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THE GROUNDHOG COALFIELD

by

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Vancouver, B.C.

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THE GROUNDHOG COALFIELD

GENERAL

The Groundhog Coalfield is possibly the only known but uncommitted coal deposit in British Columbia, in fact in Western Canada. Simply as such, it should be considered a good exploration prospect. Field work carried out in the coalfield over many years has been limited; however it has indicated that significant quantities of coal are present.

Recent (1970) drilling and outcrop sampling has confirmed the presence of seams up to some 12 ft. in thickness, though the majority identified to date are in the 5'-6' range.

Geologically, considerably more field information is essential to establish the structure stratigraphy in the area of interest. The size of the Groundhog area and the existing data point to the possibility that a viable resource may be found in one or both of the following conditions:

- (a) A multi-seam configuration amenable to surface stripping techniques.
- (b) Local areas of structurally thickened high quality thermal coal. (An example of this thickening is found in the Coal Valley area of Alberta where Luscar - Sterco Ltd. is mining the structurally thickened "Mynheer" pod adjacent to an undisturbed multi-seam dragline operation).

In general: The Groundhog field is large and the potential rewards for exploration success will be commensurate with the size; the climate politically and economically is highly favourable for the coal industry. Thus it is concluded that further exploratory development is warranted.

LOCATION AND LOGISTICS

(See Drawing Number 1)

The Coalfield is located in the Cassiar Land District of northwestern British Columbia; it is within an area bounded by 56 degrees 47 minutes - to - 56 degrees 58 minutes latitude and 128 degrees 07 minutes - to - 128 degrees 30 minutes longitude. The road between Stewart and Dease Lake lies approximately 50 miles to the southwest. The British Columbia Railway (B.C.R.) right-of-way bisects the coalfield; at the present time, railway steel is approximately 25 miles from the southern edge. The distance by rail to Prince George is 309 miles and to Vancouver is a further 500 miles. Considerable potential exists for shortening the route to tide-water, especially when Prince Rupert becomes a coal shipping terminal. A railway route from the existing B.C.R. line via the Skeena and Kispiox rivers to Hazelton has already been surveyed and received "approval in principle." Additional shorter routes are possible as a result of the Forest Industries plans for a "logging railway" network in the general area.

The development of the Groundhog Coalfield could act as a catalyst in the establishing - by federal/provincial resources of a railway link in the area, of benefit to all concerned. This would release the coal developer from the financing of a major infrastructural item and eliminate a major constraint.

THE POTENTIAL

At the present time, the world consumption of thermal coal is increasing and will continue to do so in the foreseeable future. It is considered highly probable that within this framework, the selling price of thermal coal will escalate at a rate faster than the cost of production. Accepting these basic premises, a sound business concept would be to develop and thereafter

Cont'd.../3

sell a competitive coal in the expanding market. The Groundhog Coalfield appears to offer the opportunity for discovering reserves in viable quantities with the following advantages:

- (1) Very good heating values (12,000 - 14,500 Btu/lb.).
- (2) Low sulphur levels (less than 0.5%).
- (3) A virtually smokeless fuel.
- (4) A particularly desired fuel in South Korea - (one of the major markets).

With reference to Drawing Number 2, the potential for the development of reserves is as follows:

- (1) An immediate target area along the east and west flanks of the Skeena River. This area is covered by the main block of the Groundhog Coal Ltd.'s Coal Licences. Throughout this block, coal outcrops or coal float have been discovered in all the creeks. A very limited amount of diamond drilling has been completed at each end of the target area.
- (2) The second target lies to the west of the Skeena. This area is "controlled" by 12 Coal Licences held by Groundhog Coal Ltd. Other than a few old reports of "thick clean coal seams" and a preliminary geological reconnaissance, very little information is available. It is in this area, that the possibility for structurally thickened coal zones is intriguing.

THE MARKETS

An outstanding opportunity exists for Western Canadian coal developers. Not only has there been an increase in the tonnage requirements of existing steam coal users, but also the market base has broadened considerably. Consumers are emerging as a result of a swing from natural gas and oil. Available markets are: Japan, South Korea, Europe, Eastern Canada, and the Pacific side of North America. In addition to conventional sales, Groundhog Coal has unique opportunities. Due either to its anthracitic composition, or its location, the following

possibilities can be pursued:

- (1) There are several mineral prospects in Northwest British Columbia that will probably be producing mines within the next decade. The most significant of these is the Stikine Copper prospect. (For its location along with a typical selection of other major prospects, refer to Drawing Number 2). One of the major constraints to their development is the power supply.

The proving of reserves at Groundhog in sufficient quantity to assure a long term thermal power supply would be attractive to both the mineral developers and B.C. Hydro. The generation of power by hydro methods in the general area would be costly and subject to environmental problems.

- (2) Assuming a portion of the coal can be upgraded to anthracite type specifications, the following markets can be investigated:
 - (a) Sale as a smokeless fuel.
 - (b) The steel industry.
 - (c) As a base material for industrial carbon.

THE COALFIELD

History

Outcrops, which are exposed in the various creeks that feed the Skeena River, have been prospected since 1903. The initial exploration was curtailed by the 1st World War and was coincident with a need for coal resulting from the utilization of steam power in world commerce. During this stage of exploration numerous diggings were made in seam outcrops. However the remoteness of the area and the short season restricted progress.

The second stage of exploration was initiated by the expanding market for metallurgical coal in the late 1960s. The Dillingham

Corporation completed a surface prospecting survey in 1968 and reported:

- (a) No coking coal was found.
- (b) The coal is high in ash (before cleaning).
- (c) Coal occurs in several seams from 5'-12' in thickness.
- (d) The area is severely contorted and this will result in steeply dipping seams.

In 1970, a joint venture between Placer Development, Quintanna Minerals and the National Coal Corporation also completed a geological survey and selected an area which was more encouraging than the previous workers had concluded. They drilled six holes in this area (See Drawing Number 2, 3, 4A and 4B). As a result of the drilling, they concluded that the "possibility of surface mineable coal should not be discounted." Following this programme, the political climate was very negative, no further work was carried out and the licences allowed to lapse.

Groundhog Coal Ltd. now propose, in the light of the existing energy climate, to continue the exploratory development of the Groundhog. The favourable area established by Placer et al is now contained within Coal Licences held by the Company.

Seam Thickness and Quality

The available information is very limited for a field with the complexity and size of the Groundhog. Therefore the data should be used with caution and considered as indicative rather than representative. On a general basis, the following comments are applicable:

- (1) The ash content of "clean coal" ranges from 4.5% to 20.0%.
- (2) Volatile matter ranges from 1.8% to 18%.
- (3) The total sulphur varies from 0.3% to 1.2% with 70% of the determinations at less than 0.6%.
- (4) Calorific values vary from 11,800 Btu to 14,700 Btu/lb. on potential "clean coal."
- (5) A weighted average yield from washability tests (made on very small quantities of coal) is approximately 50%. The Ross seam, one of the more important known seams was cleaned to 13,000 Btu/lb. @ 11% ash with a yield of 62.5% from the 10 ft. of the seam tested (assays on a dry basis).

(6) A 100# sample was taken from the Upper Discovery Creek outcrop in 1978. This sample was taken from the top 4"-6" of the coal seam. The proximate analysis was:-

Contained moisture	5.36%
Ash	6.72%
Volatile matter	11.49%
Fixed carbon	76.43%
Btu/lb.	12,889 (13,619 dry)
Sulphur	0.45

EXPLORATION

EXPLORATION

The various published reports on the Groundhog give confidence in the conclusion that coal, in potentially large tonnages exists in the area. There is, however, a considerable number of conflicting geological opinions as to the structure of the coal bearing sediments. In a field of this size and complexity when coupled with the limited knowledge, opinions inevitably will vary. Recent work (1969 - 70) in the area of interest of this programme has been encouraging. Nevertheless in view of the insufficiency of geological data with which conclusive definitive interpretation could be made, a prudent approach to the overall development of the coalfield is recommended. In this context it is proposed to limit the exploration work during 1979 to the achievement of the following objectives:

- (1) To define target areas for coal drilling aimed at "proving-up" surface mineable coal reserves.
- (2) To investigate (on a preliminary basis) the order of magnitude costs; possible infrastructure assistance; and market prospects; to facilitate the definition of a viable resource base (clean coal tonnage).
- (3) To establish a reasonable "order-of-magnitude" potential for the amount of surface mineable coal and the possible marketable quality.

PROGRAMME

Objective No. 1

This will be achieved by detailed geological mapping consisting of photo-interpretation, field reconnaissance, prospecting and detailed mapping. It is planned to define more clearly the stratigraphy and structure; also any economic stratigraphical sequences will be highlighted. Subject to the results of this work a 2 - 4 drill hole programme will be developed aimed at providing additional stratigraphic information and seam correlation data. Alternatively, geophysical methods have recently been used to trace subcropping coal seams. Their application will be studied prior to making a drilling decision.

Objective No. 2

It is proposed to study in some detail the various financing possibilities versus an annual coal production rate. The rate should be commensurate with the ability to sell the coal produced, thus market potential will also be more precisely determined.

As an example of the numerous options, the coal could be shipped by existing rail over a longer route (at extra cost) or a new line could be built to shorten the route; decrease the operating cost but increase the required capital significantly. The amount of coal (resource base) necessary to realize a viable operation and the rate of production for the two cases in the example would be different. This difference could alter the exploration strategy drastically and is another good reason for the limited programme for 1979.

Objective No. 3

This will be carried out towards the end of the 1979 programme, since the information needed for its achievement will be generated by the work completed for the two previous objectives. To determine the surface tonnage it will be necessary to plot the potential out-crop lengths of the more important seams and to formulate some initial stripping ratios and clean coal yields.

The marketable quality aspect will be considered by taking bulk samples from the more important potentially commercial seams (eg Ross; Benoit; Upper Discovery) and subjecting them to washability testing; coal analyses and burnability testing.

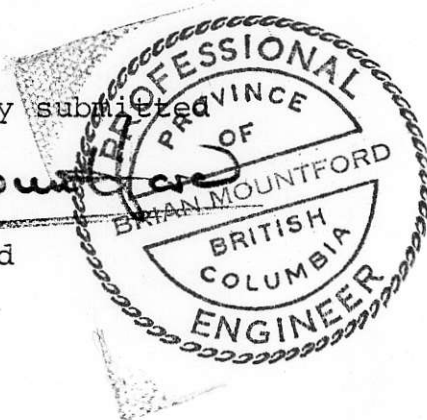
PROGRAMME COSTS

Photo-interpretation, field geological mapping and reconnaissance	\$ 50,000
Bulk sample acquisition	10,000
Development strategy studies	10,000
Coal marketability and quality assessment	10,000
Project management, travel and miscellaneous	10,000
Final programme report and submission reports to Government	<u>5,000</u>
Cost without drilling	\$ 95,000
Contingency	<u>5,000</u>
TOTAL	\$100,000
Assuming a drill programme equivalent to 2,000' @ \$50	
Drilling Cost	<u>100,000</u>
SUGGESTED PROGRAMME 1979	<u>\$200,000</u>

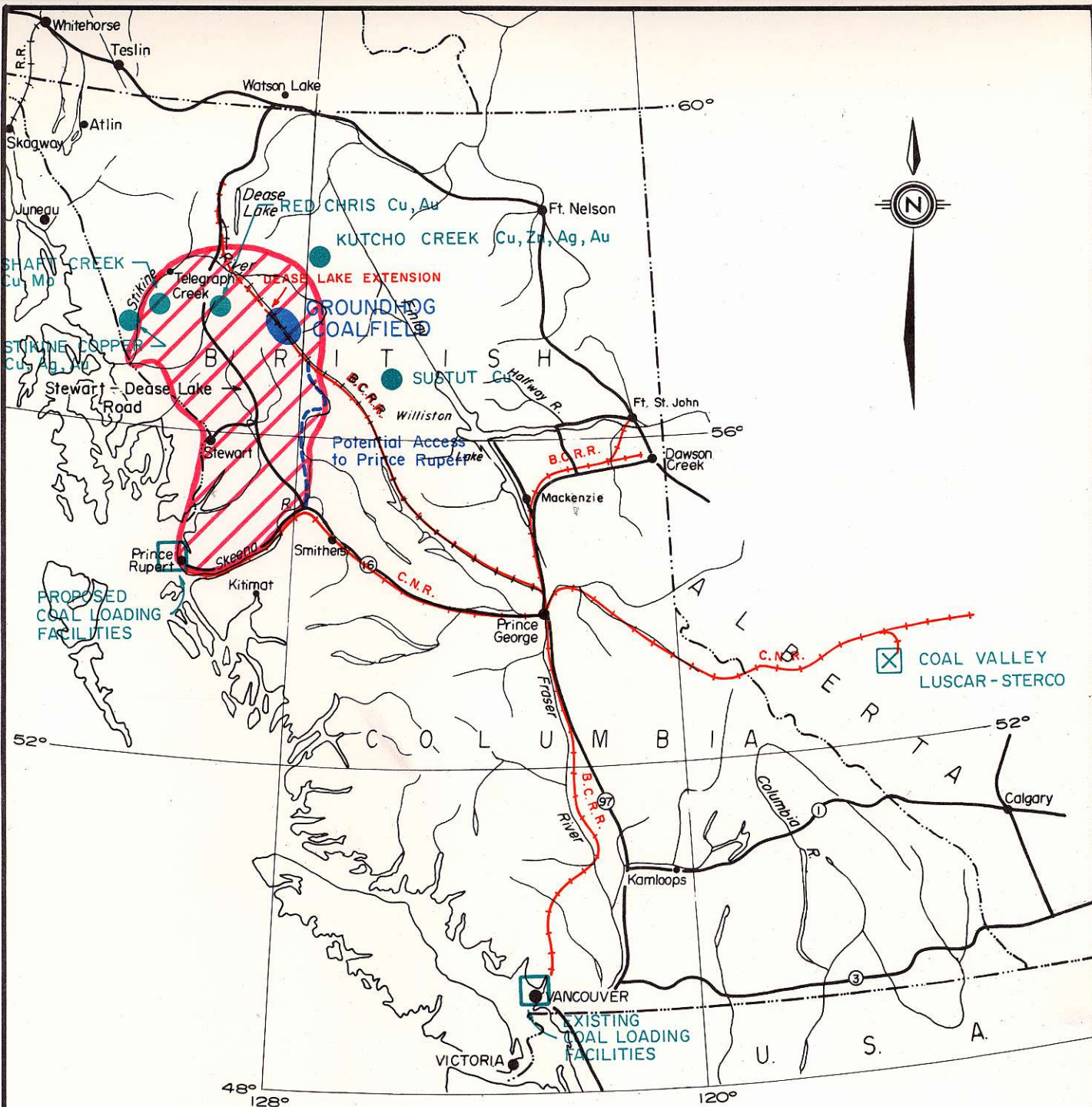
Respectfully submitted

B. Mountford

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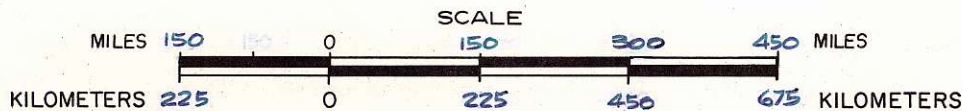
DRAWINGS

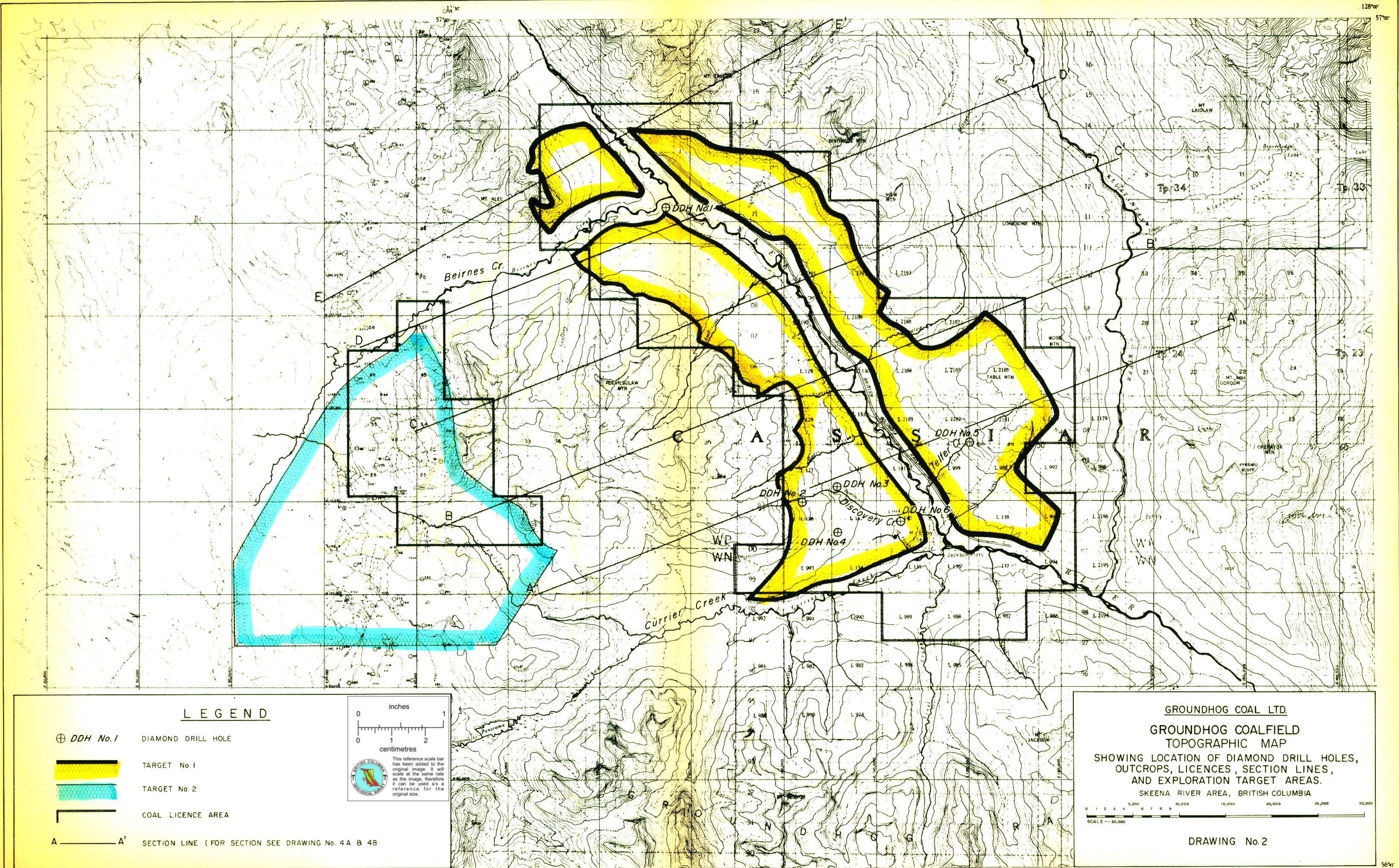


 - AREA PRESENTLY BEING CONSIDERED FOR AN INDUSTRIAL RAILWAY NETWORK

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LOCATION AND ACCESS MAP OF THE
GROUNDHOG COALFIELD SHOWING OTHER
ADJACENT MINERAL DEVELOPMENTS THAT REQUIRE POWER.





LEGEND

⊕ DDH No. 1

DIAMOND DRILL HOLE



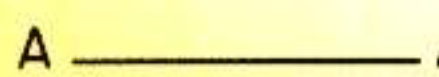
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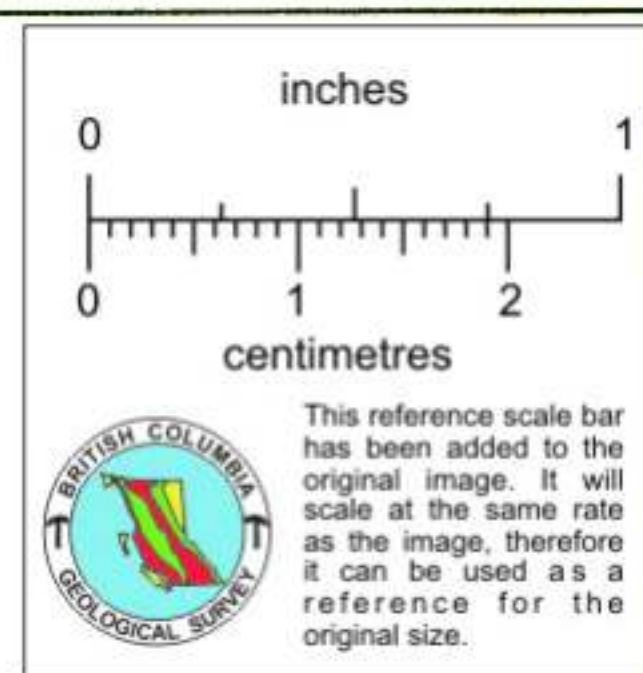
TARGET No. 2



COAL LICENCE AREA



SECTION LINE (FOR SECTION SEE DRAWING No. 4A & 4B)

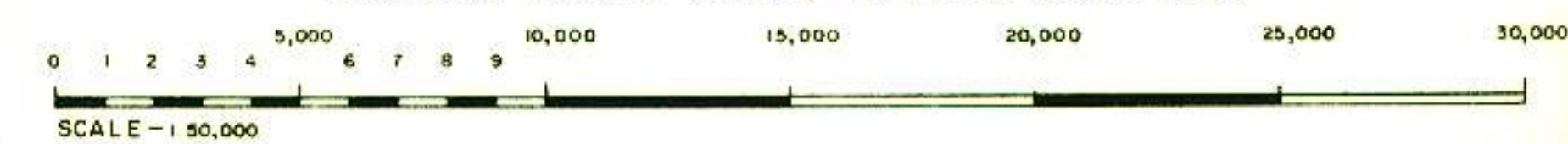


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GROUNDHOG COALFIELD
TOPOGRAPHIC MAP

SHOWING LOCATION OF DIAMOND DRILL HOLES,
OUTCROPS, LICENCES, SECTION LINES,
AND EXPLORATION TARGET AREAS.

SKEENA RIVER AREA, BRITISH COLUMBIA



DRAWING No. 2

1 1/2 Miles (3.2 Kilometers)

SURFACE MINING POTENTIAL

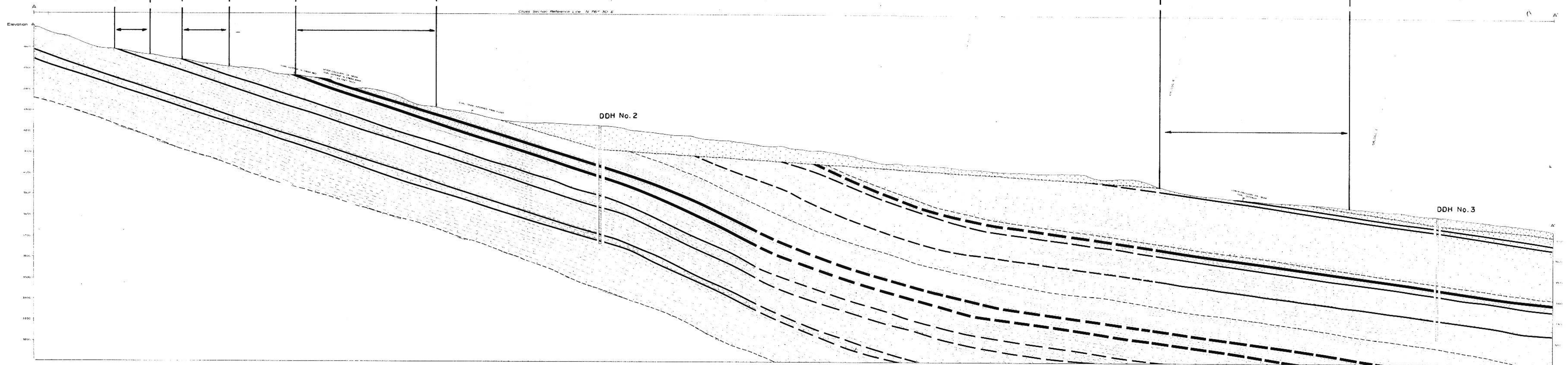
SURFACE MINING POTENTIAL



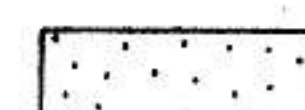
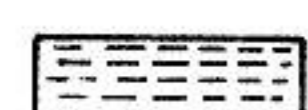
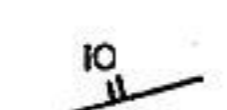

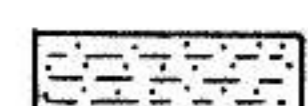
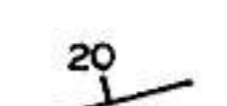
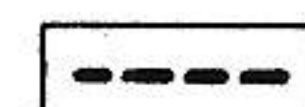


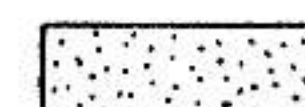
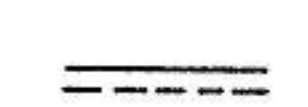

DDH No 3
Vertical 588'

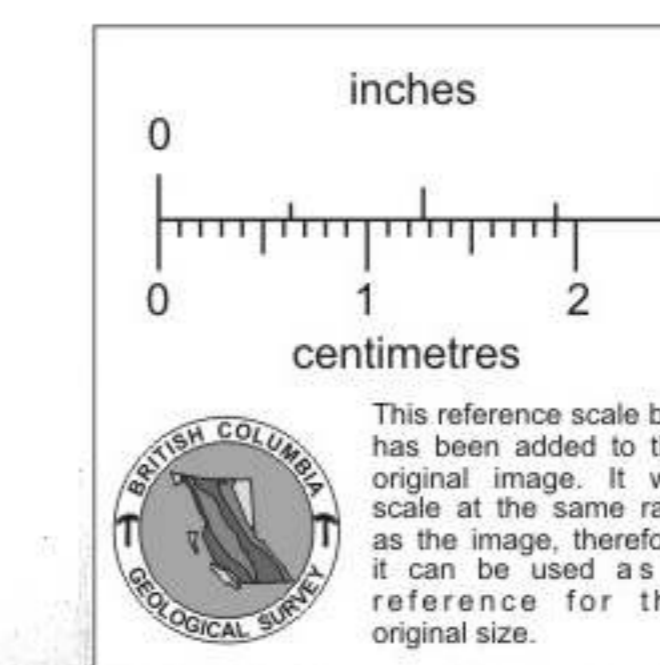
DDH No 2
Vertical 565'
Elevation 4240'

Cross Section Reference Line: N 76° 30' E

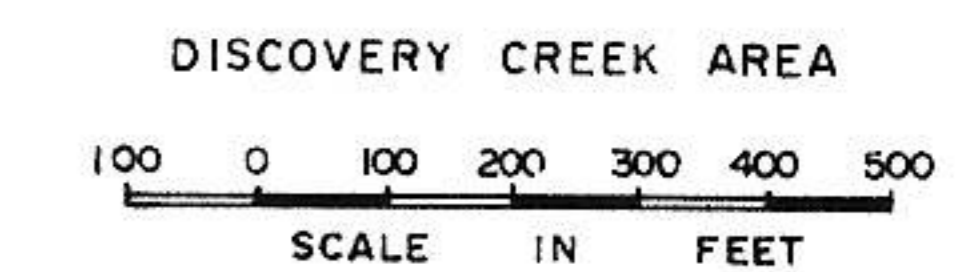


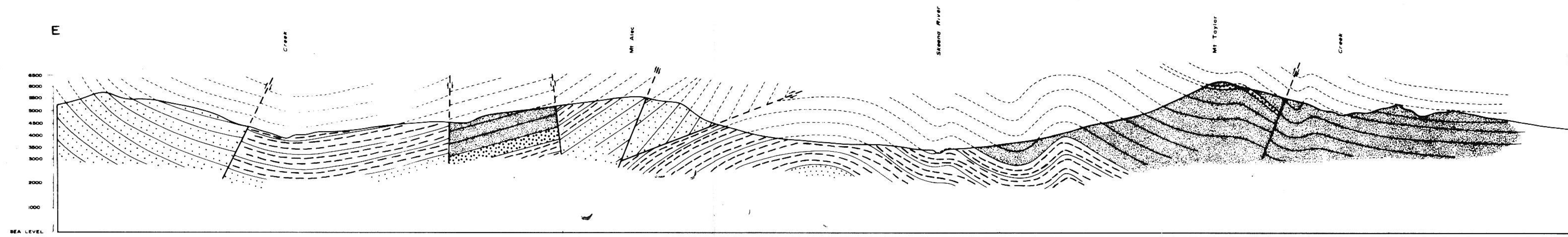
L E G E N D

- | | | |
|--|---|---|
|  OVERBURDEN |  SHALE |  STRIKE AND DIP OF COAL SEAM |
|  COAL SEAM |  INTERBEDDED SANDSTONE AND SHALE |  STRIKE AND DIP OF BEDS |
|  COAL SEAM, INFERRED POSITION |  DIAMOND DRILL HOLE |  ADIT, CAVED |
|  SANDSTONE |  CONTACT, DASHED WHERE INFERRED |  COAL OUTCROP |

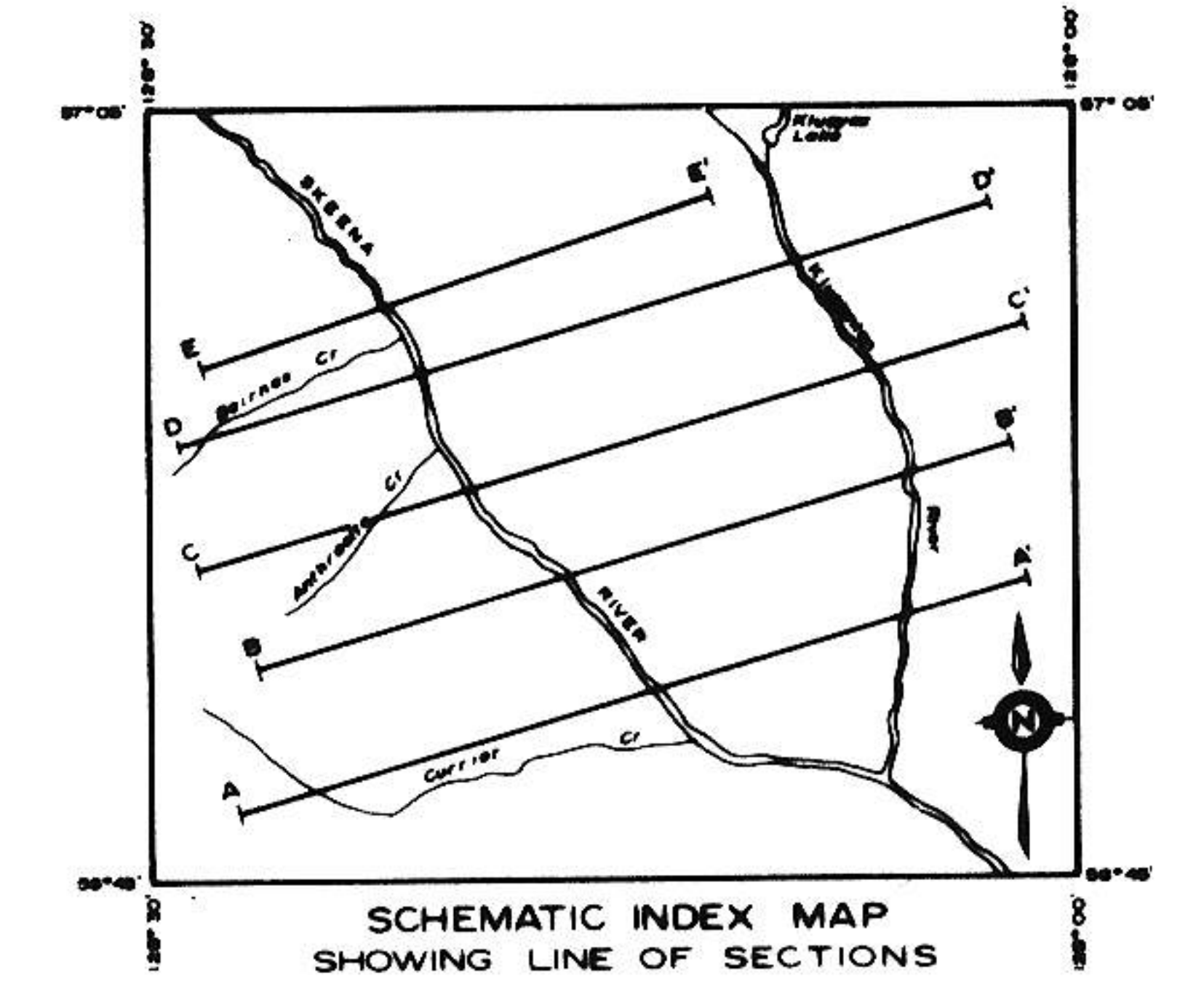


GROUNDHOG COAL LTD.
GROUNDHOG COALFIELD
GEOLOGICAL CROSS SECTION
OF THE DISCO DRILL HOLES 2 AND 3.

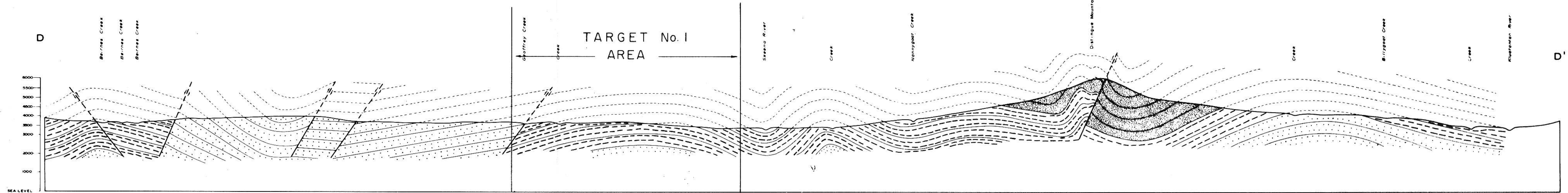




GEOLOGICAL CROSS SECTION E-E'
SECTION LOOKING NNW, PLANE OF SECTION STRIKES N. 61° E.


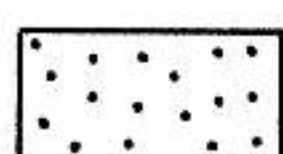

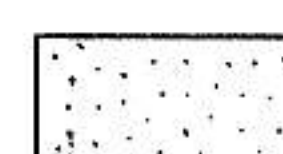


SCHEMATIC INDEX MAP
SHOWING LINE OF SECTIONS

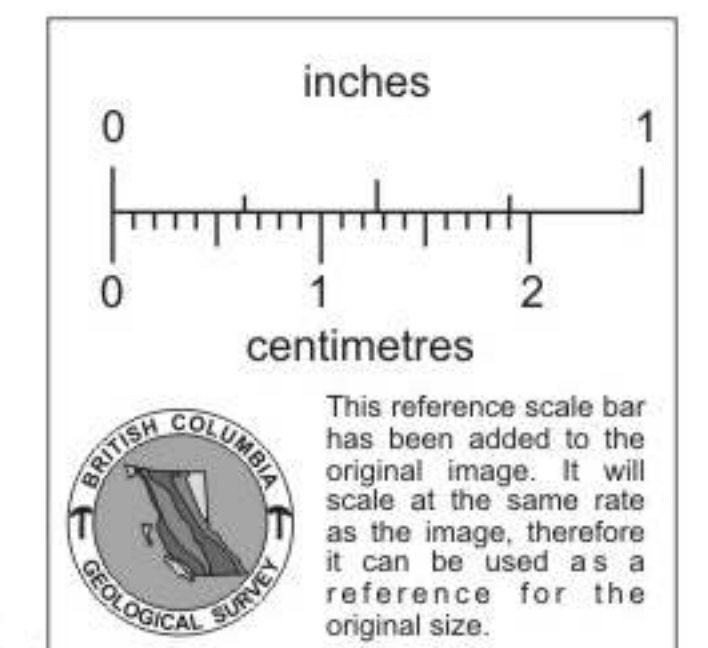


GEOLOGICAL CROSS SECTION D-D'
SECTION LOOKING NNW, PLANE OF SECTION STRIKES N. 70° E.

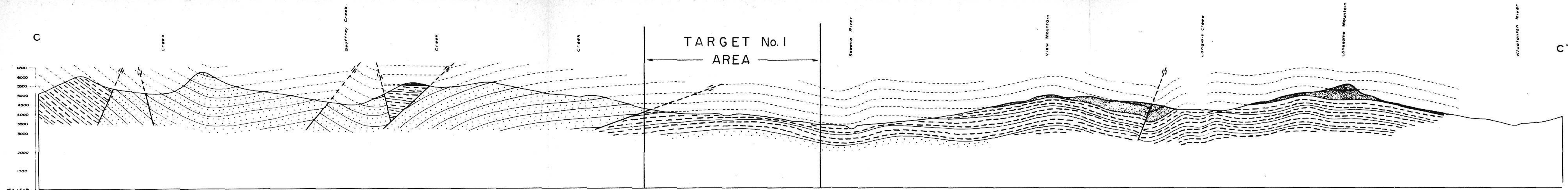
LEGEND

- | | |
|--|---|
| <p> LONESOME MOUNTAIN LITHOSOME
Sombre brown coloured, well indurated, sparsely fossiliferous, conglomeratic sandstones, sandstones, mudstones and thin, rare, discontinuous coal beds.</p> <p> DEVIL'S CLAW CONGLOMERATE LITHOSOME
Thick bedded, coarse grained, chert pebble conglomerate interbedded with mudstone, and minor coal.</p> | <p> COAL BEARING LITHOSOME
Soft, medium to thick bedded mudstones (70-75%), carbonaceous units (15-20%), and grey sandstones (10%) which typically weather brown to orange.</p> <p> Mc EVOY RIDGE LITHOSOME
Dark coloured, well indurated mudstones predominate, with some fine grained sandstones and some carbonaceous matter. Evenly bedded, 1-5 feet thick.</p> |
|--|---|

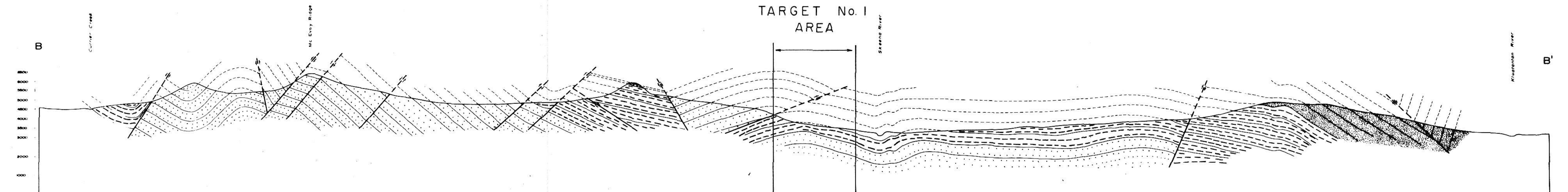
NOTES:
For Map Showing Section Lines
See Drawing No. 2



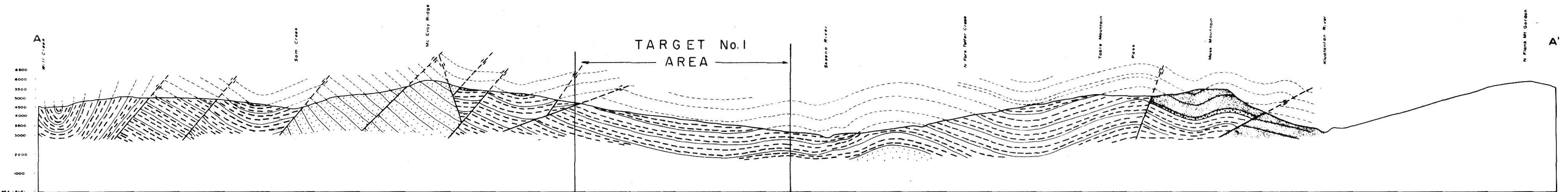
GROUNDHOG COAL LTD.
GROUNDHOG COALFIELD
GEOLOGICAL CROSS SECTIONS
FEET 2000 0 2000 4000 6000 FEET
SCALE



GEOLOGICAL CROSS SECTION C-C'
SECTION LOOKING NNW, PLANE OF SECTION STRIKES N 70° E.

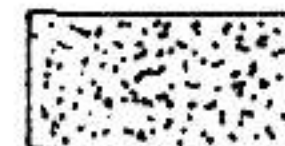
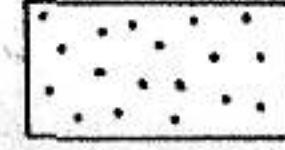
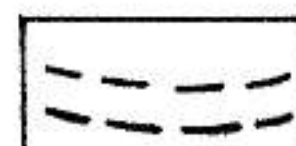
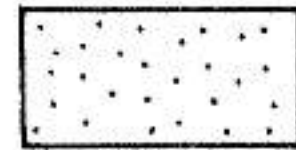


GEOLOGICAL CROSS SECTION B-B'
SECTION LOOKING NNW, PLANE OF SECTION STRIKES N 70° E.

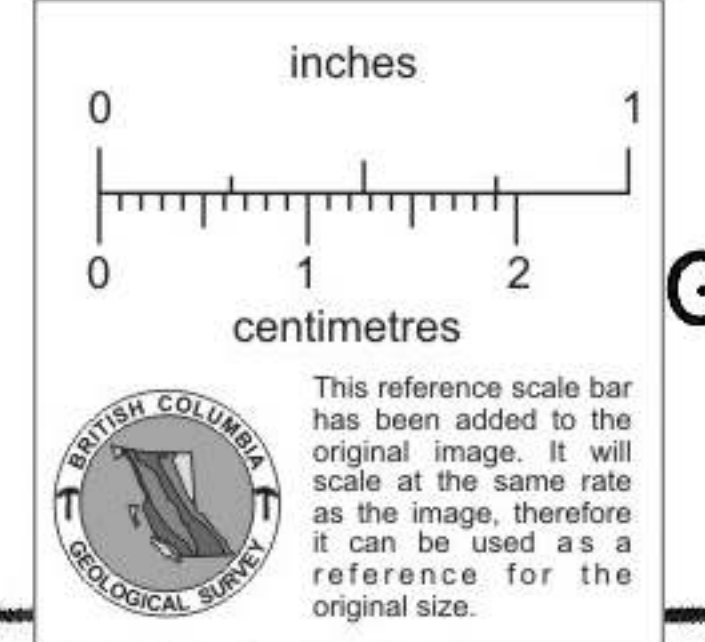


GEOLOGICAL CROSS SECTION A-A'
SECTION LOOKING NNW, PLANE OF SECTION STRIKES N 70° E.

LEGEND

- | | |
|--|---|
| <p> LONESOME MOUNTAIN LITHOSOME
Sombre brown coloured, well indurated, sparsely fossiliferous, conglomeratic sandstones, sandstones, mudstones and thin, rare, discontinuous coal beds.</p> <p> DEVIL'S CLAW CONGLOMERATE LITHOSOME
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|--|---|

NOTES:
For Map Showing Section Lines
See Drawing No. 2



GROUNDHOG COAL LTD.
GROUNDHOG COALFIELD
GEOLOGICAL CROSS SECTIONS
SCALE: FEET 2000 0 2000 4000 6000 FEET