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TELKWA VALLEY COAL DEPOSITS

CHAPMAN, WOOD + GRISWOLD LTD.

OCT. 1972

GEOLOGICAL BRANCH
ASSESSMENT REPORT

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BULKLEY VALLEY COLLIERIES LTD.

TELKWA VALLEY COAL DEPOSITS

OMINECA MINING DIVISION

BRITISH COLUMBIA

SUMMARY REPORT

October 1972

CONFIDENTIAL

SUMMARY REPORT
TELKWA VALLEY COAL DEPOSITS
OMINECA MINING DIVISION
BRITISH COLUMBIA

PREPARED FOR

BULKLEY VALLEY COLLIERIES LIMITED

OCTOBER 1972

1456-1

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EXHIBITS

CW&G Ltd.
Drwg.

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INTRODUCTION

Chapman, Wood & Griswold Ltd. was commissioned by Mr. J. D. Carnahan of Bulkley Valley Collieries Limited to:

1. Review available reports and data pertaining to that Company's coal deposits in the Omineca Mining Division of British Columbia.
2. Prepare a report summarizing this information and setting forth the conclusions derived from studying it.
3. Recommend a program of exploration, delineation and development of the coal measures to the point that the technical and economic feasibility of producing in the range of one million tons per year of coking coal by surface mining methods and subsequent cleaning procedures could be determined.
4. Estimate the cost and time required to carry out such a program.

In carrying out this assignment we have carefully studied reports prepared by B. V. C. and by provincial and federal government agencies together with supporting data. C. R. D. Miller and E. P. Chapman Jr. of Chapman, Wood & Griswold Ltd. visited the B. V. C. properties on 9 September 1972 and inspected coal exposures and mine sites with Mr. Lloyd Gething, property superintendent. Messrs. Miller and Chapman participated in discussions with Mr. Carnahan of Bulkley Valley Collieries and with Mr. John Britton of Britton Research Limited on various metallurgical, organizational and conceptual aspects of the project. Messrs. Carnahan and Chapman met in Denver, Colorado, with Mr. Frank Coolbaugh, a recognized consultant in mining engineering and finance, and with Mr. Albert Keenan, an established authority in coal technology and production, to assure that the proposed procedures meet the highest engineering standards for coal evaluation.

Grateful acknowledgement is given to those mentioned above for their assistance and cooperation in furnishing and commenting on the information upon which our conclusions and recommendations are based and for their assistance in formulating the program and reviewing the cost estimates set forth in this report.

II

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

1. Bulkley Valley Collieries Limited own or control through various agreements coal mining rights in about 25 square miles of lands southwest of Telkwa in the Omineca Mining Division of British Columbia. We have made no investigation of B. V. C. 's titles.
2. These lands contain multiple seams of coal of unknown lateral extent within the "Telkwa Coal Basin" of Jura-Cretaceous age.
3. From 1918 to the present some 480, 000 tons of coal have been removed by underground and surface mining from a relatively small portion of the company's holdings principally along the margins of the Goathorn Creek Valley.
4. From geological interpretation and limited exploration elsewhere on the properties it appears probable the holdings encompass a multi-million ton reserve of coal recoverable by surface mining methods. These reserves would be in multiple seams probably ranging in total thickness from twenty feet to more than forty feet.
5. The coal is a bituminous variety indicated by a limited amount of analysis and test work to be of or close to coking quality with a sulphur content somewhat above desirable limits. In all tests to date the coal was found suitable for blending with other coals to achieve a coking product.
6. In-house economic evaluations by B. V. C. indicate that approximately \$11, 122, 000, including working capital of \$720, 000, would be required to place the property into production at the rate of one million tons per year. The company estimates that operating costs per long ton sold would range from \$5. 35 to \$6. 00 at that production rate.
7. We conclude that these projections are sufficiently realistic and encouraging to justify comprehensive onward investigations to develop information from which more precise evaluations can be made.
8. We recommend that the investigations should be concentrated within the portion of the holdings adjacent to substantial coal exposures, deemed to present the greatest potential for profit

and having a high probability of containing sufficient coal to sustain a one million ton per year operation for a minimum of fifteen years.

9. Four areas north, south, east and west of existing workings on either side of Goathorn Creek have been selected as meeting these requirements.
10. In our opinion the project should be carried out in two stages involving first orientation drilling and preliminary tests for coal quality by drilling three cored drill holes on each of two or more of these four tracts, followed by selection of one area, and a second stage of pattern drilling to substantiate reserves, establish character and quality of cleaned coal product and carrying out economic evaluations to the point at which a realistic production decision can be made.
11. To carry out the proposed program Bulkley Valley Collieries Limited has assembled a team having not only the technical, management and financial skills and experience required to properly assess any large scale mining situation but also incorporating the specialized expertise in production and treatment of coal essential to the sound and accurate evaluation of a large coal deposit and the optimum method of bringing it to production. The collective experience of this group plus the fact that its members have to varying degrees been associated and worked together on major projects for many years should ensure a smooth and efficient organization and performance meeting the highest engineering standards.
12. The time required and the cost of the proposed program are estimated to be:

Phase 1	-	6 weeks	\$115,000
Phase 2	-	14 weeks	\$435,000

13. We believe that the information developed by the program and set forth in the preliminary feasibility report covering the work will constitute a sound base for a production decision on the property. The word "preliminary" is used in recognition of the fact that substantial expenditures may be required prior to production to carry out a large scale test mining program, operation of a pilot plant and the submission of bulk samples of cleaned coal as a part of negotiating firm sales contracts. These activities would

influence final selection of mining and washing equipment and the timing of achieving production and are properly part of pre-production rather than feasibility expenditures.

14. We believe that the proposed program is soundly conceived and that the potential of the deposits justifies the expenditure involved. The fact that if the reserves should prove to be unsuitable for coking use they will at some point in time be an attractive source of coal for thermal power generation, or other use, minimizes downside risk.
15. We recommend that Phase 1 be implemented on a firm basis and that funds for Phase 2 be committed contingent upon satisfactory results from the first stage.

Respectfully submitted,

CHAPMAN, WOOD & GRISWOLD LTD.


C. R. D. Miller, P. Eng.

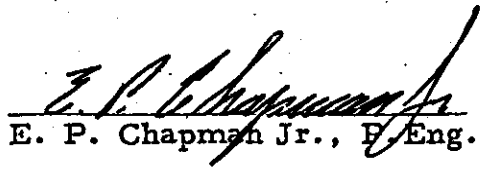

E. P. Chapman Jr., P. Eng.

October 1972

CERTIFICATE

I, E. P. Chapman Jr. of West Vancouver, British Columbia, do hereby certify:

1. That I am a Mining and Geological Engineer residing at 1985 Bellvue Avenue, West Vancouver, British Columbia.
2. That I am President of Chapman, Wood & Griswold Ltd., Consulting Mining Engineers and Geologists, 1520 Alberni Street, Vancouver 5, British Columbia.
3. That I am a registered Professional Engineer in the Province of British Columbia and in the States of Colorado, New Mexico and Texas, and that I am a member of the Consulting Engineers Division of the Association of Professional Engineers of British Columbia.
4. That I have practised my profession for over thirty years.
5. That I have no direct or indirect interest in Bulkley Valley Collieries Limited and I do not expect to receive any such interest.
6. That I have personally studied the data and information summarized in this report and have augmented my general engineering experience and knowledge relative to specific aspects of the evaluation and production of coal by personal discussions with engineers fully qualified and experienced in that field.
7. That I personally inspected the coal exposures near Goathorn Creek on 9 September 1972.


E. P. Chapman Jr., P. Eng.

10 November 1972

CERTIFICATE

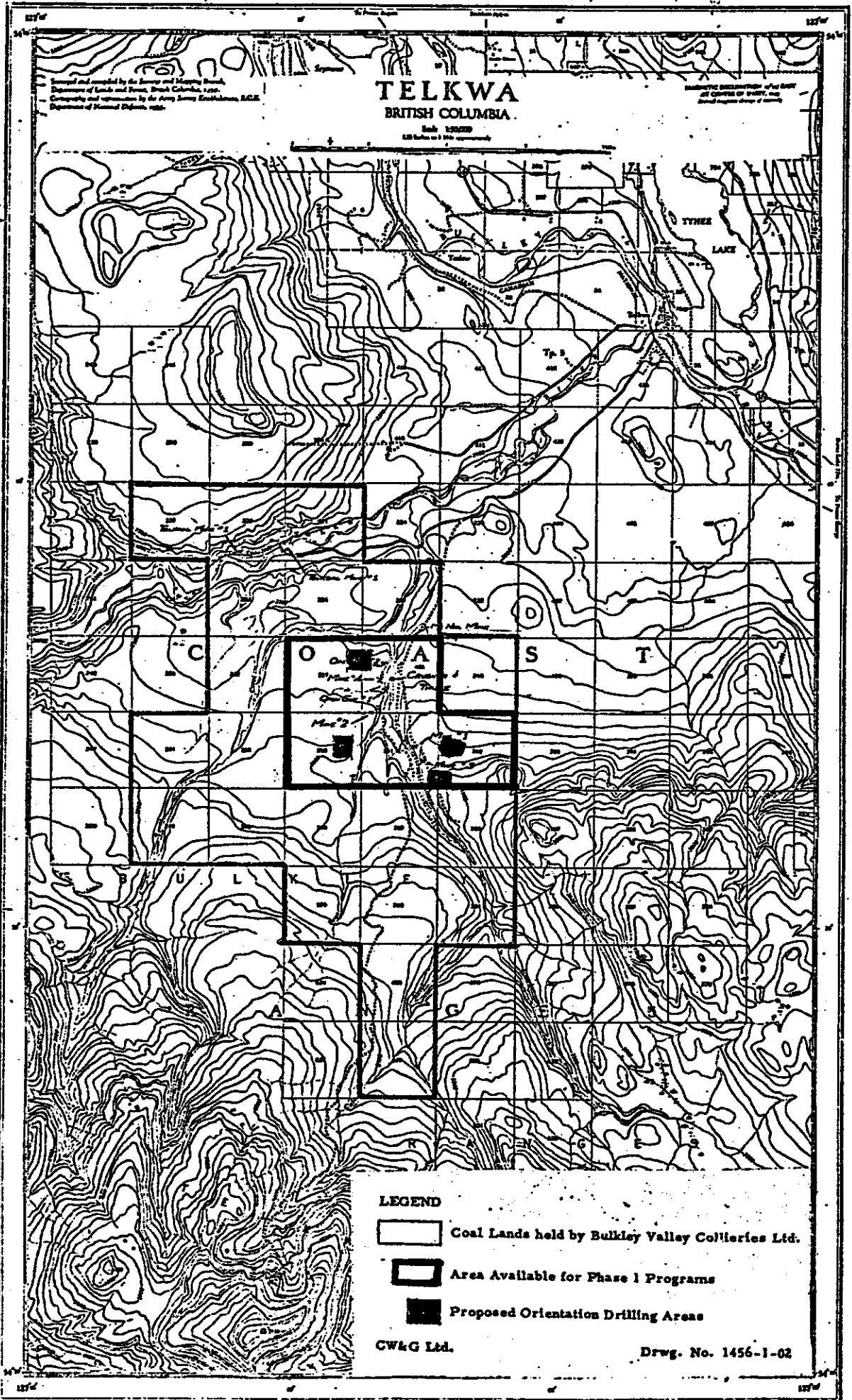
I, Carl R. D. Miller of Vancouver, British Columbia, do hereby certify that:

1. I am a Geologist residing at 2732 Oliver Crescent, Vancouver, British Columbia.
2. I am a registered Professional Engineer in the Province of British Columbia.
3. I am employed by Chapman, Wood & Griswold Ltd., Consulting Mining Engineers and Geologists, 1520 Alberni Street, Vancouver 5, British Columbia.
4. I have practised my profession for over twenty years.
5. I have no direct, indirect or contingent interest in Bulkley Valley Collieries Limited or in any of the properties controlled by this company.
6. I do have personal knowledge of the coal deposits described in this report, having visited the property on 9 September 1972.


Carl R. D. Miller



10 November 1972



III

GENERAL DESCRIPTIONS

HISTORY

Exploration for coal commenced in the Telkwa area during the early 1900's. The search was prompted by the discovery of exposures of coal in creek bottoms and had progressed sufficiently by 1907 that W. W. Leach of the Geological Survey of Canada reported that these coal deposits "appear confined to a series of shallow troughs with a general northwesterly trend, there also existing a number of minor undulations within these main synclines and numerous small faults."

In 1906 the Cassiar Coal Company and the Transcontinental Exploration Syndicate were investigating coal occurrences on Goat Creek, the Kitimat Development Syndicate exploring other deposits on Mud Creek and the Telkwa River. Leach suggested all were investigating related seams within the "Telkwa Coal Basin," a theory which appears to be supported by all subsequent development to date.

Production commenced in 1918 with the establishment of the McNiel mine on Goat Creek, initially as a winter operation. F. M. Dockrill commenced mining upstream on a royalty basis in 1930 and in 1937 organized Bulkley Valley Collieries as a private company which has operated on a continuous basis to the present time. Prior to 1966 most of the production was from underground mines, since that date production has been primarily from surface stripping of selected areas.

Of the total production to date some 440,000 tons were from underground mines, about 40,000 tons exploited by strip mining.

Between 1943 and 1951 some exploratory drilling was undertaken in an attempt to substantiate further reserves in the vicinity of the existing operations. The program was successful in that coal intersections were returned from most of the holes. The reported core recoveries were poor, probably because the equipment and techniques employed were most inadequate in comparison to the standards now considered acceptable. Management elected to relocate their mining operations to exploit other nearby coal seams exposed along Goathorn Creek instead of pursuing those investigations to a logical conclusion. We believe this decision was further influenced by the availability of markets at that time and the limitations of the mining equipment then on site.

After assuming management in 1962, Mr. Carnahan achieved greater efficiency in the operation through improvements to the crushing and screening plants and implementation of mechanical mining equipment. Further gains in productivity were achieved in 1966 through adoption of a surface mining system (#2 open pit).

Maximum productivity was sustained so long as markets were available. To date these have been essentially the seasonal heating market. The only nearby industrial market available to the company disappeared in 1955 with the conversion of the pulp mill in Prince Rupert from coal to oil. The company was successful, however, in replacing this outlet through winning contracts to supply the annual fuel requirements for a substantial number of government buildings throughout the province. With the gradual conversion of these buildings to more convenient fuels, output in recent years has decreased to a few thousand tons produced by short term operations each fall to supply local customers.

In 1969 D. Malcolm, P. Eng., remapped the Company holdings and reconstructed sections from the available data. His work indicated that the multiple seam deposit may have sufficient lateral extent to include a multi-million ton reserve of coal recoverable by strip mining techniques. In addition the Company completed sufficient metallurgical research and in-house economic evaluations to indicate the desirability of initiating a more comprehensive study, the first phase of which will be the investigations recommended within this report.

TOPOGRAPHY, ACCESS AND SERVICES

The Company holdings are trisected by Tenas (Mud) and Goathorn (Goat) creeks, glacier fed tributaries uniting with the Telkwa a few miles upstream from this river's confluence with the Bulkley River at the town of Telkwa.

The Telkwa River meanders easterly through a broad valley crossing the northern portion of the Company holdings (see Drawing 1456-1-02). On average the elevations increase uniformly across the holdings, the slope gradually becoming more precipitous towards the Telkwa Range some 10 miles south of the Telkwa.

The Tenas and Goathorn creeks drainage systems have carved north-trending valleys superimposed on this regional trend, the elevations in the immediate vicinity of the old coal workings ranging from approximately 1900 feet at Goathorn Creek to about 2600 feet on top of either bank. In cross section this valley has generally steep to precipitous sides, the

gradient sometimes tempered through slumping of the less competent portions of the sediments.

An all weather gravel road links the old mines to Telkwa (6 miles) on the CNR railway some 8 miles southeast of Smithers. As the Yellow-head Highway also links the Bulkley Valley to the transcontinental and ocean trade routes, access to services and markets is readily available.

Serviceable buildings at the old mines will be an adequate base for the proposed investigation but additional sleeping quarters (trailers) may be desirable. On site water and power services are sufficient for the foreseeable future. It is probable, however, that new plant construction would require additional power. Adequate supplies of water could be available from Goathorn Creek on which B. V. C. owns full recorded water rights covering 10 C.F.S. "for purposes of washing coal." If it proves advantageous to create reservoirs to supply the washing plant, they would probably be constructed in conjunction with diversion of the creek during implementation of the mine design and cost should not be excessive.

Regardless of plant size, accommodations for construction and operating personnel should present minimal concern since the area is so ideally located with respect to existing communities.

Many areas of the holdings are now accessible from logging (and mine) roads and access to all but the most precipitous areas could be readily provided by bulldozer.

The annual temperatures range from the high 80's to 30 degrees below zero or more, the very cold weather usually only intermittent intervals of a few days' duration during the mid November-March period. Snow-fall averages about four feet or less but occasionally has exceeded eight feet in recent years. Winter conditions should be anticipated in the November-mid May period.

Logging is in progress on site and conceivably timber for construction purposes could be available on the property. In all probability, however, it will prove more advantageous to purchase such needs from existing suppliers in the area.

TITLES

Total land controlled by Bulkley Valley Collieries Limited in the Telkwa Coal Basin comprises approximately 25 square miles held under various forms of ownership, licences and agreements. As the cost of effectively exploring all of these holdings prior to significant production would be prohibitive, the initial investigation will be concentrated in that portion adjacent to substantial coal exposures, having a high probability of containing sufficient reserves to sustain a one million ton per year operation for at least 15 years and deemed to present the greatest potential for profit.

The area chosen for the first phase of the program consists of five lots, 227, 390, 391, 392 and 401, comprising five square miles or 3200 acres (see Drawing 1456-1-02). After orientation drilling in this first phase has indicated the most favorable location and demonstrated the size of tract required to provide adequate reserves of coal, a portion of these five lots will be selected for more comprehensive evaluation.

We have made no investigation of titles to these five lots but assume that the following information furnished to us by B. V. C. is accurate and complete.

In lots 391 and 401, comprising 1280 acres, land and coal rights are owned by Bulkley Valley Collieries Limited. Land, buildings and improvements are subject to annual provincial tax assessments. Over the period from 1967 through 1970 the annual tax on these two lots has averaged \$500. No royalties are due on coal production from lots 391 and 401.

For lots 227, 390 and 392, comprising 1920 acres, rights to coal are held by coal licence in favor of Bulkley Valley Collieries Limited. Under the Provincial Coal Act this licence is subject to annual renewal. Annual licence fees of 50 cents per acre, a total of \$960 per year, are payable for these three lots. If development work of \$7.50 per acre is done then this rental will be rebated. This is to say that if development work in the amount of \$14,400 is carried out in any year on these lots no rental fee is due for that year. A renewal fee, independent of rental or development work, in the amount of \$25 per licence, is payable each year upon renewal. Thus rental plus renewal fees for lots 227, 390 and 392, payable each year, amount to \$960 plus \$75 or \$1035.

The British Columbia Coal Act provides that Coal Licences may be taken to lease having a term of 20 years. The annual rental fee for a coal lease is \$1.00 per acre, which cannot be recovered from

expenditures for development work. At such time as production is justified from any or all of these lots, application should be made to take the appropriate lot or lots to lease. If all three lots were taken to lease the annual rental would amount to \$1920.

Coal produced and removed from either licenced or leased land is subject to a royalty of 25 cents per ton. Royalty fees cannot be applied against renewal or rental charges.

IV

TONNAGE POTENTIAL

A succession of coal measures is present within the Jura-Cretaceous sedimentary complex which forms a low angle synclinal structure traversing the Telkwa River just west of its confluence with the Bulkley.

This basin appears to be about eight miles long (northwesterly direction) by two to four miles in width, the exact limits masked by widespread glacial till and by thick gravel accumulations north of the Telkwa. The coal is classified as a bituminous variety believed to be of coking quality. The coal occurs as multiple seams of varying thickness apparently confined to a few carbonaceous horizons (coal measures) within the sedimentary sequence.

Several seams exceed five feet in thickness and there are indications that the total thickness of coal recoverable by surface mining techniques will approximate at least 20 feet and could exceed 40 feet. The lateral extent of the mineable portions is unknown but from present knowledge the potential total reserves within the Company holdings are believed to be many million tons of coal.

In formulating these conclusions we have supplemented our personal observations by those reported by Leach (GSC 1907), Black (MM 1951) and Malcolm (BVC 1969).

The exposures created by erosion in Goathorn Valley have been supplemented by surface cuts and mine developments on both the east and west sides of the valley. Our present concept of this coal basin is based to a very large degree on these exposures augmented by the rather poorly documented exploration drilling completed in 1943, 1944, 1950 and 1951. This drilling was concentrated in the immediate vicinity of the mine developments then extended to include the area immediately east of the #3 UG mine (Lot 391 east of creek). Only small diameter cores were recovered and the core was either discarded or abandoned to the elements so that the full significance of these investigations has been lost.

Near Goathorn Creek, the sedimentary formations generally dip easterly at 20 degrees or less with numerous local rolls and anticlinal folds along the major structure. The beds are often displaced by faults and many of the coal seams have been segmented by post-deposition dikes.

Within the complex some beds are lenticular and pinch out while others reappear. The thickness of individual coal seams and the number and thickness of the intervening beds are observed to vary considerably within short distances. There are no known marker horizons, hence the sequential lithology of the series, and correlation of the various coal intersections is now apparent only where proven by mine development or trenching.

There appears to be a greater number of significant (depth) coal seams on the east side of Goathorn Creek. This may be an erroneous conclusion because of less extensive exploration on the west side. This may indicate, however, that the upper portion (including the coal) has been eroded to a greater extent west of Goathorn, or that conditions in the eastern part of the basin were more favorable for deposition of the coal.

The complete sedimentary section is not exposed and in addition to displacement by faults, etc., the upper beds have been subjected to differential erosion so that at present one can only speculate as to the probable depth to which exploration is warranted.

Black comments that the figures given for the coal measures, the beds above, and those below total 650 feet, but cautions that the total thickness of this series could be much greater in certain areas - probably considerably less in the northern part. The latter conclusion is based on an exposure of underlying volcanics in Goathorn Creek some 600 feet south of the north boundary of Lot 401. Gritty beds in Tenas Creek, a few miles to the west, are believed near the base of the complex.

Black also comments that the observed maximum thickness of sediments overlying the top coal seam approximates 100 feet (holes 5 and 21). No coal was encountered in hole #6 drilled in the SW portion of Lot 401 and Black presumes that this hole intersected only the lower (barren) part of the series thus indicating that the sedimentary section below the measures is at least 350 feet in this area, thinning to about 100 feet to the north.

Black's observations with respect to #6 drill hole were based on his examination of the records (cores discarded) and appear to be in conflict with certain other factual information. There are exposures of coal on three sides of this hole, namely about 700 feet to the north, 900 feet to the east, and 1500 feet to the south of the collar location, thus suggesting that at least one coal seam of mineable thickness has substantial lateral dimensions across this area. This analogy can only be resolved through further exploration and emphasizes the need for extreme care during both field exploratory investigations and the evaluation of results.

On the basis of all observations we conclude that the average depth which can be considered favorable for the location of significant coal seams will approximate 350 feet from the existing surface.

A one foot thickness over one square mile will contain 27.8 million cubic feet. It is reasonable therefore to assume there would be over one million tons of recoverable coal for each foot thickness of coal proven over an area of one square mile.

Current data indicate that the total thickness of recoverable seams will be at least 20 feet and could exceed 40 feet over substantial areas within the presumed 350 feet of favorable depth, thus suggesting the existence of a multi-million ton reserve.

As many of these seams are exposed in or appear to extend just beneath Goathorn Creek valley, we conclude that it may be possible to maintain a relatively low waste to coal ratio by taking advantage of existing topography in designing the pit. The in-house preliminary evaluations completed by B. V. C. suggest such an undertaking would be a profitable venture. We therefore conclude that further studies are warranted.

In our opinion these should initially be oriented towards substantiation of the mineable reserves consistent with a mining operation on a scale which would ensure a reasonable return on the invested capital. Assuming results are encouraging, the studies should be expanded to include metallurgical research and the economic evaluations prerequisite to a realistic production decision. From information at hand, we conclude that this initial program would delineate reserves sufficient to support production of one million tons of coal annually for a mine life of a minimum of 15 years.

The initial exploration target should therefore be systematic exploration of about one square mile within that portion (or portions) of the coal lands which appears to present the greatest profit potential (maximum total thickness coal of suitable quality and minimum stripping requirement).

Four areas appear to exhibit such potential:

1. East or south of #3 UG Mine (east side of Goathorn)
2. Northwest of #4 UG Mine (west side of Goathorn)
3. South of #2 UG Mine (west side of Creek).

Of these, the areas to the east and south of the #3 UG mine would appear to present the more attractive possibilities but from geological interpretation the overlying thickness of barren sediments may increase with distance east from the creek.

A program detailing our recommendations is included in Section V, following.

PROPOSED PROGRAM

Bulkley Valley Collieries Limited controls a substantial portion of the Telkwa Coal Basin in which a flat lying succession of coals seams has been shown to have significant lateral extent through underground exploitation of individual seams, a limited amount of surface mining and through exposures in the steep banks of the streams which have cut through the area. Sufficient information is not available to either provide correlation between the seams exposed in the widespread workings and outcrops or to permit projecting with reasonable confidence continuity of thicknesses of mineable coal at economic waste to coal ratios or predicting uniformity of quality and amenability to cleaning techniques.

Preliminary studies carried out by Bulkley Valley Collieries Limited, augmented by results of investigations by federal and provincial authorities, clearly demonstrate that there is an excellent probability that these deposits may be capable of supporting a viable strip mining operation to produce one million tons or more of coal product per year.

The program described herein has been designed to provide:

1. Delineation of sufficient reserves to support a one million ton per year operation for at least 15 years.
2. Sufficient information on the configuration and position of the coal making up these reserves to permit design of a mining plan, selection of equipment and preparation of accurate capital requirements and operating costs.
3. Enough coal cleaning test work to demonstrate the probable quality and uniformity of product and permit preliminary plant design, selection and sizing of equipment and estimation of capital and operating costs.
4. A cash flow, sensitivity and risk analysis to evaluate the feasibility of onward work, including bulk sampling, test mining and pilot plant work if deemed necessary and of placing the property into large-scale production.

The program suited to achieve these objectives can best be carried out in two stages.

PHASE 1 - ORIENTATION DRILLING

The first stage is designed to develop information upon which more precise procedures for Phase 2 can be formulated. From the results of the first stage we believe it should be possible to:

1. Select an area for delineation and development drilling with sufficient potential of coal reserves to support an operation at the proposed level.
2. Make a preliminary assessment of probable number and thickness of mineable coal seams and their indicated uniformity so that an appropriate drilling pattern can be designed, drillhole spacing indicated and the possibility of incorporating some open hole drilling in the second stage of the program can be considered.
3. Derive sufficient indications of the consistency in quality of the coal from seam to seam and of the type of product that can be obtained from the raw coal by standard cleaning techniques to permit an assessment of the scope and nature of metallurgical test work which will be required in the second phase.

Bulkley Valley Collieries Limited proposes to make available for the Phase 1 stage of the program five lots comprising 3200 acres. Four sites within the boundaries of these lots have been selected for Phase 1 orientation drilling.

In order to assess the relative merits of these areas it is proposed to put down at least three vertical HQ diamond drill holes ($\pm 2 \frac{3}{16}$ " core diameter) each to a depth of 400 feet at the corner of an equilateral triangle having 200-foot sides in each area tested. At least two of the four areas selected for Phase 1 would be so tested with investigation of the third and/or fourth undertaken only if continuity of coal seams, indicated waste to coal ratios or other characteristics of the deposits were deemed less favorable than desired.

Cores would be handled to extract the maximum amount of valid information possible from the project. At the suggestion of Mr. Albert M. Keenan, who will be responsible for insuring that the most stringent coal evaluation techniques are followed, procedures will include:

- a. Taking color photographs of all cores.
- b. Careful logging and selection of sample intervals.
- c. Breaking of all coal intercepts into individual samples wherever visual examination indicates any changes in quality or characteristics of the coal.
- d. Inclusion of all coal-bearing core in samples rather than splitting.
- e. Placing samples in double sealed bags as soon as practical after cores are recovered to preserve inherent moisture content and to protect the core from contamination and change.
- f. Storage of unsampled intervals of waste core in boxes within plastic jackets.

It is planned to probe each drillhole in the first stage with electro-logging equipment to provide resistivity and gamma radiation data. Such information could assist greatly in correlation between coal seams and in recognition of marker beds.

It is proposed to institute ecological base line studies as a part of the first stage to insure that all phases of the project through to large scale production conform to regulations to protect the environment.

Metallurgical testwork on core samples would be carried out in the Vancouver laboratories of Britton Research Limited under the direction of John W. Britton utilizing procedures recommended, monitored and approved by Albert M. Keenan. Parameters investigated will include B. T. U. and ash content, swelling index, amenability to cleaning by gravity and washing in various size ranges and heavy liquid densities, percentages of volatile matter and deleterious matter such as sulfur and, if necessary, response to other separation techniques such as flotation.

We estimate that pre-field corporation organization, negotiation of contracts and completion of arrangements may require approximately three months. The drilling portion of the first stage should take from two to three weeks with an additional three weeks needed to complete

test work and compile an interim evaluation. Our estimate of the cost of the first stage of the Bulkley Valley Collieries preliminary feasibility project is:

Field, laboratory and engineering	\$100,000
Administration and corporate expense	<u>15,000</u>
Total Funds Required	\$115,000

The details of this estimate are tabulated at the end of this Section V.

PHASE 2 - DELINEATION AND DEVELOPMENT DRILLING
PRE-PILOT PLANT TEST WORK

The second phase of the proposed program is to a very considerable degree contingent upon the results derived from the first stage. If such results were to be completely negative, an eventuality which we consider to be unlikely, a second phase would probably not be implemented. With the more probable outcome of better defined conditions and problems the second stage would be designed to meet these conditions and provide answers to those problems.

For the purposes of preliminary budgeting we have assumed that one square mile of company land holdings must be examined to provide the required reserves, that 52 HQ core drill holes will be required to delineate the necessary tonnage and that an additional 14 holes may be required to ensure that reserves can be given a proven classification. Provision has been made for taking larger or semi-bulk samples and for expanded cleaning tests on those samples. Such samples may come from large diameter calyx drill holes, from adits driven on several coal seams or from one or more test pit areas. The principal determining factor in selecting sampling method will undoubtedly be the degree to which the method will supply material representative of the feed to a full scale cleaning plant.

The program is flexible and will be adapted to conditions encountered. Since we have assumed what we believe to be the most severe conditions, we also believe that the preliminary cost estimates will provide adequate funds to carry out the proposed program with whatever revisions are deemed necessary.

We estimate that the field portion of the second stage of the recommended program will take about two months and that an additional six weeks will be needed to complete evaluation studies and compile the Preliminary

Feasibility Report. Our estimation of the cost of the second stage of this program is:

Field, laboratory and engineering	\$400,000
Administration and corporate expense	<u>35,000</u>
Total Funds Required	\$435,000

DETAIL OF COST ESTIMATES

Phase 1 - Orientation Drilling

Field, laboratory and engineering

A. M. Keenan - Consulting	15 days	\$ 3,000
Expenses - Travel		1,300
CW&G Ltd. - Consulting		
C. R. D. Miller, Project Engr.	1 mo.	3,700
E. P. Chapman Jr.	6 days	1,800
Expenses - Travel		1,000
Britton Research Limited		
Core analysis and metallurgical tests		10,000
Diamond Drilling - Contract	4800' @ \$10	48,000
Electro-Logging	4800' @ \$1	4,800
Bulldozer	10 days @ \$300	3,000
Ecological Baseline Study		5,000
Property Superintendent		
L. Gething		1,500
Chief Engineer and Geologist		
D. Malcolm		3,000
Geological Assistants		
Core grabbers, rodman	4 @ \$500	2,000
Subsistence	60 man days @\$25	1,500
Transportation - Field		<u>1,000</u>
Sub-Total		\$ 90,600
Contingency (10.4%)		<u>9,400</u>
Total - Field, laboratory and engineering		\$100,000

Administration and corporate expense

J.D. Carnahan	4 mo. @ \$1600		\$ 6,400
Travel			1,400
Office	4 mo. @ \$150	\$ 600	
Secretary	4 mo. @ \$200	800	
Bookkeeper	4 mo. @ \$100	400	
Telephone	4 mo. @ \$400	400	2,200
Legal			
Fees		\$1500	
Incorporation Licenses		1500	3,000
Sub-Total			\$ 13,000
Contingency (15.4%)			2,000
Total - Administration and corporate expenses			\$ 15,000

Phase 2 - Delineation and Development Drilling
Pre-Pilot Plant Test Work

Field, laboratory and engineering

A.M. Keenan - Consulting	20 days	\$ 4,000
Expenses - Travel		2,600
CW&G Ltd.		
C.R.D. Miller	2 mo.	7,400
E.P. Chapman Jr.	1 mo.	5,000
Computer Evaluation		2,600
Britton Research Limited		
(including possible tests by others)		41,000
Diamond Drilling	19800' @ \$9.50	188,100
Electro-Logging	19800' @ \$1.00	19,800
Bulldozer	20 days @ \$300	6,000
Ecological Studies		5,000
Property Superintendent		
L. Gething	2.6 mo.	4,000
Chief Engineer and Geologist		
D. Malcolm	2 mo.	6,000
Geological Assistants		
Core grabbers, rodman	4 @ \$1000	4,000
Subsistence	120 man days @\$25	3,000
Transportation - Field		3,000

Field, laboratory and engineering - cont'd

Supplies	\$ 1,000
Travel	3,000
Bulk Samples - Mining and Transport	20,000
Senior Consulting	20,000
Preliminary Design	<u>15,000</u>
Sub-Total	\$360,500
Contingency (11%)	<u>39,500</u>
Total - Field, laboratory and engineering	\$400,000

Administration and corporate expense

J. D. Carnahan	12 mo. @ \$1600		\$ 19,200
Office	12 mo. @ \$150	\$1800	
Secretary	12 mo. @ \$200	2400	
Bookkeeper	12 mo. @ \$100	1200	
Telephone	12 mo. @ \$100	<u>1200</u>	6,600
Legal and Audit			2,000
Supplies			500
Transportation and Expenses			<u>2,000</u>
Sub-Total			\$ 30,300
Contingency (15.5%)			<u>4,700</u>
Total - Administration and corporate expense			\$ 35,000

SUMMARY - ESTIMATED COSTS

	Engineering and Field	Administration and Corporate	Total
Phase 1	\$100,000	\$15,000	\$115,000
Phase 2	<u>400,000</u>	<u>35,000</u>	<u>435,000</u>
Total	\$500,000	\$50,000	\$550,000

ORGANIZATION - STEERING COMMITTEE

The published financial results for several operations producing coal in western Canada for export markets have clearly demonstrated that sound and extensive engineering procedures during evaluation stages and experienced and competent management during operations are essential to financial success in large scale coal production. This is true for most business enterprises and particularly so for mining ventures. From the record, we infer that experience and expertise in mining and treatment of base metal ores does not necessarily provide the skills to anticipate and solve some of the problems peculiar to production of coking coal.

In assembling a team to carry out the evaluation of the feasibility of producing coking coal from lands in the Telkwa Coal Basin, Bulkley Valley Collieries Limited has sought to combine recognized experience in evaluation, engineering, metallurgy, management and coal production. The proposed organization is shown in chart form in Figure 1.

The Steering Committee will be responsible for the technical and evaluation aspects of the project. E. P. Chapman Jr., who will act as chairman, is president of Chapman, Wood & Griswold Ltd., a Vancouver based consulting firm which has carried our major feasibility studies on metallic and non-metallic mineral deposits in many parts of the world for more than twenty years. Frank Coolbaugh, currently a consultant to the mining industry from his headquarters in Denver, Colorado, has had wide experience in both engineering and top level management. He has served as chief executive officer of a major U.S. based mining company, been a member of the board of directors of several large corporations and is an acknowledged expert in technical and business fields. Albert M. Keenan has had broad experience in coal as an engineer, a producer, a top level advisor and as an educator. Experience records for these Steering Committee members and for other key personnel to be involved in the project appear at the end of this Section VI.

J. D. Carnahan, president of Bulkley Valley Collieries Limited, will administer the business aspects of the project, such as accounting and negotiation of drilling contracts, and will serve as an ex-officio member of the Steering Committee. Lloyd Gething, the property superintendent, is thoroughly familiar with the property, services available in the area and with past production from the property, much of which he has

BULKLEY VALLEY COLLIERIES LTD.

ORGANIZATION CHART

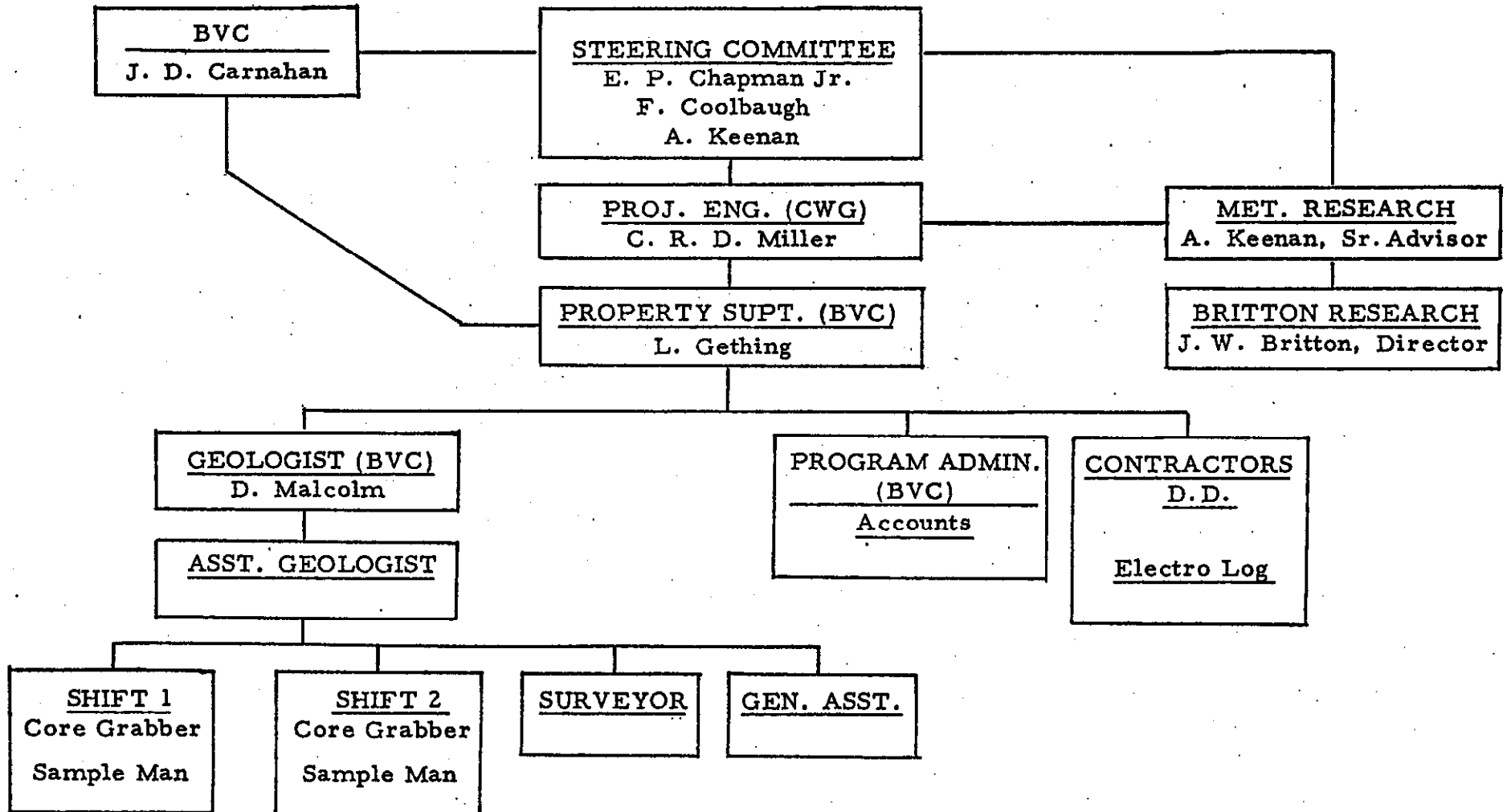


Figure 1

supervised during the past 21 years. He will carry out technical requirements of the Steering Committee at the request of C. R. D. Miller of Chapman, Wood & Griswold Ltd., the project engineer.

Douglas C. Malcolm, who from 1965 to the present has acted as a consulting engineer retained by B. V. C., has compiled a study and geological interpretation of all available data on the Telkwa Coal Basin and has been responsible for exploration work resulting in discovery of the open pit No. 2 mine, will serve as geological engineer for the project.

Metallurgical research, washing tests and analytical work will be directed by Mr. John Britton of Britton Research Limited of Vancouver, with cooperation and monitoring by A. M. Keenan who will provide specific expertise in coal to augment Mr. Britton's recognized capabilities in the metallurgical field.

It is recognized that during the period of this project problems may arise requiring specialized skills for optimum resolution. Provision has been made in cost estimates for obtaining such experts on a consulting basis.

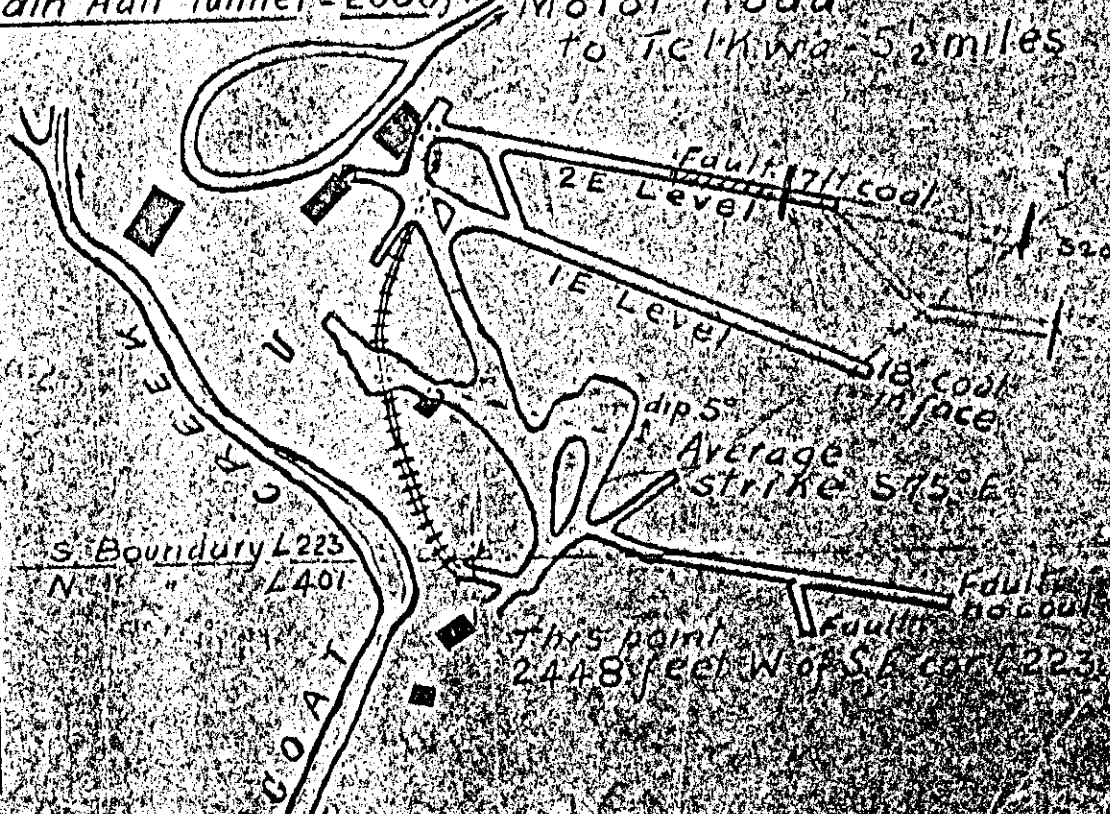
EXPERIENCE RECORDS

TELKWA COLLIERIES LTD.

54-127

Scale
0 100 200 feet

El. of Main Adit tunnel = 2000 ft. Motor Road to Telkwa - 5 1/2 miles



To accompany report of D.L.A.
Resident Engineer Hazelton, 1926



EDWARD P. CHAPMAN JR.

Director and President
CHAPMAN, WOOD & GRISWOLD LTD.

Geol. Eng., Colorado School of Mines, Golden, Colorado, Geological Engineering 1935. Registered Professional Engineer, Mining Engineering, British Columbia, 1960; Colorado, 1943; New Mexico, 1948; Texas, 1952. Member, Canadian Institute of Mining and Metallurgy. Member, American Institute of Mining, Metallurgical, and Petroleum Engineers.

- 1935-1942 Golden Queen Mining Company (American subsidiary of Goldfields of South Africa), Mojave, California, U.S.A.
Mine Engineer

- 1942-1943 Reconstruction Finance Corporation and Metals Reserve Company, Denver, Colorado and Washington, D.C., U.S.A.
Supervising Engineer
Evaluation of deposits for U.S. Government loans, setting up stockpile and purchase depot facilities and purchasing critical and strategic minerals.

- 1943-1947 Hayden Mining Company and Monarch Mineral Products Company, Colorado Springs, Colorado, U.S.A.
Vice-President and General Manager
Operation of mines producing manganese and tungsten, and three mines producing lithium minerals, tantalum, beryl and topaz.

- 1947-1956 CHAPMAN AND WOOD, Albuquerque, New Mexico, U.S.A.
Partner

- 1956-1959 CHAPMAN, WOOD AND GRISWOLD Albuquerque, N.M., U.S.A.
Partner

- 1956 to Date CHAPMAN, WOOD & GRISWOLD LTD., Vancouver, Canada
Director and President
General Consulting in North and South America, Europe, Africa, the Philippines and Australia.

FRANK COOLBAUGH

Consulting Mining Engineer

Graduate Engineer of Mines, Colorado School of Mines - 1933.

Graduate, Harvard Business School, Advanced Managerial Course - 1947.

Registered Professional Engineer, Colorado Member,

Advisory Council to Board of Trustees,

Colorado School of Mines

Colorado School of Mines Research Foundation

American Mining Congress

American Institute of Mining, Metallurgical and Petroleum Engineers

Mining and Metallurgical Society of America

Institution of Mining and Metallurgy - London

Colorado Mining Association

British Columbia and Yukon Chamber of Mines

Board of Directors - several mining companies

1933-1941

Climax Molybdenum Company, Colorado, U.S.A.

Junior Engineer in the mine, subsequently

transferred to the concentrator

Assistant Mill Superintendent

Crusher Superintendent

1941-1945

Military Service

U.S. Army Corps of Engineers

1945-1959

Climax Molybdenum Company, Colorado

Advanced from mine foreman through various managerial positions to become

Vice-President Operations

1959-1967

AMAX (American Metal Climax Inc.), New York

Appointed President of the Climax Division

after amalgamation of American Metal and

Climax Molybdenum companies

President of AMAX one year later

Chairman of the Board - 1965

1967 to Date

Consultant to the Mining Industry, Denver, Colorado

In addition to consulting at the management level,

Mr. Coolbaugh has been responsible for the

organization of various joint exploration ventures.

ALBERT M. KEENAN

Professor Emeritus
Former Head, Mining Department, Colorado School of Mines
Consultant to the Coal Mining Industry

Graduate Engineer of Mines, Colorado School of
Mines - 1935
Registered Professional Engineer and Land Surveyor,
Colorado
Recipient of Distinguished Achievement Award,
Colorado School of Mines
Member, American Institute of Mining &
Metallurgical Engineers
Former member of executive, Coal Division, AIME
Former associate editor of Mechanization and Coal
Utilization Magazine

- 1935-1938 Gulf Research and Development Corporation
Junior Engineer
- 1938-1939 Pittsburgh Coal Company
Junior Engineer
Surveying, production supervision and
coal property evaluations
- 1939-1946 Military Service, U. S. Army Corps of Engineers
Airfield construction in Aleutians
Executive Officer, Combat Battalion of Engineers
in Europe
Lieutenant Colonel on General Eisenhower's staff
at end of World War II assigned to rehabilitation
of European Coal Mines
- 1946-1947 U. S. Government
Commodity Expert in the United States Military
Government in Germany and U. S. Representative
to the Quadrapartite Commission
- 1947-1948 Pennsylvania State University
Assistant Professor of Mining
In addition to University responsibilities he was
advisor to U. S. Government in Europe with
respect to implementation of the Marshall Plan
(Mining Machinery Committee) and the
Dismantling Plan for Europe (Dept. of Defense)

cont'd/

ALBERT M. KEENAN - cont'd

1948-1954

Colorado School of Mines

Associate Professor of Mining Engineering

Design of coal mining engineering curriculum
in addition to teaching the related coal mining
subjects

1952-1969

Thompson Creek Coal and Coke Corp.

President and General Manager

Founded company while at Colorado School of
Mines then resigned from Faculty in 1954
because of managerial responsibilities in this
successful coal mining venture

1968 to Date

Colorado School of Mines

Professor of Mining and former head of

Mining Department, now Professor Emeritus

In addition to scholastic responsibilities,
Professor Keenan has continued his distinguished
association with the coal industry. Currently he
is an advisor to the Colorado School of Mines
Research Institute, serves on an advisory com-
mittee to Mr. Hollis M. Dole, Assistant Secretary,
Mineral Resources, Department of the Interior,
and acts in a consulting capacity for the Paul Weir
Company of Chicago. His assignments include all
phases of this industry from economic evaluations
and design of coal mining systems to consultations
on legislation governing the operation of coal
mines within the United States of America.



CARL R. D. MILLER

Chief Geologist and
Assistant to the President
CHAPMAN, WOOD & GRISWOLD LTD.

B. Sc., University of Manitoba,
Geology and Chemistry - 1940.
Post graduate studies, University of
Manitoba, Geology - 1941.
Registered Professional Engineer,
British Columbia, 1964.
Member, Canadian Institute of Mining
and Metallurgy, 1962.

- 1941-1945 Military Service, R. C. A. F.
- 1946 John Drybrough, Consulting Engineer,
 Winnipeg, Manitoba, Canada
 Field Geologist
- 1947-1957 Hudson Bay Mining & Smelting Co.,
 Flin Flon, Manitoba, Canada
 Mine Geologist, Flin Flon Mine - supervision of underground
 diamond drilling, grade control and ore estimations
- 1957-1961 McIntyre Porcupine Mines Ltd. (and subsidiaries), Canada
 Mine Geologist - Belleterre Quebec Mines Ltd.
 Field Geologist - Quebec and Maritime Provinces
- 1961-1966 Various Mining Companies
 Senior Geologist associated with mine and exploration pro-
 jects in the Maritimes, British Columbia, Yukon and
 Northwest Territories, Canada
- 1966-1968 Pyramid Mining Co. Ltd., Canada
 Geologist and Exploration Manager
 Property evaluations, planning and completion of various
 exploration programs in Western Canada
- 1968 to Date CHAPMAN, WOOD & GRISWOLD LTD., Vancouver, B.C., Canada
 Project Co-ordinator and Senior Advisor, property
 evaluations and feasibility studies
 Directed mine planning for underground copper mine
 Project Co-ordinator, feasibility study of bulk type
 copper-molybdenum deposit

LLOYD M. GETHING

Mine Superintendent
Bulkley Valley Collieries Limited

Diploma in Teaching, University of British Columbia - 1938

Member, Canadian Institute of Mining and Metallurgy

Member, B. C. and Yukon Chamber of Mines

Member, Smithers and District Prospectors' Club

- 1939-1943 Prospector, miner and shift boss
 Various placer gold and coal mines in the
 Peace River district of British Columbia
- 1944-1951 Peace River Coal Mines Ltd., Hudson Hope, B. C.
 Manager
 Responsible for underground development
 and coal production at this mine
- 1951 to Date Bulkley Valley Collieries Ltd., Telkwa, B. C.
 1951-1955 - Mine Captain (underground)
 1956-1958 - General Underground Foreman
 (three mines in operation)
 1958-1962 - General Foreman responsible to
 Mine Superintendent for all mining
 and surface plant operations
 1962-present - Mine Superintendent, responsible
 to General Manager for all on site
 operations including implementation
 of exploration programs recom-
 mended by the Company's geological
 consultant.

DOUGLAS C. MALCOLM

Consulting Geological Engineer

B. A. Sc., University of British Columbia,
Geological Engineering - 1935
Registered Professional Engineer in the Provinces
of British Columbia and Ontario
Member, Canadian Institute of Mining & Metallurgy

1936-1955

Consolidated Mining and Smelting Company of
Canada Ltd., Trail, B. C.

Exploration Geologist, 1936-1946

Senior Exploration Engineer, 1946-1955

Responsible for all Cominco exploration
projects in British Columbia, Washington
and Northern Montana. Discoveries during
this period included the Duckling Creek and
Bluebell mines

1955-1958

Preston East Dome Mines Ltd.

Exploration Manager, Timmins, Ontario

Directed various exploration ventures in
Ontario, Quebec, Maritime provinces and
the Northwest Territories

1958-1963

Phelps Dodge Corp. of Canada Ltd.

Resident Geologist, Vancouver, B. C.

Established Vancouver office and directed
exploration in British Columbia and the
Yukon

1963-1965

Macsan Exploration Ltd., Vancouver, B. C.

Vice-President and Chief Geologist

Property evaluations, planning and completion
of various exploration programs in British
Columbia

1965 to Date

Consulting Geological Engineer, Vancouver, B. C.

In addition to other assignments has been associated
with Mr. J. D. Carnahan as advisor in several ex-
ploration ventures, responsible for comprehensive
geological studies of the coal deposits held by
Bulkley Valley Collieries Ltd. and the discovery of
the coal horizon exploited in the open pit #2 Mine.

JOHN W. BRITTON

President, Britton Research Limited
Consulting Metallurgists

B.Sc., Engineering, University of London - 1939
Associate of Royal School of Mines, London
Registered Professional Engineer, British Columbia
and Ontario
Registered Assayer, Province of British Columbia
Member,

Canadian Institute of Mining and Metallurgy
Institution of Mining and Metallurgy, London
National Association of Corrosion Engineers
Engineering Institute of Canada

- 1939-1954 Imperial Chemical Industries, England
 Research Metallurgist, Technical Services Department
 1950 appointed Deputy Manager, I. C. I. Technical
 Services Department (ore treatment) at Runcorn,
 Cheshire, England
- 1954-1961 Lakefield Research of Canada Limited, Toronto, Ontario
 Manager
 Vice-President and General Manager
- 1961 to Date Britton Research Limited, Consulting Metallurgists
 Vancouver, Canada
 Formed Company and has assumed direct responsi-
 bility for all phases of metallurgical research in the
 field of ore beneficiation, including the exploitation
 of industrial mineral deposits. A few of the projects
 with which he has been associated are the now pro-
 ductive developments at Anvil, Brenda and Western
 Mines, and his clients include several internationally
 prominent mining companies. Mr. Britton has
 developed and patented several processes with
 specific applications in the field of ore beneficiation.

LABORATORY SERVICES

BRITTON RESEARCH LIMITED

1612 WEST THIRD AVENUE

VANCOUVER 9, B.C.

CANADA

BRITTON RESEARCH LIMITED

Consulting Metallurgists

1612 WEST THIRD AVENUE

VANCOUVER 9, B. C.

CANADA

JOHN W. BRITTON, A.R.S.M., B.Sc., P.Eng.
PRESIDENT

PHONE: 738-7195
AREA CODE: 604

MAJOR ASSIGNMENTS UNDERTAKEN

Atlas Explorations

Flotation tests on copper-molybdenum ore.

Brenda Mines

Laboratory tests; consulting on pilot plant operation; member of feasibility committee.

BrenMac Mines

Flotation tests on copper-molybdenum-tungsten ore.

B. C. Molybdenum

Laboratory flotation and leaching tests; consulting on operating problems.

Casino Silver

Flotation tests on copper-molybdenum ore.

Churchill Copper

Flotation tests; member of feasibility committee.

Dolly Varden

Flotation and cyanidation tests on silver ore.

Highmont Mining

Flotation and leaching tests on copper-molybdenum ore.

Kerr Addison (Adanac)

Laboratory tests on flotation, leaching, gravity concentration; technical control of on-site pilot plant; participation in feasibility study.

New Imperial Mines

Flotation tests on copper and copper-molybdenum ore; recovery of magnetite.

Pacific Copper (Cadia)

Flotation, leaching and magnetic separation tests on copper-iron ore.

Pyramid Mining

Concentration tests on lead-zinc ore; economic calculations.

Western Mines

Laboratory tests on copper-lead-zinc ore.

BRITTON RESEARCH LIMITED

Consulting Metallurgists

1612 WEST THIRD AVENUE

VANCOUVER 9, B. C.

CANADA

JOHN W. BRITTON, A.R.S.M., B.Sc., P.Eng.
PRESIDENT

PHONE: 738-7195
AREA CODE: 604

CLIENTS SERVED

During our 11 years of operation, we have carried out investigations for more than 300 clients, including the following:

Adanac Mining and Exploration	Kennco Explorations
Alrae Engineering	Kerr Addison Mines
Anvil Mining Corporation	Lornex Mines
Arctic Gold and Silver Mines	L. J. Manning and Associates
Atlas Explorations	Mastodon - Highland Bell Mines
Bethlehem Copper Corporation	Mathilde Mine
Bralorne Pioneer Mines	Matsuda Minerals Survey
Bramcda Resources (Casino Silver)	Mountain Minerals Ltd.
Brenda Mines	Nadina Mines
BrenMac Mines	National Nickel Mines
B.C. Molybdenum	New Imperial Mines
Cannon-Hicks Associates	Newmont Exploration Limited
Cascade Molybdenum Mines	Noranda Explorations Limited
Chapman, Wood and Griswold	Pacific Copper (Cadia)
Churchill Copper Corporation	Phillips Petroleum Company
Dolly Varden Mines	Placer Development Limited
Dolmage Campbell and Associates	Pyramid Mines
Echo Bay Mines	Scurry-Rainbow Oil Limited
Falconbridge Nickel Mines	Silbak Premier Mines
Giant Mascot Mines	Union Pacific Resources
Granduc Mines	Utica Mines
Hart River Mines	Wesfrob Mines
Hightmont Mining Corporation	Western Mines Limited
Kaiser Exploration and Mining	Wright Engineers Limited

BRITTON RESEARCH LIMITED

Consulting Metallurgists

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PRESIDENT

PHONE: 738-7195
AREA CODE: 604

TYPICAL INVESTIGATIONS CARRIED OUT

Antimony ores

Flotation; leaching.

Copper ores

Flotation of sulphide ores (Cu; Cu/Mo; Cu/Pb/Zn; Cu/Au/Ag; Cu/Fe).

Leaching of oxide ores.

Leach-precipitation-flotation of mixed oxide/sulphide ores.

Treatment of concentrates by hydrometallurgical methods.

Gold and silver ores

Flotation, cyanidation; gravity concentration. Development of improved methods for recovering gold from "refractory" ores.

Industrial minerals

Beneficiation of silica, feldspar and lithium ores.

Iron ores

Magnetic separation; flotation.

Lead and zinc ores

Flotation.

Mercury ores

Flotation; leaching.

Molybdenum ores

Flotation of Mo and Cu/Mo ores; separation of Cu and Mo; recovery of heavy minerals. Roasting of molybdenite concentrates. Leaching of molybdenite concentrates.

Nickel ores

Flotation of sulphide Ni ores. Recovery of nickel by hydrometallurgical methods.

Tin ores

Gravity concentration and flotation.

Tungsten ores

Gravity concentration and flotation.

Uranium ores

Flotation and leaching.