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PROPOSED PLAN •
EXPLORATORY HEADINGS – BLOCK A •
PRODUCTION COSTS – RUN OF MINE COAL

Sukunka River Project
CHETWYND B.C.

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BRAMEDA RESOURCES LIMITED

FENCO Foundation of Canada Engineering Corporation Limited

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FOUNDATION OF CANADA ENGINEERING
CORPORATION LIMITED
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March 31, 1970

PR-SUKUNKA 70(1)A

SUKUNKA RIVER PROJECT

(copy 1)
March 31st 1970

Mr. Morris M. Menzies
Vice President - Exploration
Brameda Resources Limited
Board of Trade Building
1177 West Hasings Street
Vancouver, B. C.

FENCO LTD.

Dear Mr. Menzies,

During our meeting of March 18, 1970, you requested that we submit an interim Report to cover the suggestion of combining the advantages of driving underground exploratory headings in Block A with the production of run-of-mine coal for sale, on the assumption that this would meet with your client's requirements.

We now have pleasure in forwarding this Report to you, with our recommendations.

Yours very truly,
FOUNDATION OF CANADA ENGINEERING
CORPORATION LIMITED

for W. R. Holden, P. Eng.
SENIOR DIVISION MANAGER
MINING AND METALLURGY

GEOLOGICAL BRANCH
ASSESSMENT REPORT

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Sukunka River Project
CHETWYND B.C.

BRAMEDA RESOURCES LIMITED

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1. ASSIGNMENT

1.1. At a meeting at the offices of Brameda Resources Limited (Brameda), on Wednesday March 18, 1970, it was indicated that the Japanese interests who intend to purchase coal produced from the Sukunka River Coal Project, may be prepared, in the very near future, to purchase any suitable run-of-mine coal obtained from headings, even though the scale of such an operation may be small.

1.2. Foundation of Canada Engineering Corporation Limited (FENCO) were asked to evaluate this proposal and to give an estimate of:-

(a) Coal production which could be anticipated

(b) Capital expenditure involved for underground workings.

(c) Cost of production.

(d) The effect of the driving of exploratory headings in order to assist the geological exploration programme.

2. ASSIGNED FENCO PERSONNEL

W. R. Holden, Manager, Mining & Metallurgy Division - FENCO
H. S. (John) Haslam, Consulting Coal Mining Engineer - FENCO

3. GEOLOGICAL EXPLORATION OF THE SUKUNKA COAL AREAS

3.1. As of the date of the meeting referred to (paragraph 1), the progress of the diamond drilling programme was presented as follows:-

Mining Block	No. of D. D. Holes Drilled	Total Footage Drilled
A	10	6840
B	5	1454
	15	8294

3.2. This information from the drilling log has been plotted, and is shown in Figure 1. A section through the strata is shown in Figure 2. Further drilling, on a 2000' interval plan grid, is now being carried out.

3.3. In the ordinary course of events, and where the time factor for obtaining the full desired production is not of vital importance, one would normally anticipate that no mine planning or layout of workings would be finalized until a comprehensive investigation of the coal seams had been made by diamond core drilling methods, and by geological observations. Such a programme would give the mine planner accurate information regarding the contours of the base of the seams to be worked, their quality, the nature of their roofs and floors, and knowledge of any seam discontinuity by faulting or folding.

3.4. The urgent requirement for coal production which is indicated by the customer, and by the need, for obvious reasons, to reach full designed production as soon as possible, leads to a re-examination of exploration procedures with a view to achieving a speedy start to coal production operations.

3.5. It is necessary to point out that in an unproven coal field, or block of coal, in which geological proving by drilling may only be described as of a partial nature, certain risks involving lack of continuity of daily production may be incurred if a detailed configuration of the seams and their surrounding strata have not been determined before exploratory and/or development headings are commenced. Thus, one is left to make the best technical use of data already found, with some degree of optimism that the interpretation of this data in the drafting of geological maps can be relied upon. In this respect, it is noted that the practical value of the geological information which has been given to Brameda as a result of the work of Dr. Hughes leads us to believe in the continuity of this seam.

3.6. Whilst it is always desirable to have a more detailed or closer grid diamond drill programme for mine planning, the value of the additional expenditure may be questionable as thorough evaluation of potential faulting and coal cleanliness requires the driving of sufficient development headings. Consequently it is desirable to commence exploratory headings as soon as indications warrant them.

In short, there is a balance to be struck between drilling exploration dollars and the risk of a fluctuating coal output obtained from exploratory headings underground before the coal areas may be relied upon to yield consistent daily outputs at the ultimately desired quantity.

3.7. Provided the risk mentioned in the previous paragraph is admitted to be present, information may be obtained by exploratory headings which may well be more valuable in the long run than a comprehensive diamond drill programme would provide.

4. UNDERGROUND EXPLORATORY HEADINGS

4.1. By surface observation, the geologist is able to recognize major faulting of the strata, as shown on Figures 1 and 2. In any event the mine planner will be governed by these faults in laying out coal extraction panels, but he also must know the location of faults and folds between the known major faults, if they exist, whose position and displacement would disturb the working of the coal panels. Other local geological difficulties may also be encountered such as seams, volcanic dykes or wash-outs of the seams but so far as is presently known, we believe we have no evidence to suspect the presence of such difficulties in the Sukunka Valley coal fields under investigation.

4.2. Exploratory headings would thus be arranged in accordance with the lines of known or suspected geological faulting. The risk that these headings will run into other faults, if present, must be taken, but on the other hand such a procedure may be regarded as the only one which will accurately enough locate these disturbances and thus then allow mine planning for daily production continuity to be intelligently carried out.

4.3. From the preceding paragraph, it will be seen that, provided the mine operator is prepared for a possible lack of continuity of coal output from exploratory headings, dependent upon the degree of uniformity of coal seam configuration, quality and conditions, the use of exploratory headings can be of vital importance to the overall development of the coal areas concerned.

4.4. In the FENCO Report to Brameda to be issued April 15, 1970, development headings for retreating long wall operations are

mentioned, and some of these are also envisaged to be of an exploratory character, even though full information from a drilling programme was anticipated. It was further assumed that run-of-mine coal from these headings would be stock piled until the coal preparation plant which is proposed in the report is available, since the run-of-mine coal is assumed to carry 15% of reject material which would be removed by the coal preparation plant.

5. QUALITY OF RUN-OF-MINE COAL FROM THE CHAMBERLAIN SEAM

5.1. Analysis of core samples presently being taken from this seam and available as at March 18, 1970, is reported to indicate that the seam is of such a quality as to be able to meet the purchaser's specification, provided normal supervision and care of mining operations and of coal loading in the headings is taken. It is understood, of course, that there is no definite knowledge of the nature of the roof and floor beyond that which drill cores have indicated, and there is no means of knowing that the cores are fully representative of the comparatively large areas of coal strata involved. Exploratory headings will provide this information concerning the strata conditions.

5.2. If for any reason, the quality of coal as mined falls below the analytical specifications set out by the purchaser, some negotiation would be necessary to outline the general circumstances of the mining operation in order to avoid excessive monetary penalties.

5.3. If the quality of coal as mined is such as to exceed the purchaser's specifications, there may be a case for a bonus clause in the Agreement of Sale.

5.4. The experience gained by the mine operator in the matter of run-of-mine coal quality will play an important part in the decision to provide the coal preparation plant for the full designed production tonnage. If the actual penalties per ton are in reasonable balance with the total cleaning costs per ton, including financing of the plant and providing the grade of coal is still acceptable to the client, it is then pertinent to thoroughly investigate the necessity of a cleaning plant for full or partial output of the operation.

6. SIZING OF THE RUN-OF-MINE COAL FROM THE CHAMBERLAIN SEAM

6.1. Although the purchaser has indicated the sizing of the coal he wishes to buy is -2" to 0", it may well be that the run-of-mine coal will contain a

proportion of lump coal of 6" size or greater. In order to eliminate a coal crushing process, the purchaser may be approached with a view to his accepting the size of coal as mined, of course without penalty as to size.

6.2. Such an arrangement would be of great advantage as no further handling of the output of coal would be required between the portal and the railway car. Furthermore, any degradation of coal in transit from the mine to its ultimate destination would not create so large a percentage of very fine coal as when it has previously passed through a crusher.

6.3. Generally speaking, the very fine sizes of coal which make up the screen analysis of a sample of run-of-mine coal contain a higher proportion of dirt than the larger sizes - say over 1/4" in size. Thus, the larger the percentage of coal over 1/4" in size, the cleaner the product.

7. PRELIMINARY LAYOUT OF HEADINGS - BLOCK A

7.1. Block A has been chosen to be explored since:-

(a) It is the nearer to the Sukunka Valley road and thus has the easier access to the rail head at Chetwynd. The access roads to this block are more advanced than those to any other area.

(b) Diamond drilling has so far indicated the Chamberlain seam to be approximately 9' thick minimum to 11'6" thick maximum, and lying at an inclination of between level and 5°.

7.2. Headings may be so arranged, according to the present information, to serve both as exploratory headings to prove the ground to the desired extent and as development headings for long wall operation later on.

7.3. A proposed layout for exploratory headings is shown in Figure 3. Assuming the headings in these positions do not encounter faulting or other disturbance, the possible layout for retreating long walls is as shown in Figure 4.

7.4. It will be noted that a barrier of some 300' in width has been left in the seam workings layouts in Figures 3 and 4 around the outcrop of the seam.

8. COAL EXTRACTION FROM EXPLORATORY HEADINGS

The rate of coal extraction and its production cost will depend upon the type of machinery used and the number of men employed. Four stages of progress are proposed. The concept of Stages II, III and IV allows for an appreciation of the amount of money which may be available to provide the facilities and to do the work of producing the coal, also for the provision of adequate facilities to transport the coal to the railway at Chetwynd.

8.1. Stage I

The equipment which has been used recently to drive an adit, now completed at 157' in length, was an Eimco 123 loader delivering into a side tipping tracked mine car operated on one shift per day and employing 3 men. Shotholes were drilled by Atlas Copco airleg drills, and explosives were used to blast the coal 'off the solid'. The operation was hindered by many factors and cannot be taken as a standard for future operations. Whilst the work achieved its objective, the method is not recommended for further coal production and exploratory heading procedures.

8.2. Stage II

8.2.1. It is proposed that an Eimco 632 rubber-tired loader be used to load coal previously blasted 'off the solid' onto a 30" wide extensible conveyor, in a heading 16 ft. wide and 8 ft. or so in height, whose length would not exceed 200 ft. approximately.

The proposed layout is shown on Figure 5, and it is further proposed that this layout may be applied to an area of coal within the outcrop barrier, as shown in a suggested position on Figures 3 and 4. The precise position would be determined by the ease of access to the road system for trucking the coal down the valley to Chetwynd. Whatever position is chosen within the outcrop barrier will not hinder future workings.

8.2.2. Assuming an advance of 10 ft. per shift, or 30 ft. per day using 3 men per shift - the tonnage per day will be :-

16 ft. x 8 ft. x 30 ft. ÷ 26.5 cu. ft/ton

or 145 tons per day

x 7 days per week is 1000 tons

8.2.3. Output per manshift to portal is $\frac{145}{9}$ or 16 tons/man shift.

8.2.4. It is anticipated that the rate of advance of 10 ft. per shift may be exceeded as the crews become more accustomed to the work.

8.2.5. Estimated Cost of Production - Stage II

Per Week		$	Cost/ton $
Labour	9 men @ $5/hr. x 8 hrs. x 5 days	1800	
	9 men @ $7/hr. x 8 hrs. x 2 days	1008	
	(including fringe benefits)	2808	2.80
Materials	timber, explosives, consumables, etc. - say	150	.15
Rental of Equipment	Say $1600/month of 28 days	400	.40
Loading & Trucking	to Chetwynd - say	1400	1.40
Royalty	(to B. C. Government)	250	.25
	Total thus far	$5008	$5.00

8.2.6. Items not provided for in the above figures:-

(a) Means of loading trucks at mine portals - such as scraper chain conveyor, or movable bin of say 30 tons capacity.

(b) Provision of adequate roads from mine portals to Sukunka Valley road, for type of truck chosen for the work.

(c) Weighing of coal in trucks or in railway car at Chetwynd.

(d) Stockpiling of coal during spring breakup period for road travel.

(e) Camp costs for labour and supervision personnel.

(f) Cost of rail freight to Vancouver.

(g) Cost of port facilities in Vancouver.

(h) Demurrage charges on railway cars if held at Chetwynd.

8.2.7. Matters concerning the Corporation taxes payable on this scheme are beyond the scope of this Report, but will doubtless be borne in mind.

8.3. Stage III

8.3.1. In order to be able to drive headings longer than those of Stage II, and to drive more efficiently and quickly, it is necessary to provide longer conveyors, and to undercut the coal so that it may be blasted more cheaply.

It is thus proposed to use a Joy Loader in place of the Eimco 622, and to undercut the coal with a shortwall coal cutter.

The Joy Loader would load onto a short length of scraper chain conveyor, or, if available, into a shuttle car, either of which discharge onto an extensible belt conveyor system of 3000 ft. or more in length.

Prices for this equipment are being developed for purchase and/or lease.

8.3.2. The drivage per shift with this equipment is expected to be of the order of 25 ft. or 75 ft. per day on the average.

8.3.3. The tonnage per day would then be 360 tons or say 2500 tons per week.

8.3.4. The estimated cost of production would be:-

Per Week	$	Cost/ton $
Labour 12 men @ $5/hr. x 40 hrs.	2400	
12 men @ $7/hr. x 16 hrs.	1344	
	3744	1.50
Materials - say	300	.12
Rental of Equipment - say $3200/month	800	.32
Loading & Trucking to Chetwynd	3500	1.40
Royalty (to B. C. Government)	625	.25
Total thus far	$8969	$3.59

8.3.5. Items not provided for are listed in paragraph 8.2.6.

8.3.6. Whilst it would be anticipated that the major portion of the proceeds of sale of the coal would be placed against the cost of producing and transporting the coal to Vancouver, there is a credit, at any rate in principle, to be applied from the exploration programme.

8.3.7. Matters concerning the Corporation taxes payable on this scheme are beyond the scope of this Report, but will doubtless be borne in mind.

8.3.8. The above equipment requires electric power, which may be provided, initially at any rate, by one of the diesel generator sets available to Brameda from Arizona, together with a transformer and the necessary electrical distribution equipment.

8.3.9. Figure 3 shows the proposed layout of headings which this equipment will drive.

8.4. Stage IV

This proposal involves the use of Continuous Miners, shuttle car(s) and belt conveyors, and is described in the Report of April 15, 1970, paragraphs 9.2.1. and 10.1.

9. DESIRED OUTPUT OF RUN OF MINE COAL

9.1. This is 500,000 tons per annum, or on the basis of 325 working days - 1540 tons per day.

9.2. Stage II equipment would require $\frac{1540}{145}$ or ten such units to start with, but eight units may later produce this daily tonnage.

9.3. Stage III equipment would require $\frac{1540}{360}$ or four such units.

9.4. Stage IV equipment would require $\frac{500,000}{190,000}$ or two such units.

10. CONCLUSIONS

10.1. Having regard for the fact that Stage I has limited application and that Stage II will not provide the necessary geological exploratory information, it is recommended that Stage III procedures and equipment be adopted.

10.2. The Stage III method of working and layout will provide the desired information as to geological conditions and the exploratory headings will be in a convenient position to permit long wall panels to be worked at a later date and without further development costs on these main roads. However, one additional road will be required adjoining and parallel to those designated on Figure 3 as A-C and E-G, and as shown on Figure 4.

10.3. This Stage III procedure presents the most conclusive and economical manner in which the coal seam can be proven to meet the market requirements on a production scale basis. The purchaser would also be able to appraise the commercial and technical potentials of the product.

10.4. Irrespective of the extensive amount of drilling which could now be undertaken for Block A it could not be as conclusive as the exploratory heading system, consequently we propose the Stage III operations be pursued forthwith.

10.5. The results of the Stage III programme will also enable Brameda to fully assess the overall viability of the mining operation as represented by Block A. From the information to date we are led to believe that Block B is a continuation of Block A.

10.6. If during a search for used equipment to undertake Stage III, a second hand continuous miner and shuttle car are available at reasonably equivalent prices, we would recommend the use of the latter equipment as greater productivity may be anticipated.

The foregoing was investigated and prepared by Mr. W.R. Holden with Mr. H.S. Haslam as the Consultant in Coal Mining Engineering.

Presented March 31, 1970

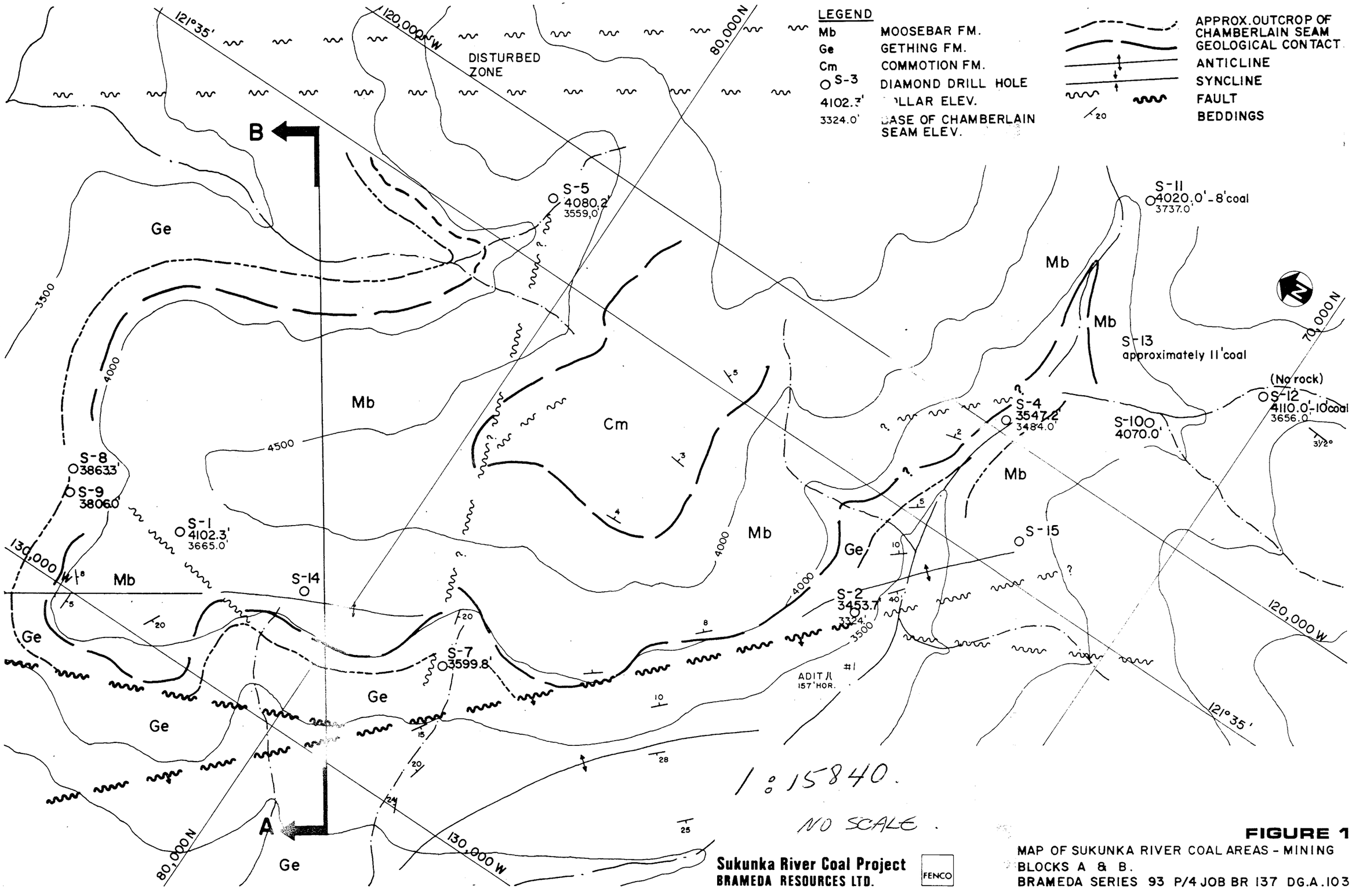
W.R. Holden, P. Eng.
Senior Division Manager, Mining & Metallurgy

Non-resident Licence for the Association of Professional Engineers of British Columbia.

H.S. Haslam, P. Eng.
Consultant in Coal Mining Engineering

Expiry Date: January 28, 1971

Non-resident Licence for the Association of Professional Engineers of British Columbia



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NO SCALE.

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FIGURE 1

MAP OF SUKUNKA RIVER COAL AREAS - MINING BLOCKS A & B.
BRAMEDA SERIES 93 P/4 JOB BR 137 DG.A.103

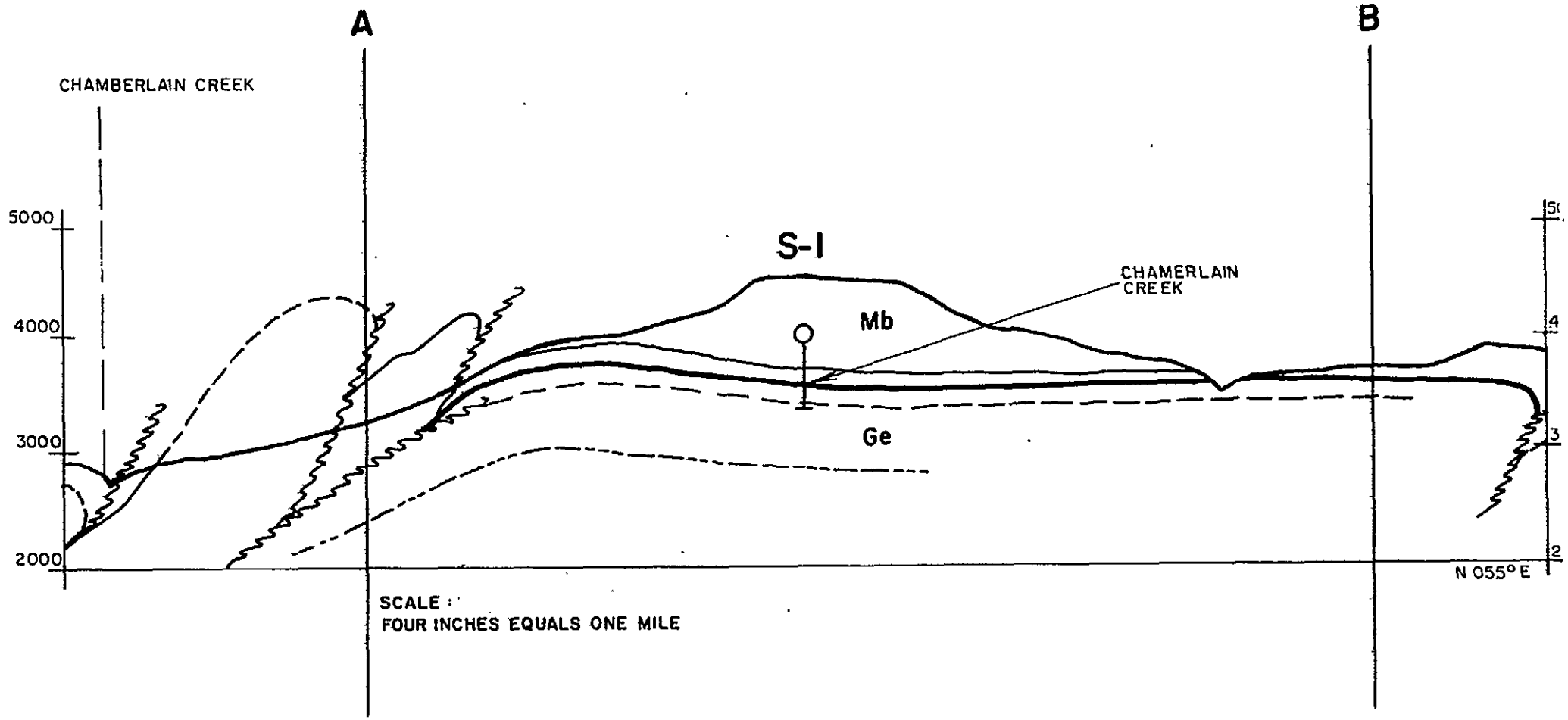

FIGURE 2

SECTION OF STRATA ON LINE A-B AS SHOWN IN FIGURE I.

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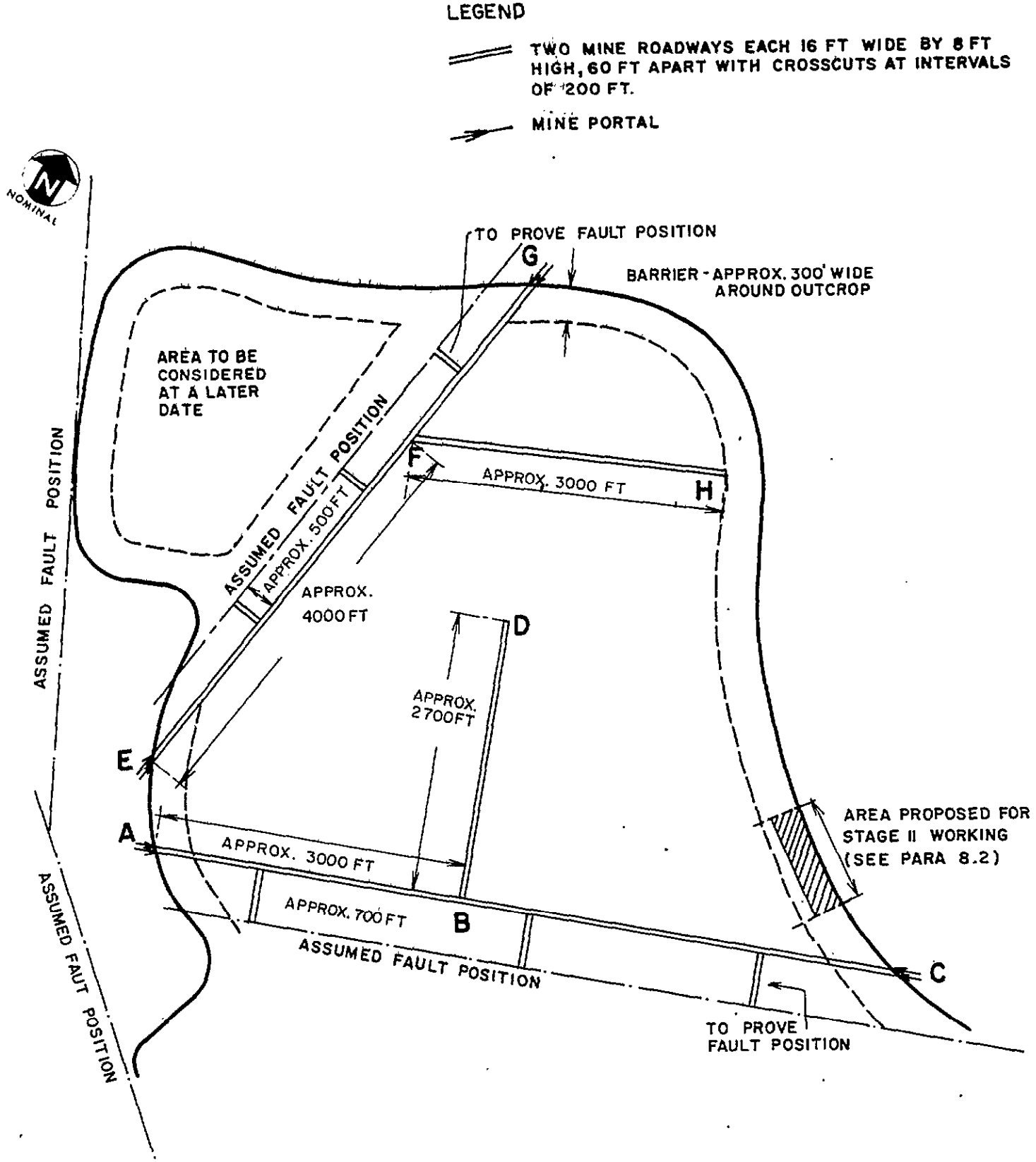

FIGURE 3

STAGE III
SCHEMATIC PLAN OF MINING BLOCK "A" SHOWING PROPOSED EXPLORATORY HEADINGS.
TEMPORARY PORTALS SHOWN AT A, C & G.

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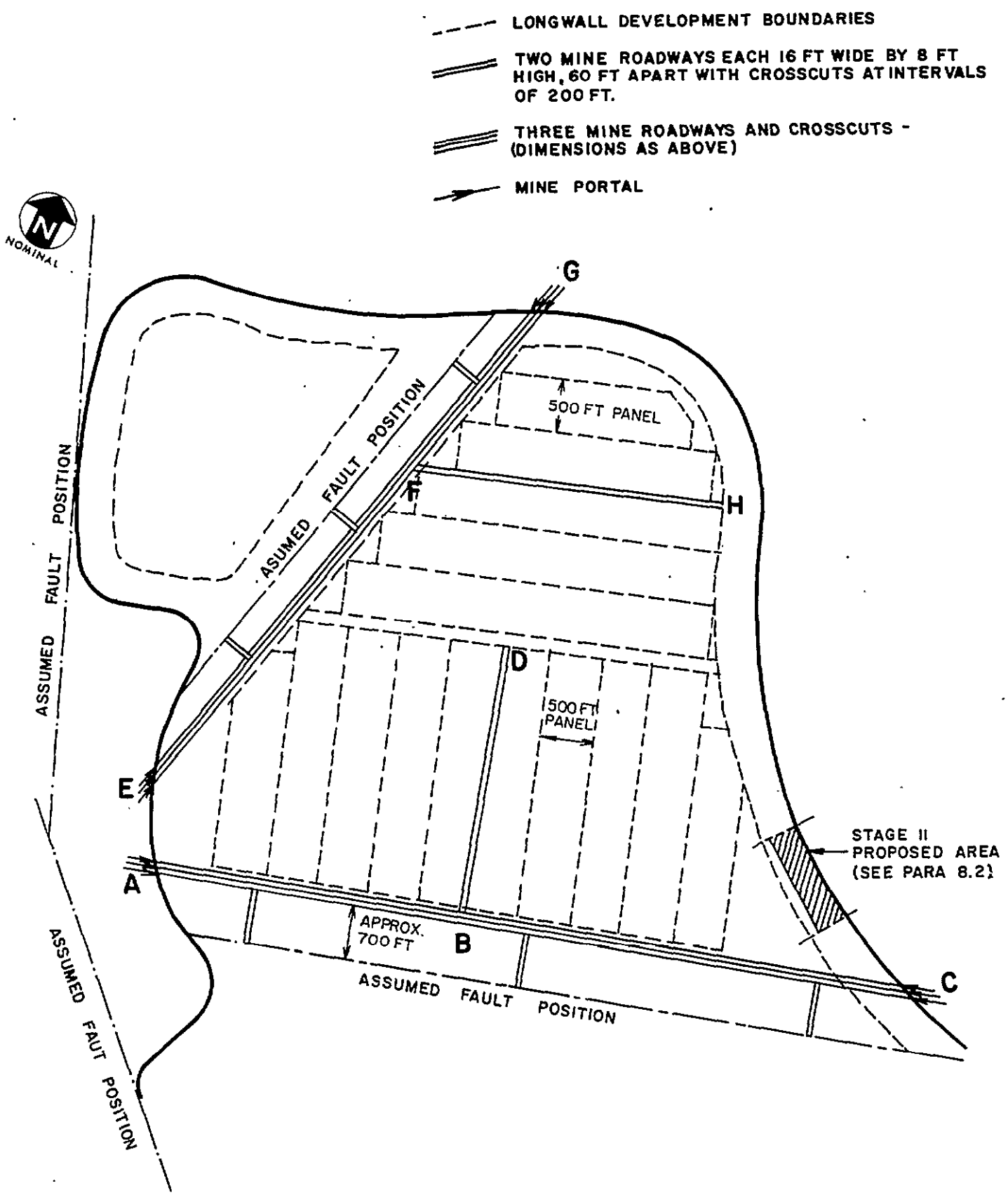

FIGURE 4

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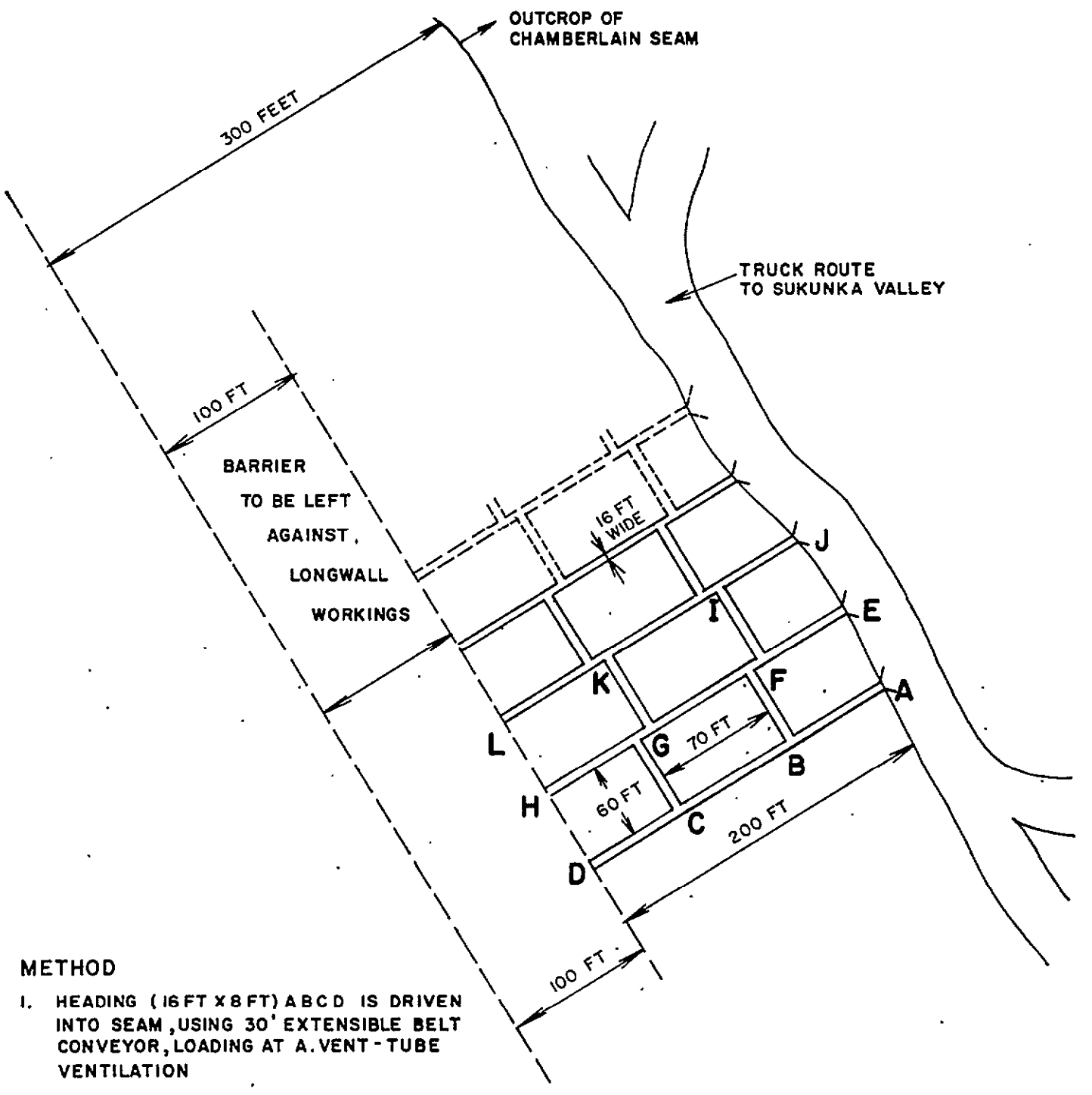
SCHEMATIC PLAN OF MINING BLOCK "A" - SHOWING PROPOSED LAYOUT OF LONGWALL PANELS - ASSUMING EXPLORATORY HEADINGS HAVE PROVED THE AREA TO CONTAIN REASONABLY WORKABLE COAL.



METHOD

1. HEADING (16 FT X 8 FT) A B C D IS DRIVEN INTO SEAM, USING 30' EXTENSIBLE BELT CONVEYOR, LOADING AT A. VENT-TUBE VENTILATION
2. CROSSCUTS ARE DRIVEN CG + BF USING SRAPER CHAIN CONVEYOR.
3. HEADING EFGH IS DRIVEN, CONNECTING WITH CROSSCUTS AT G+F FOR VENTILATION CONNECTION, WITH CROSSCUTS GK+FI.
4. SIMILARLY - HEADING JIKL AND CROSSCUTS - ETC.

FIGURE 5

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STAGE II - PROPOSED LAYOUT OF HEADINGS AND CROSSCUTS - SKETCH PLAN.