to feet, divide by 0.3048,
   (e) Rotate "θ" east (+) $9^{0}22'09.7''$,
   (f) Convert to rectangular coordinates, x & y,
   (g) Add: 74 + 36.614 ft. N, 114 + 61.096 ft. E.

Errors Identified to Date in the Existing Elco Mapping and Surveying Documentation

Grid Convergence: - All topographical maps that have been produced by Geomess to date are labelled with a grid convergence diagram that indicates the EMGS grid convergence to be $1^{0}38'$. This convergence angle has apparently been adopted from the local NTS map sheet, *Mount Head* (82J/7W) rather than using the convergence angle calculated for Mount Bleasdell,

$1^{o}34'30''$. The NTS convergence angle, $1^{o}38'$, represents an approximate grid convergence at the centre of the NTS map sheet, which is located slightly to the east of the licence area, whereas, Mount Bleasdell, at $1^{o}34'30''$, is on the western edge of the licence area. Only the calculated convergence angle of $1^{o}34'30''$ should be used to show grid convergence on the licence area maps. There are two reasons for this:

1. $1^{o}34'30''$ is a more precise representation of EMGS convergence, and the total mapping area is not large enough to warrant more than one grid convergence adjustment.

2. The calculated Mount Bleasdell convergence angle $1^{o}34'30''$ is an integral component of the rotation angle between the EMGS and MSEL grids.

<u>Control Monuments for the EMGS</u>: - The Feasibility Report states that north orientation was established by the azimuth taken from Mount Bleasdell to Mount Weary. This is not correct; the published bearing from Mount Bleasell to Riverside was used to establish north orientation.

<u>Techman, Exploration and Metric Mine Baseline Azimuths</u>: - The Feasibility Report has used unreferenced azimuths for these baseline systems. These azimuths were considered to be referenced to True North, however, investigations have indicated that they were referenced to the EMGS Grid North. It is adviseable to use only True North referenced azimuths, but should other references be used, they should always be identified.

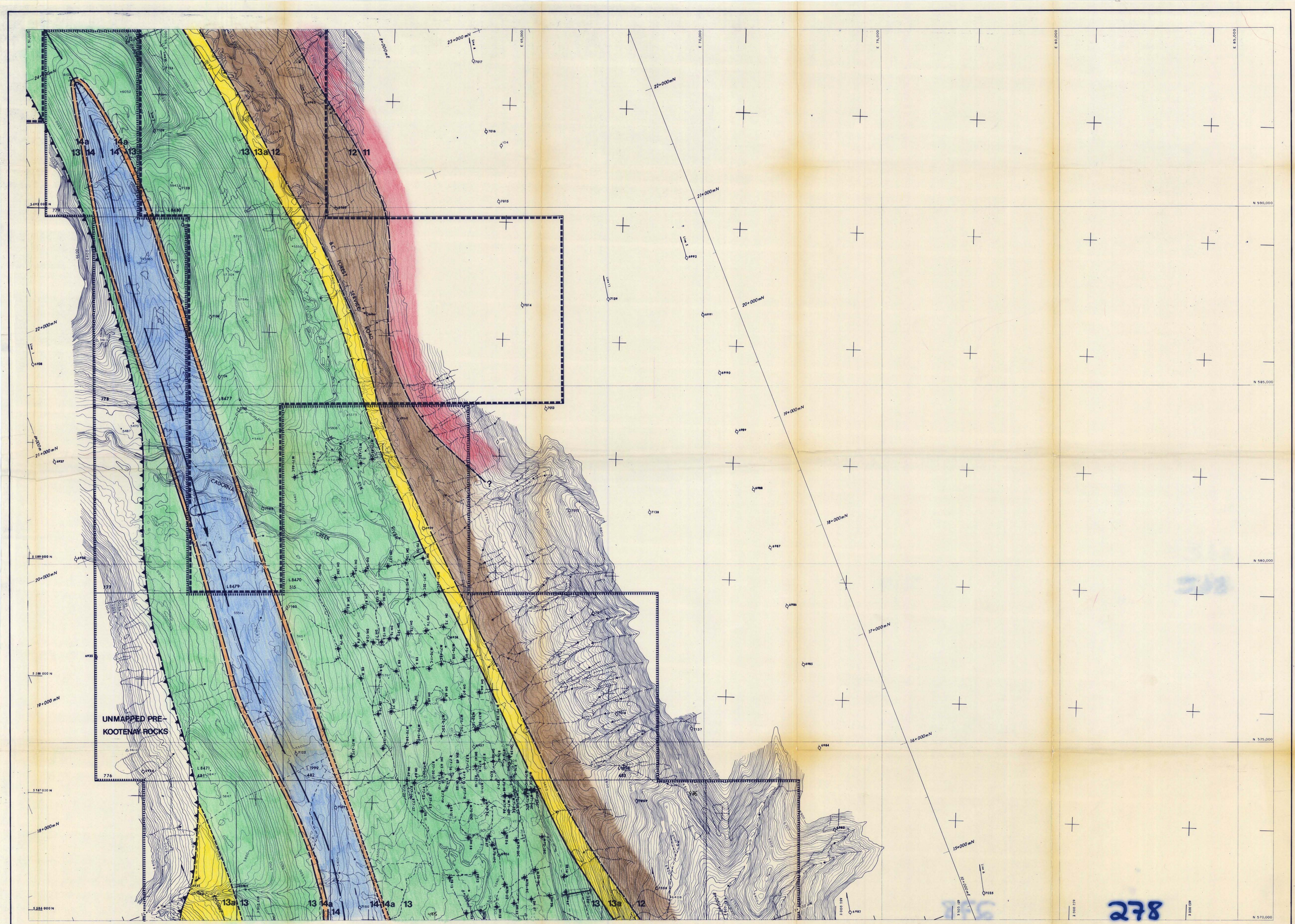
- The Feasibility Report also stated that the metric Mine Baseline was established parallel to the Techman Baseline. This is not exactly correct, when the azimuth quoted in the Feasibility Report for the Techman Baseline was changed to a True North referenced azimuth, a slight difference from the actual Techman Baseline True North azimuth was found. Elco's proposed Metric Mine Baseline has been oriented parallel to the Techman Baseline.

CONCLUSIONS

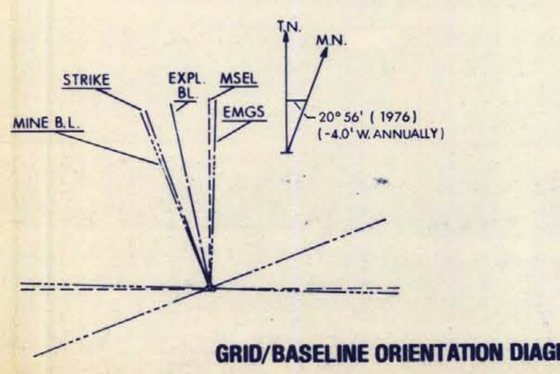
It is intended that this review of the various Elk River grid/baseline systems will serve as a reference for both present and future Elk River operations. It has been useful in identifying certain areas where either corrections were necessary and where data was not clearly defined. In time, it is expected that this review will have to be updated again.

The alternative Metric Mine Baseline System, as proposed by Elco, will take care of all future mine planning and operations control requirements. Since it has also been designed to be used as the layout control for the bench plans, it is recommended that this system be adopted as soon as possible.

Appendix 2.0



JOINS XG-ER80-71000-003 2/3



GRID/BASELINE ORIENTATION DIAGRAM

LOWER CRETACEOUS

14 — **BLAIRMORE GROUP (Undivided):** grey and greenish grey sandstone, grey and maroon, silty mudstone, conglomerates.

14a — **CADOMIN CONGLOMERATE (Basal Blairmore):** green and black chert, white and pink quartzite, pebble to cobble size clastes in a matrix of dark coarse grained sand

13 — **KOOTENAY FORMATION (Undivided):** grey and black carbonaceous sandstone, siltstone and mudstone; coal.

13c — **ELK MEMBER:** thick, generally cliff-forming succession of inter-bedded sandstone, siltstone, shale, sporadic thin coal seams, and conglomerates at some localities.

13b — **COAL-BEARING MEMBER:** thick succession of grey to greyish brown, interbedded carbonaceous – argillaceous sandstone, siltstone, mudstone, shale, and economically important thin to thick coal seams.

13a — **BASAL SANDSTONE MEMBER:** consists of two units; lower unit comprised of medium – to thick-bedded, fine to medium grained, orange – to yellow-brown weathering quartzose sandstone, argillaceous, slightly limonitic and calcareous and moderately to poorly indurated; upper unit consists of fine – to coarse-grained quartzose sandstone, only slightly argillaceous and ferruginous, siliceous and highly indurated.

JURASSIC

12 — **FERNIE GROUP:** grey, brownish grey, and black shale, siltstone and sandstone, limestone; glauconitic sandstone and shale

TRIASSIC

11 — **SPRAY RIVER FORMATION:** dark grey silty shale, siltstone and shale, light grey dolomitic or sideritic argillaceous siltstone in upper part.

11a — **SPRAY RIVER** phosphate

PERMIAN AND PENNSYLVANIAN

10 — **ROCKY MOUNTAIN FORMATION:** light grey quartzitic, dolomitic, and calcareous sandstone, dark grey sandstone; dolomite; cherty dolomite; chert; phosphate in upper part.

MISSISSIPPIAN

9 — **RUNDLE GROUP (Undivided):**

Geological Contact — known
Geological Contact — approximate
Geological Contact — estimated
Thrust Fault — known
Thrust Fault — approximate
Thrust Fault — inferred
Normal Fault — (showing direction of movement)
Normal Fault — known
Normal Fault — approximate
Normal Fault — inferred
Syncline, Anticline — known & showing direction of plunge
Syncline, Anticline — approximate & showing direction of plunge
Overturned Syncline
Overturned Anticline
Bedding, (inclined, vertical, horizontal)

B.C. Coal Reserve
Elk River Coal Project
Fording Coal Licenses
Cominco Freehold
Cominco Licenses

L1998 — Lot No
483 — Coal Licence No.

Diamond Drill Hole
Rotary Drill Hole
Exploration Trench
Bulk Sample Trench
Adit
Exploration Trail
7023 — Air Photo Centre
Horizontal Control Point
Vertical Control Point
N570,000 / E 85,000 — MSEL Grid System
5 579 000N / 644 000 E — Elco Mining Grid System (EMGS)
10+000mN / 0+000mE — Mine Grid System

REV	Description	By	Date

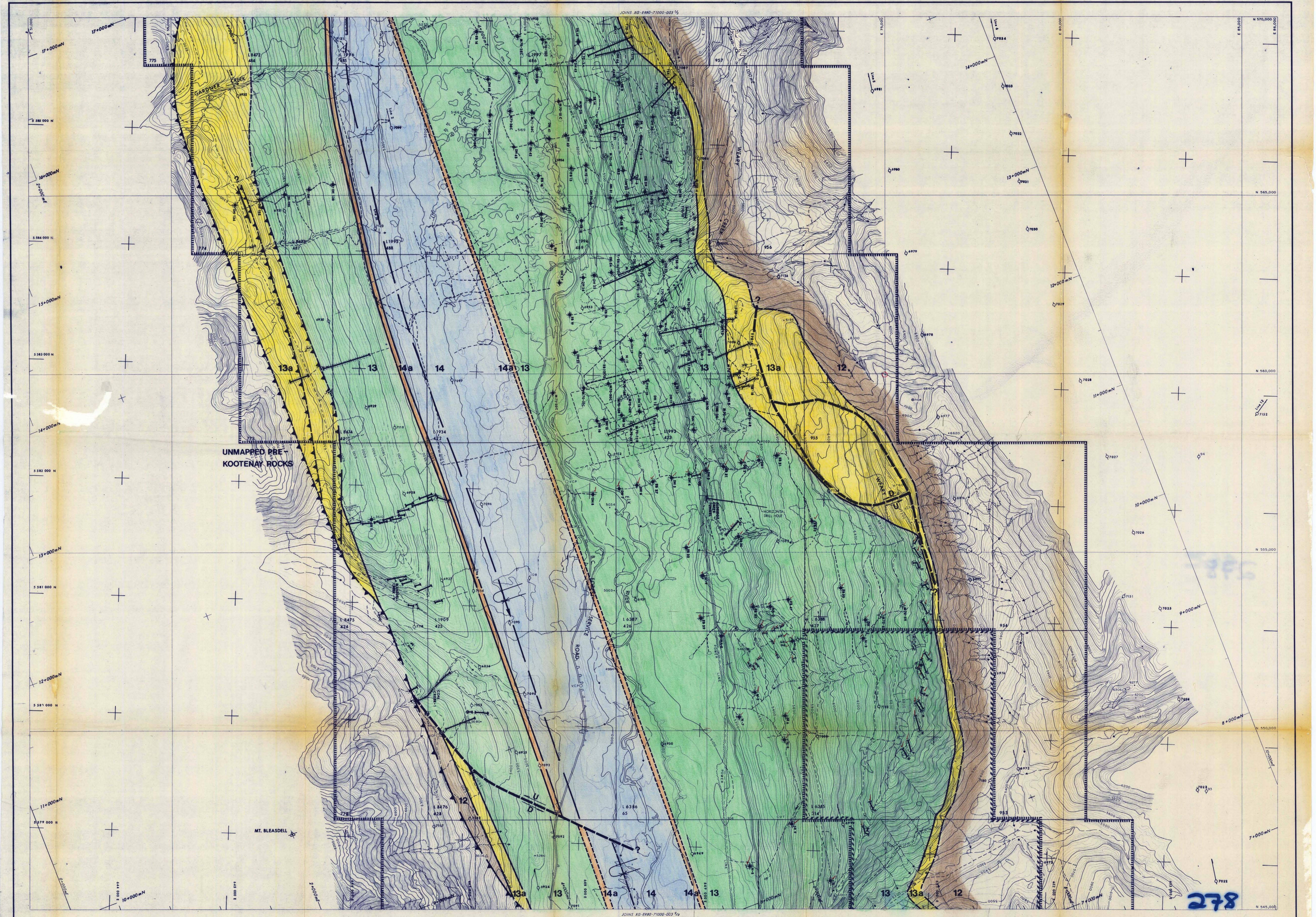
278

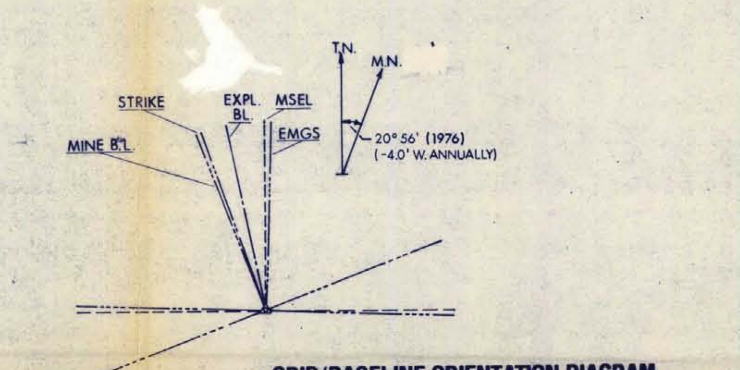
K-ELK RIVER 79(2)A

ELCO MINING LIMITED
ELK RIVER COAL PROJECT
BRITISH COLUMBIA

GENERAL GEOLOGY OF THE ELK RIVER COAL LICENCES

Drawn By: B. FLASHA	Date: MARCH, 1980
Checked By:	Scale: 1:10 000
Compiled By: G. LAWRENCE	Dwg. No.: XG-ER80-71000-003 1/3





GRID/BASELINE ORIENTATION DIAGRAM

LOWER CRETACEOUS

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Syncline, Anticline — known & showing direction of plunge
Syncline, Anticline — approximate & showing direction of plunge
Overturned Syncline
Overturned Anticline
Bedding, (inclined, vertical, horizontal)

B.C. Coal Reserve
Elk River Coal Project
Fording Coal Licenses
Cominco Freehold
Cominco Licenses

L6386 — Lot No.
65 — Coal Licence No.

Diamond Drill Hole
Rotary Drill Hole
Exploration Trench
Bulk Sample Trench
Adit
Exploration Trail
7023 Air Photo Centre
Horizontal Control Point
Vertical Control Point
N570,000 / E 85,000 — MSEL Grid System
5 579 000 N / 644 000 E — Elco Mining Grid System (EMGS)
10+000 mN / 0+000 mE — Mine Grid System

75000

REV	Description	By	Date

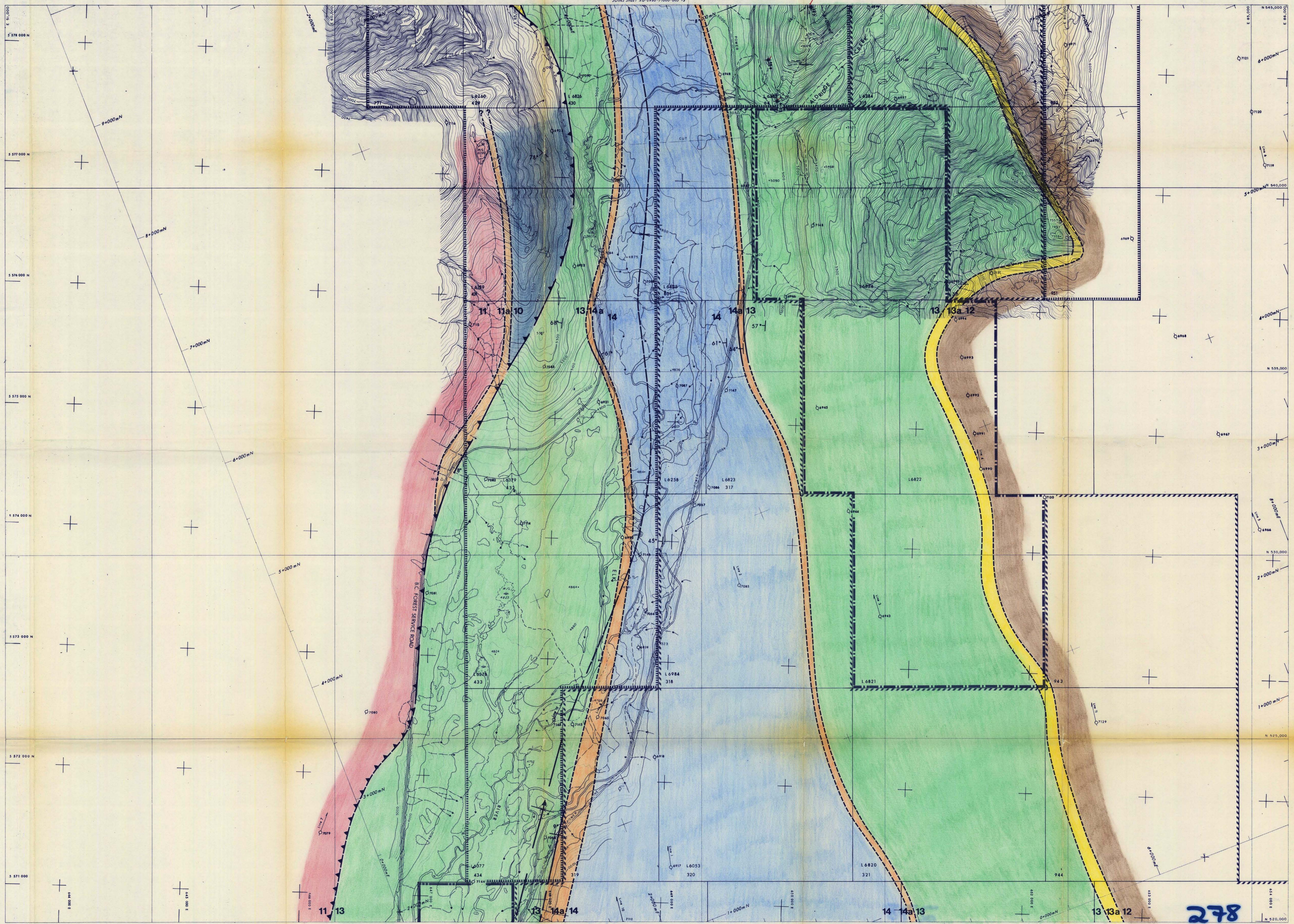
278

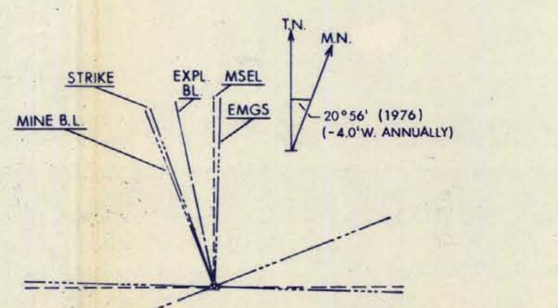
K-ELK RIVER 79(2)A

ELCO MINING LIMITED
ELK RIVER COAL PROJECT
BRITISH COLUMBIA

GENERAL GEOLOGY OF THE ELK RIVER COAL LICENCES

Drawn By: B.FLASHA	Date: MARCH, 1980
Checked By:	Scale: 1:10000
Compiled By: G. LAWRENCE	Dwg. No.: XG-ER80-71000-003 2/3





GRID/BASELINE ORIENTATION DIAGRAM

LOWER CRETACEOUS

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Normal Fault — inferred
Syncline, Anticline — known & showing direction of plunge
Syncline, Anticline — approximate & showing direction of plunge
Overturned Syncline
Overturned Anticline
Bedding, (inclined, vertical, horizontal)

B.C. Coal Reserve
Elk River Coal Project
Fording Coal Licenses
Cominco Freehold
Cominco Licenses

L6053 — Lot No
320 — Coal Licence No

Diamond Drill Hole
Rotary Drill Hole
Exploration Trench
Bulk Sample Trench
Adit
Exploration Trail
7025 — Air Photo Centre
Horizontal Control Point
Vertical Control Point
N570,000 E 85,000 — MSEL Grid System
5 579 000N 644 000E — Elco Mining Grid System (EMGS)
10+000mN 0+000mE — Mine Grid System

REV	Description	By	Date

K-ELK RIVER 79(2)A.

ELCO MINING LIMITED
ELK RIVER COAL PROJECT
BRITISH COLUMBIA

GENERAL GEOLOGY OF THE ELK RIVER COAL LICENCES

Drawn By: B. FLASHA	Date: MARCH, 1980
Checked By:	Scale: 1:10 000
Compiled By: G. LAWRENCE	Dwg. No.: XG-ER80-71000-003 3/3

Appendix 3.0

POINT #	NORTHING	EASTING	ELEVATION	
1	5 579 003.400	645 546.100	2590.240	BLEASDELL
2	5 579 843.484	650 752.202	2116.100	SEAM IP597
3	5 585 221.009	648 609.502	1915.900	CASS IP596
4	5 591 387.909	642 929.631	2338.900	RIVERSIDE
5	5 574 004.183	645 450.220	2181.540	ARB IP598
6	5 564 977.084	647 057.406	2264.670	RIV IP651
7	5 562 343.430	647 164.836	2397.860	CONE IP599
8	5 557 708.744	649 537.404	2153.410	FORD IP615
9	5 549 083.327	645 789.159	2106.550	ELK IP608
10	5 541 843.802	649 309.473	1254.170	HELI IP600
11	5 545 279.079	653 403.578	1489.230	COB IP611

278 K-ELK RIVER 79 (2) A.

NOTE:
CO-ORDINATES BASED ON ELCO MINING GRID SYSTEM (EMGS)
ORIGIN OF GRID AT MOUNT BLEASDELL WITH A VALUE OF 5,579,003.4 N. AND 645,546.10 E.
GRID BEARINGS DERIVED FROM UTM AZIMUTH BLEASDELL TO RIVERSIDE OF 348° 04' 14"
ALL DISTANCES REDUCED TO 1500 m DATUM ABOVE SEA LEVEL
ELEVATIONS TO GEODETIC DATUM AND DERIVED FROM EXISTING TRIG STATION AND BENCH MARK RECORDS.

UNDERHILL ENGINEERING LTD.
CONSULTING ENGINEERS
VANCOUVER, BRITISH COLUMBIA — WHITEHORSE, YUKON

C. D. Underhill
P. ENG., B.C.L.S.

NO	DATE	BY	REVISION	APP'D

SURVEY BY: C.D.U.	JOB NO.: 79-1
DRAWN BY:	DATE: DEC. 17 th, 1979
APPROVED:	SCALE: 1 : 50,000

CLIENT: ELCO MINING LIMITED
PROJECT: ELK RIVER PROJECT
TITLE: CONTROL SURVEY
SHEET 1 OF 3
DRAWING NUMBER: E-71
REVISION:

F.B. 951 p.
DESTROY PRINTS BEARING PREVIOUS NUMBER

POINT #	NORTHING	EASTING	ELEVATION		
1	5 579 003.400	645 546.100	2590.240	BLFASDELL	
2	5 579 843.484	650 752.202	2116.100	SEAM IP597	
3	5 585 221.009	648 609.502	1915.900	CASS IP596	
4	5 591 387.909	642 929.631	2338.900	RIVERSIDE	
5	5 574 004.183	645 450.220	2181.540	ABB IP598	
6	5 564 977.084	647 057.406	2264.670	RIV IP651	
7	5 562 343.430	647 164.836	2397.860	CONF IP599	
8	5 557 708.744	649 537.404	2153.410	FORD IP615	
9	5 549 083.327	645 789.159	2106.550	ELK IP608	
10	5 541 843.802	649 309.473	1254.170	HELI IP600	
11	5 545 279.079	653 403.578	1489.230	COB IP611	
17	5 557 329.930	645 442.809	1391.400	DIP17	
20	5 541 352.404	649 305.655	1252.070	IP601	
21	5 585 507.844	647 645.843	1586.200	W POLE	PP
22	5 582 811.133	648 774.132	1621.000	W POLE	PP
23	5 580 239.470	649 215.613	1579.300	W POLE	PP
24	5 579 317.547	649 221.000	1561.000	W POLE	PP
25	5 576 395.495	649 597.571	1528.900	W POLE	PP
26	5 574 263.745	649 141.347	1498.700	E POLE	PP
27	5 573 194.946	648 905.168	1504.400	W POLE	PP
28	5 571 531.180	648 115.694	1476.400	E POLE	PP
29	5 569 874.051	647 489.476	1462.800	W POLE	PP
30	5 568 333.182	646 834.252	1452.900	ROAD INTER	PP
31	5 565 126.414	645 852.397	1469.100	W POLE	PP
32	5 564 264.796	645 732.100	1468.500	W POLE	PP
33	5 541 352.571	649 308.147	1252.100	TREE	PP
34	5 561 677.125	645 741.502	1473.300	W POLE	PP
35	5 560 731.529	645 878.216	1450.600	W POLE	PP
36	5 559 033.522	646 632.091	1428.900	W POLE	PP
37	5 556 711.552	647 661.432	1394.500	W POLE	PP
38	5 555 511.813	648 198.216	1413.600	E POLE	PP
39	5 545 383.220	648 540.971	1266.900	TREE	PP
40	5 541 844.209	649 315.642	1254.200	POLE	PP
41	5 547 443.242	648 916.992	1291.000	W POLE	PP
42	5 546 311.875	650 388.665	1373.000	IP 654	PP
43	5 545 606.968	650 945.318	1482.700	IP610	
44	5 549 519.168	619 313.371	1316.000	TREE	PP
45	5 552 023.275	647 337.478	1309.400	TREE	PP
46	5 587 726.768	647 045.340	1625.200	W POLE	PP
47	5 586 426.540	647 398.157	1591.400	W POLE	PP
48	5 585 703.863	647 593.609	1587.700	W POLE	PP
49	5 555 511.813	648 198.216			
50	5 542 159.454	654 891.650	1507.400	RR ROAD INTERSEC	
51	5 544 137.738	656 133.449	1527.700	TREES	PP
52	5 543 487.481	655 390.666	1504.100	CL BRIDGE E END	PP
53	5 580 583.734	647 913.236	1547.800	BUSH	PP
54	5 584 422.691	646 038.314	1630.400	TREE	PP
55	5 589 924.748	646 297.999	1662.800	W POLE	PP
56	5 589 949.561	646 274.366	1668.400	TREE	PP
57	5 545 053.342	653 608.420	1489.100	TREE	PP
58	5 542 992.723	649 285.133	1265.100	CL BRIDGE S END	PP
59	5 548 970.734	647 687.789	1300.100	CL ROAD	PP
60	5 590 870.231	645 859.281	1671.300	CENTRE TWO POLES	PP
61	5 589 785.694	645 220.075	1654.700	TREE	PP
62	5 555 089.349	646 481.563	1396.900	CL ROAD	PP
63	5 553 698.584	647 062.639	1362.000	CL ROAD	PP
64	5 556 778.069	645 867.750	1388.800	CL ROAD	PP
65	5 558 921.852	643 872.713	1434.000	CL ROAD	PP
66	5 578 246.527	647 804.833	1574.600	TREE	PP
67	5 583 715.194	647 552.379	1568.400	CL ROAD	PP
68	5 584 326.056	646 969.828	1585.400	TREE	PP
69	5 571 483.028	646 824.394	1498.100	CL ROAD	PP
70	5 574 475.572	647 061.157	1532.500	BUSH	PP
71	5 567 231.305	645 467.647	1430.500	CL ROAD	PP
72	5 568 688.167	645 860.393	1467.500	CL ROADS	PP
73	5 568 900.474	645 254.963	1485.900	TREE	PP
74	5 568 903.585	645 256.061	1485.900	H	
75	5 563 398.125	643 998.191	1411.400	CL ROAD	PP
76	5 565 999.766	644 901.137	1413.800	CL ROAD	PP
77	5 562 145.514	643 774.474	1406.400	CENTRE BRIDGE	PP
78	5 562 423.895	642 986.027	1437.900	TREE	PP
79	5 562 537.287	643 281.464	1432.400	H	
80	5 560 948.548	644 071.261	1392.300	PP	
81	5 551 853.031	648 345.863	1304.800	TREE	PP
82	5 554 342.406	647 877.660	1318.700	BUSH	PP
83	5 587 275.856	645 288.043	1658.600	TREE	PP
84	5 557 347.140	645 464.387	1390.000	TREE	
85	5 545 609.263	652 859.939	1502.800	TREE	PP
86	5 545 062.166	651 780.038	1506.800	CL HYW GAS RW	PP

NOTE:
PP....DENOTES PICTURE POINT
IP....DENOTES IRON POST
H.....DENOTES HUB

NOTE:
CO-ORDINATES BASED ON ELCO MINING GRID SYSTEM (EMGS)
ORIGIN OF GRID AT MOUNT BLEASDELL WITH A VALUE OF 5,579,003.4 N. AND 645,546.10 E.
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C. D. Underhill
P. ENG., B.C.L.S.

NO.	DATE	BY	REVISION	APP'D

278 K- ELK RIVER 79 (2)A.

SURVEY BY C.D.U.	JOB NO. 79 - 1
DRAWN BY	DATE DEC. 17 th, 1979
APPROVED	SCALE 1 : 50,000

CLIENT: ELCO MINING LIMITED
PROJECT: ELK RIVER PROJECT
TITLE: PHOTO CONTROL
SHEET 2 OF 3
DRAWING NUMBER: E-71
REVISION

FB. 951 p.
DESTROY PRINTS BEARING PREVIOUS NUMBER

POINT #	NORTHING	EASTING	ELEVATION	
1	5 579 003.400	645 546.100	2590.240	BLEASDELL
2	5 579 843.484	650 752.202	2116.100	SEAM IP597
3	5 585 221.009	648 609.502	1915.900	CASS IP596
4	5 591 387.909	642 929.631	2338.900	RIVERSIDE
5	5 574 004.183	645 450.220	2181.540	ABB IP598
6	5 564 977.084	647 057.406	2264.670	RIV IP651
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9	5 549 083.327	645 789.159	2106.550	ELK IP608
10	5 541 843.802	649 309.473	1254.170	HELI IP600
11	5 545 279.079	653 403.578	1489.230	COB IP611
465	5 572 879.071	646 895.870	1524.440	IP
466	5 573 412.299	646 935.445	1524.510	IP
467	5 573 766.988	646 939.893	1523.010	IP
468	5 574 010.844	646 929.155	1532.790	IP
469	5 574 233.132	646 968.176	1540.900	IP
470	5 574 445.737	647 066.447	1530.370	IP
471	5 574 686.198	647 225.460	1510.520	IP
472	5 574 760.942	647 413.607	1505.690	IP
473	5 574 737.109	647 807.126	1505.720	IP
474	5 574 822.778	647 960.062	1498.140	SPIKE
475	5 575 169.890	648 278.261	1508.060	IP
476	5 575 318.207	648 346.142	1517.090	IP
477	5 575 591.560	648 378.352	1510.970	SPIKE
478	5 575 900.802	648 306.163	1533.420	IP
479	5 576 540.075	648 162.385	1547.870	IP
480	5 576 763.702	648 159.895	1559.700	SPIKE
481	5 576 864.858	648 106.745	1571.660	IP
482	5 578 208.526	647 808.721	1575.910	IP
483	5 578 371.889	647 759.955	1567.480	IP
484	5 578 827.671	647 807.749	1547.730	IP

POINT #	NORTHING	EASTING	ELEVATION	
485	5 579 085.408	647 788.245	1551.720	IP
486	5 579 276.135	647 815.163	1553.470	IP
487	5 579 971.465	648 037.747	1534.240	IP
488	5 580 745.438	647 889.238	1544.290	IP
489	5 580 916.436	647 969.635	1543.570	IP
490	5 581 446.754	648 031.277	1550.730	IP
491	5 581 840.261	647 840.921	1556.340	H
492	5 582 193.031	647 737.620	1555.920	SPIKE
493	5 582 677.870	647 510.337	1557.500	H
494	5 582 841.035	647 497.233	1558.190	H
495	5 583 166.274	647 591.042	1560.390	H
496	5 583 500.764	647 567.120	1566.680	SPIKE
497	5 583 715.839	647 537.594	1568.450	IP
498	5 583 888.039	647 579.981	1567.130	IP
499	5 584 050.244	647 912.776	1573.760	IP
509	5 565 990.326	644 892.344	1413.630	SPIKE
510	5 555 428.641	646 346.531	1397.670	SPIKE
511	5 553 340.658	647 207.227	1346.790	SPIKE
512	5 548 329.156	648 439.823	1298.070	SPIKE
513	5 547 867.969	648 953.308	1282.340	H
514	5 547 307.829	648 971.030	1279.420	H
515	5 544 095.688	648 545.488	1264.380	SPIKE
516	5 542 986.591	649 291.911	1264.990	NAIL
591	5 587 739.286	647 033.040	1625.240	IP
592	5 584 426.780	646 013.408	1631.660	IP
593	5 576 395.285	649 595.934	1528.940	OIP
595	5 580 596.321	647 910.192	1547.850	IP
600	5 541 843.990	649 309.366	1254.170	IP HELI
601	5 541 352.591	649 305.547	1252.090	IP
602	5 564 697.434	644 702.061	1405.350	OIP16
603	5 568 690.439	645 855.827	1467.810	IP
604	5 580 439.498	647 962.761	1547.130	IP
606	5 589 959.154	646 293.986	1671.030	IP
607	5 590 088.793	646 212.824	1672.930	IP

POINT #	NORTHING	EASTING	ELEVATION	
611	5 545 278.878	653 403.689	1489.130	IP COB
616	5 543 445.119	649 052.720	1268.170	IP
617	5 543 671.409	648 690.407	1271.790	IP
618	5 545 235.817	648 898.823	1268.220	H
619	5 546 085.173	649 014.057	1271.920	H
620	5 547 928.343	648 827.247	1285.110	IP
621	5 548 025.147	648 704.931	1295.950	IP
622	5 548 094.032	648 560.955	1301.970	IP
623	5 548 182.680	648 497.979	1302.670	IP
624	5 548 533.003	648 192.163	1298.150	IP
625	5 548 670.910	648 024.334	1293.900	IP
626	5 548 828.112	647 742.189	1293.410	IP
627	5 548 962.329	647 694.729	1299.830	SPIKE
628	5 549 313.845	647 540.117	1303.830	IP
629	5 549 707.573	647 552.405	1311.220	IP
630	5 549 849.111	647 521.567	1321.260	IP
631	5 550 130.563	647 425.491	1327.220	IP
632	5 550 507.195	647 354.345	1315.070	IP
633	5 550 777.250	647 317.175	1316.180	IP
634	5 551 019.022	647 219.238	1337.430	IP
635	5 551 220.561	647 228.090	1335.920	IP
636	5 551 370.354	647 196.351	1327.850	IP
637	5 552 053.199	647 320.489	1312.500	IP
638	5 552 320.275	647 290.360	1319.770	IP
639	5 552 807.017	647 171.724	1348.910	IP
640	5 553 027.179	647 198.784	1357.680	IP
641	5 553 172.261	647 209.976	1356.800	IP
642	5 553 779.815	647 034.398	1366.000	IP
643	5 555 054.244	646 490.398	1396.730	IP
644	5 555 855.187	646 168.497	1392.060	IP
645	5 556 822.169	645 853.981	1388.530	IP
646	5 557 658.617	645 186.401	1401.500	IP
647	5 557 941.602	644 918.647	1410.860	IP

POINT #	NORTHING	EASTING	ELEVATION		
647	5 557 941.602	644 918.647	1410.860	IP	
648	5 558 205.015	644 704.924	1407.210	IP	
649	5 558 446.768	644 353.637	1420.820	IP	
650	5 558 728.087	643 983.699	1428.150	IP	
652	5 569 943.521	646 816.574	1441.370	IP	
653	5 544 880.976	650 418.889	1410.190	H	PP
655	5 545 536.147	653 482.580	1500.790	IP	
656	5 547 415.109	648 936.961	1288.820	IP	
657	5 589 138.526	646 665.261	1667.620	IP	
658	5 589 291.500	646 588.823	1672.600	IP	
659	5 590 530.661	646 013.156	1676.840	IP	
662	5 586 417.801	647 407.094	1591.420	IP	
663	5 585 724.585	647 585.928	1587.670	IP	
664	5 585 516.508	647 648.008	1586.170	IP	
665	5 584 689.052	647 993.937	1606.430	IP	
666	5 584 409.884	648 104.781	1623.750	IP	
667	5 584 208.170	648 187.005	1622.480	IP	
668	5 582 811.521	648 775.054	1621.020	IP	
669	5 581 337.460	649 029.355	1606.060	IP	
670	5 580 206.906	649 214.082	1577.760	IP	
671	5 579 248.030	649 229.206	1560.960	IP	
672	5 576 256.947	649 576.907	1530.500	IP	
674	5 573 146.668	648 903.692	1504.460	IP	
675	5 571 508.199	648 114.751	1476.410	IP	
676	5 571 134.835	647 958.346	1448.820	IP	
677	5 569 872.600	647 484.659	1462.780	IP	

POINT #	NORTHING	EASTING	ELEVATION	
678	5 568 203.461	646 783.816	1452.580	IP
679	5 568 331.913	646 837.727	1453.380	IP
680	5 565 126.171	645 850.412	1469.100	IP
681	5 559 076.769	643 777.997	1439.930	IP
682	5 559 847.561	643 643.303	1418.590	IP
683	5 560 101.772	643 685.947	1415.150	IP
684	5 560 510.883	643 877.831	1407.590	IP
685	5 560 974.006	644 084.511	1393.090	IP
686	5 562 305.574	643 735.910	1418.780	IP
687	5 562 546.655	643 782.093	1422.750	IP
688	5 564 144.791	644 184.171	1415.270	IP
689	5 564 322.230	644 306.255	1413.860	IP
690	5 564 622.678	644 695.769	1405.700	IP
691	5 564 817.667	644 768.964	1403.550	IP
692	5 566 604.520	645 170.183	1423.930	IP
693	5 567 673.074	645 676.968	1438.630	IP
694	5 568 256.438	645 822.076	1464.730	IP
695	5 568 732.335	645 741.151	1479.450	H
696	5 568 806.132	645 916.208	1468.200	IP
697	5 569 095.460	646 233.242	1462.200	IP
698	5 569 425.188	646 343.536	1461.330	IP
699	5 569 645.350	646 577.959	1455.080	IP
700	5 569 751.801	646 720.455	1448.410	IP
701	5 571 491.828	646 816.236	1500.790	IP
702	5 564 264.555	645 733.883	1468.480	IP

POINT #	NORTHING	EASTING	ELEVATION	
703	5 562 680.402	645 594.801	1468.060	IP
704	5 562 609.922	645 609.0[illegible]8	1472.920	IP
705	5 561 683.924	645 741.322	1473.300	IP
706	5 560 755.080	645 874.150	1450.620	IP
707	5 559 022.694	646 643.869	1428.950	IP
708	5 556 710.467	647 658.960	1394.540	IP
709	5 555 511.570	648 197.668	1413.590	IP
710	5 543 924.652	649 567.796	1316.040	IP
711	5 545 179.656	654 341.351	1502.820	
712	5 545 549.600	653 878.334	1504.850	IP
775	5 544 833.136	654 551.259	1496.540	IP
776	5 544 085.883	654 796.598	1497.530	IP
778	5 543 641.383	655 093.538	1500.290	IP
782	5 543 448.798	655 513.443	1504.750	IP

NOTE:
OIP ... DENOTES OLD IRON POST
IP ..... DENOTES IRON POST
H ..... DENOTES HUB

NOTE:
CO-ORDINATES BASED ON ELCO MINING GRID SYSTEM (EMGS)
ORIGIN OF GRID AT MOUNT BLEASDELL WITH A VALUE OF 5,579,003.4 N. AND 645,546.10 E.
GRID BEARINGS DERIVED FROM UTM AZIMUTH BLEASDELL TO RIVERSIDE OF 348° 04' 14"
ALL DISTANCES REDUCED TO 1500 m DATUM ABOVE SEA LEVEL
ELEVATIONS TO GEODETIC DATUM AND DERIVED FROM EXISTING TRIG STATION AND BENCH MARK RECORDS.

UNDERHILL ENGINEERING LTD.
CONSULTING ENGINEERS
VANCOUVER, BRITISH COLUMBIA — WHITEHORSE, YUKON

D. Underhill
P. ENG., B.C.L.S.

NO.	DATE	BY	REVISION	APP'D

SURVEY BY: C. D. U.
JOB NO.: 79 - 1
DRAWN BY:
DATE: DEC. 17th, 1979
APPROVED:
SCALE: 1 : 50,000

CLIENT: ELCO MINING LIMITED
PROJECT: ELK RIVER PROJECT
TITLE: SURVEY DATA

SHEET 3 OF 3
DRAWING NUMBER: E-71
REVISION:

278 K- ELK RIVER 79 (2)A.

F.B. 951 p.

DESTROY PRINTS BEARING PREVIOUS NUMBER