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CONSULTING GEOLOGICAL & MINING ENGINEERS
1000 GUINNESS TOWER
VANCOUVER 1, B.C.

B.C. Hydro & Power Authority

SUMMARY REPORT

1974 HAT CREEK EXPLORATION & DRILLING

(I) RESULTS OF STAGE I PROGRAM

(II) RECOMMENDED STAGE II (EXPLORATION) PROGRAM

(III) RECOMMENDED STAGE III (OPENPIT NO. 1) PROGRAM

November 19, 1974

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SUMMARY

The Stage 1 drill exploration program of the Hat Creek coal deposit was completed on October 15, 1974. Results indicate that the coal deposit is grossly displaced by regional block faults and internally dislocated by normal faulting. The stratigraphic sequence and structures of the coal measure and the surrounding strata are still imperfectly known.

The previously established coal reserve at Hat Creek occurs in a length of coal measure that is terminated at the north and south ends by regional block faults and along the east edge by a steep, normal fault. The area of the western termination has not been established. Faulting has subtracted some coal from the previously estimated reserve; however, coal extensions, found by Stage 1 drilling, have added appreciable reserves, for a net gain on the earlier tonnage estimates.

A possible displaced southern extension of the coal measure is inferred, from magnetometer anomalies and new coal discoveries, to lie about one mile southwest of No. 1 Openpit, in an area of apparent shallow overburden in the Finney Creek area.

A major exploratory drill program, termed Stage 2, is recommended for the exploration of:

(i) the Finney Creek area.

(ii) the remainder of the Upper Hat Creek valley to the south, in reconnaissance form.

and (iii) the unexplored potential coal areas around No. 1 Openpit.

The total cost of Stage 2 is estimated to be approximately $895,000.00. The principal purpose of the program is to determine if there is another coal deposit in the valley that would be more economic to mine at this time than No. 1 Openpit.

Additional drilling of No. 1 Openpit for definitive pit design, reserve calculations, grade determination and sampling, is recommended to be done before production is planned for that deposit. The total cost of such a program, Stage 3, is estimated to be approximately $500,000.00. It is recommended that this program be deferred until the results of Stage 2 are available, after which it might be more advisable to transfer Stage 3 to some other pit area further south in the valley.

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INTRODUCTION

The Hat Creek coal deposit has been principally defined by a limited program of surface diamond drilling done in 1957 and 1959. This drilling was not sufficiently comprehensive to establish all of the limits of the coal deposit and therefore, since the entire Hat Creek valley is deeply blanketed by overburden, any feasibility study of the deposit for production to support a thermal plant requires additional data in order to determine the optimum dimensions and/or location for the coal openpit. A drill program, termed Stage I, to serve this purpose was proposed to B.C. Hydro and Power Authority in early 1974 and was begun in July, 1974. The essential elements of this program were completed on October 15 with the completion of 21,482 feet of diamond drilling in 18 holes, two of which were aborted at shallow depths.

The present report summarizes the results of the Stage I program and recommends two follow-up drill programs, one to complete the investigation of the original openpit and the other to continue exploration of the valley for additional coal deposits. Full details, including core logs, coal analyses etc., of the Stage I program will be included in a comprehensive reassessment report of the Hat Creek deposit wherein all available data is correlated and weighted.

For convenience in reporting, the coal area drilled in 1957-59 is hereafter referred to as No. 1 Openpit.

What have been, and are, referred to in reports as "drill programs" include all ancillary exploration methods or systems that have been or will be used along with the drill holes to attain the objectives of the programs. Such auxiliary features include geophysical logging of drill holes, surface geophysical surveys, mapping, trenching and any other form of investigation that can reasonably contribute to the accumulation and/or interpretation of data.

The diamond drill holes completed in Stage I are listed, with footages, in Table I.

TABLE I

HAT CREEK - EXPLORATION - STAGE I DRILLING

Hole No.	Overburden (ft.)	Total Depth (ft.)
74 - 23	231	1355
24	210	386
25	98	2072
26	59	1522
27	420	1501
28 (1)	330	330
28 (2)	380	1469
29	383	1359
30	151	1099
31	222	664
32	304	1750
33	227	1386
34	106	998
35	390	932
36	301	967
37	162	167
38	64	2084
39	33	1441
Totals	4,071 ft.	21,482 ft.

16 completed holes
2 aborted holes - overburden only.
Total drilling - 21,482 ft.
Total overburden - 4,071 ft.
Total bedrock - 17,411 ft.
Shortest completed hole 664 ft.
Longest completed hole 2084 ft.
Ave. thickness of O.B. drilled 220 ft.

PART I

RESULTS OF STAGE I DRILLING

Hat Creek Coal

PART 1

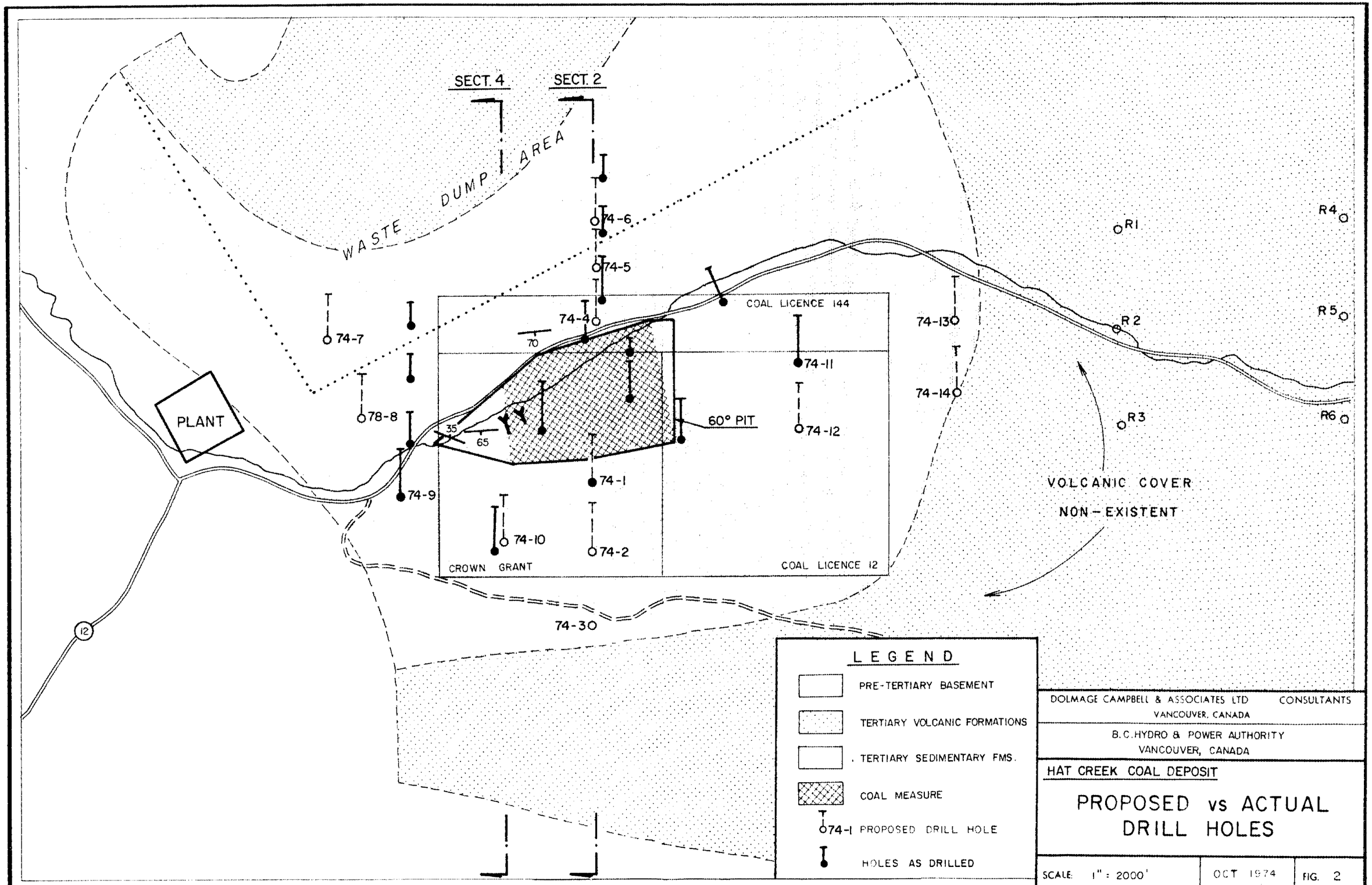
STAGE 1, 1974 HAT CREEK DRILL PROGRAM

OBJECTIVES OF STAGE 1:

Earlier analysis of the 1957-59 Hat Creek data indicated that although the drilling had proven the existence in the deposit of a very large volume of coal, mineable by surface methods, it had not delimited the extensions of the coal deposit in any direction nor had it fully resolved the geological structures of the deposit or the enclosing formation. Because of the thick, ubiquitous overburden cover on the floor of the valley of Upper Hat Creek, such coal extensions and geological structures could only be conjectured from the data available from the very limited drilling. The purpose of the 1974 Stage 1 drill program was to establish the geological limits and extensions, if any, of the coal deposit as known from the 1957-59 drilling. The program was primarily designed to optimize openpit location and design rather than confirm the coal reserves.

With the above objectives in mind a total of 21,500 feet of diamond drilling in 14 holes was proposed, together with 9,000 feet of rotary drilling in six holes. The purpose of the rotary holes was to probe through the cover of volcanic rocks that is indicated on the government geological map as blanketing the valley of Upper Hat Creek everywhere beyond a mile radius of the coal deposit. The diamond drill holes were laid out in four east-west lines, one across the north end of the deposit; another across the south end; a third extending eastward from the east side of the deposit; and a fourth extending westward. This layout of holes was predicated on the relatively simple structure of the coal measure that was assumed from the 1957-59 data. These data indicate that the coal occurs in five extremely thick beds that strike slightly west of north and dip vertically at the surface and westward with depth. The bedding attitudes exposed in the drill cores are markedly regular and do not indicate the presence of disruptive folding; however, the occurrence of gouge planes in the core is not uncommon, suggesting the presence of faulting within the coal measure. Nevertheless, there is insufficient evidence available not to adopt the simplest indicated structure of the coal measure at this time. Thus, assuming that the coal measure strikes north and south and dips steeply westward, the north line of proposed drill holes would determine its extension to the north, and the south line its extension in that direction. The holes to the west would determine the dip of the measure and the possible presence of additional coal beds in the hanging wall; the holes to the east would determine the possible presence of undiscovered coal beds in the footwall. An important function of these exploratory holes was also the determination of what land around the proposed openpit would be available for plant and waste dump locations.

It was acknowledged that the proposed holes would probably be changed in depths, inclinations or locations as the program proceeded and more data on the deposit became available.



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VANCOUVER, CANADA

HAT CREEK COAL DEPOSIT

PROPOSED vs ACTUAL DRILL HOLES

SCALE: 1" = 2000' | OCT 1974 | FIG. 2

DWG G74-1213

VANCAL - 72

CHANGES IN THE PROPOSED PROGRAM - (Figure 2)

A number of significant changes were made in the proposed program, all coming as a result of new discoveries regarding the geology of the valley or the deposit.

DELETIONS: The major deletion to the program was the cancellation of all of the rotary holes. This occurred just as drilling began and was the result of the reconnaissance mapping of the valley which revealed that the cover of volcanic rocks that was indicated on the government geological map as blanketing most of the valley of Upper Hat Creek does not exist. The valley is almost entirely covered deeply by sand-gravel overburden. There is no indication anywhere that the bedrock underlying this overburden is anything but the sedimentary coal-bearing strata that occur in the vicinity of the drilled coal deposit. Since the purpose of the rotary drilling was to provide a relatively rapid and low cost means of penetrating through what might have been a thick cover of barren volcanic rock, (testing for coal in the underlying rocks by means of geophysical logging of the rotary holes), the absence of such cover cancelled the need for the rotary holes. However, the possible use of geophysical logging of drill holes was retained as part of the program, to be employed if it would appear that it would materially benefit the program.

The other deletion to the original program was the cancellation of three southernmost diamond drill holes, shown as 74-12, 74-13 and 74-14 on Figure 2. This cancellation was brought about by the fact that the initial southern hole, 74-11 on Fig.2, indicated that the coal measure did not extend that far south and was probably faulted off north of that hole.

ADDITIONS TO THE PROGRAM:

DRILLING - There were no drilling additions to the original program; rather, the drilling that was cancelled in the south was transferred to the 1957-59 drilled area where three holes were drilled to check the geological correlation of the known coal measure within the reserve portion of the deposit.

Many of the drill holes did not reach their planned depth, whereas a few were drilled deeper than planned. A major limitation on the depth of the drill holes became evident when it was found that holes in rocks other than coal tend to squeeze shut at depths below about 500 feet. This tendency caused increasingly difficult and abortively slower drilling with depth, resulting in the loss of one core barrel, and tens of feet of rods in the Stage 1 holes. Several holes in Stage 1 were terminated because drilling progress became too slow and difficult to be economically sensible to continue. In contrast to this feature of holes drilled in the rock in and around the coal measure, holes drilled wholly or mostly in coal do not squeeze shut. This is a function of the apparent greater competence of the coal than of the very poorly indurated rock, much of which is poorly compacted, uncemented clay, silt or sand. (As an example; at the time of writing this report, drill hole No. 37A,

almost entirely in coal, is drilling easily at a depth of 2000 feet.) In any case, several short holes were added to the program as footage was gained from terminated holes.

GEOPHYSICAL SURVEYS - As the Stage 1 program progressed it became evident that the coal measure is dislocated by major faults. The search for the displaced portions of the coal measure, beneath deep overburden, would be inordinately costly and difficult if done solely by means of probing by diamond drill holes. For this reason it was decided to experiment with all available methods of surface indirect sensing in order to find some means that might detect coal through thick overburden. No such detection method is known in the industry; however, the unusually great mass of coal that comprises the body of the Hat Creek deposit is geologically unique. Its vast bulk, one half a square mile in area and over 1000 feet in depth, with physical and chemical characteristics that are very different from the surrounding rocks, would hopefully respond anomalously to some form of remote sensing. On this assumption, the following methods were tried at Hat Creek during Stage 1:

(a) Airborne - Heat sensing
- Infra-red photography

(b) Ground surveys - Resistivity
- Gravity
- Electro-magnetic
- Magnetic

All of the above test surveys were made across the centre of the known coal deposit where it is most thoroughly drilled, 1959 Section 2. Only two of the methods returned possibly anomalous results; the airborne heat sensing registered a slight anomaly at the west contact of the coal; however, it is difficult to resolve the anomaly with certainty and the cost of the survey is very high. The ground magnetometer survey registered a slight but distinct anomaly over the coal, at low cost, and it was therefore decided to survey the entire deposit with this method.

The magnetometer survey of the known coal deposit indicated a reasonably close reflection of the shape of the deposit as a relatively uniform magnetic low over the coal. This anomaly also shows an apparent truncation to the south, where a major cross fault had been suspected from the drilling. With this encouragement, the magnetometer survey was extended one mile to the south and one half a mile to the north of the drilled deposit. No significant (low) anomaly was detected to the north; however, a major anomalous area was detected to the south, but 3000 feet west of what would be the southern extension of the coal deposit. Prospecting in this area revealed signs of coal in the overburden and a subsequent trench, 40 feet in length, has been dug a few feet to bedrock

and is entirely in coal. It now remains to test the significance of the magnetometer apparent anomaly to determine whether or not it reflects a major body of coal in this new area. The magnitude of the magnetometer anomaly over known coal is slight, only 50 to 100 gammas; however, this small increment may just represent the different heavy mineral content between the coal, which is essentially devoid of magnetite, and the enclosing sedimentary rocks. However, it must be appreciated that some other stratigraphic sequence, rather than a mass of coal such as at No. 1 Openpit, could well return a similar magnetic response. All that can be assumed with certainty is that such a magnetic response may reflect a mass of coal beneath the overburden.

If the magnetometer apparent anomalies prove to be spurious, the airborne heat sensing data should be reconsidered, since it did suggest some positive response.

DRILL HOLE GEOPHYSICAL MONITORING: Portions of five of the Stage 1 diamond drill holes have been monitored by down-the-hole geophysical instruments. This method clearly differentiates between coal and waste; however, at Hat Creek, where the core recovery is close to 100 percent, this is no advantage. A study of the initial results do suggest that the geophysical logging may greatly assist in the correlation of the coal seams within the deposit by positively identifying unique electrochemical characteristics of an otherwise featureless mass of coal.

A major hindrance to the geophysical monitoring of diamond drill holes at Hat Creek is the tendency of the holes to squeeze and cave once the drill rods are pulled, especially where the holes intersect significant thicknesses of siltstone or sandstone. None of the holes monitored in Stage 1 could be probed to its full depth. This means that if geophysical hole logging is desired at Hat Creek it requires the stand-by attendance on a drill project of a logging truck and operator, at a cost of approximately $13,000.00 per month. The current assessment of the logging done to date will determine the efficacy of such monitoring at Hat Creek.

GEOLOGICAL MAPPING: Geological mapping of the valley of Upper Hat Creek was begun with Stage 1 and continued until stopped by snow. Although bedrock outcrops are sparse in the valley they are more numerous around the rim and the gross structural picture of the basin has been developed and is represented in the geological map of the valley included in this report as Figure 3.

An enlargement of an earth satellite sub-infrared photograph of the Hat Creek area has been obtained and has proven useful in detecting major faults in and around the Hat Creek basin. Two of these faults, the Medicine Creek and the West Boundary, (See Fig. 1), have been confirmed by field mapping and two, the Dry Lake and the Finney, have been inferred by drilling and the magnetometer surveys.

RESULTS OF STAGE 1:

GEOLOGY: The core drilling, mapping and magnetometer surveying completed in Stage 1 have indicated the presence of major block faults around and within the coal-bearing Tertiary basin of Upper Hat Creek. The basin itself has apparently been dislocated into blocks by cross faults which may or may not terminate to the west on a fault, the West Boundary, that forms the west and north sides of the Tertiary basin and appears to be a major branch of the Fraser Fault Zone to the southwest. The known and inferred cross faults at the north end of the valley are, (See Figure 1):

(i) Dry Lake Fault - This appears to be a branch of the West Boundary fault. Its presence is inferred from the ERTS photo and from the drill results which indicate an abrupt termination of the coal measure at 12,000 N, with entirely different strata occurring to the north.

(ii) Finney Fault - This major cross fault is inferred from the ERTS photo, the magnetometer survey and the drill results. On section 7000 N the coal measure is more than 2500 feet in stratigraphic thickness, but at 4500 N it has disappeared (on strike).

(iii) Medicine Creek Fault - This cross fault is about one mile south of the Finney Fault and has been mapped on the east side of the valley and is prominent on the ERTS photo.

It is also evident from the drilling and the magnetometer survey that major, steeply-dipping north to northeast-trending faults occur within the known coal deposit, No. 1 Openpit. One such fault, the Mag, has been precisely located by drilling and the magnetometer survey; it strikes northwestward and dips steeply eastward. This fault evidently cuts off the coal measure to the east in what appears to be a normal dip-slip displacement.

There is evidence that the coal measure is tightly folded at the north end of No. 1 Openpit near the junction of the Dry Lake and the Mag faults, however, there is no evidence of such folding elsewhere in the area, since bedding attitudes in all of the drill core are particularly uniform in each hole and generally uniform in all holes.

At this time it appears that deformation of the coal measure has been principally by block and normal faulting. Although folding and thrust faulting do not appear from present evidence to be significant, the dislocation by normal faults may be complex.

It is now apparent that the simple stratigraphic structure assumed from the 1957-59 data does not apply. Faulting has so dislocated the strata into slices and blocks that the stratigraphic sequence of the coal measure, as well as the overlying and underlying beds, cannot be determined without additional drilling. The top of the coal measure is apparently marked by a conglomerate bed that contains coal fragments. The bottom of the coal measure has not been determined.

Within the 1957-59 coal measure it appears now that Seams 2 and 3 are one massive coal bed about 1600 feet in stratigraphic thickness whose top is very dirty coal and whose bottom is very clean. This great mass of coal has been correlated visually from hole to hole and tentatively by the geophysical logging; it strikes northward and dips westward, but probably not as steeply as hitherto assumed. Seams 4 and 5 appear to be discontinuous and may represent upper parts of the Seam 2-3 mass. Seam 1 appears east of Seam 2 and was assumed to lie stratigraphically below it; however, deep drilling in Stage 1 reveals that it does not continue down below Seam 2 to the west. The answer to this problem is not yet known but dislocation by faulting appears to be the most likely. A new bed of coal, Seam 0, was found in the Stage 1 drilling to lie east of (beneath) Seam 1; however, only one hole is in this coal and its relation to the other coal seams can only be surmised at this time.

Earlier it had been assumed that the coal seams dipped very steeply down to the west and were therefore too deep to mine in that direction. There is some evidence now that the seams may dip or be faulted back up to the surface west of No. 1 Openpit but south of Dry Lake Fault, (Fig. 1).

Additional drilling is required in the vicinity of No. 1 Openpit to determine the stratigraphy of the coal measure and the enclosing strata.

COAL RESERVES: The reserves of No. 1 Openpit are being recalculated. It is evident from the drilling that some coal will be lost from the reserve at the extreme north end of the pit area, (11,500 N), where the coal is not as deep as earlier assumed. There will also be some loss of No. 1 Seam at depth along the east side of the pit; however, this loss will probably be made up by the addition of the hitherto unknown No. 0 Seam.

A very major addition to the reserves exists to the south, between 7500 N and 6500 N (Finney Fault?), where the Stage 1 hole No. 37A has intersected over 1600 feet of coal. This additional tonnage will probably result in a net increase of the 1957-59 pit reserves by possibly as much as 20 percent.

The possibility of a faulted extension of the No. 1 Openpit coal deposit occurring in the block between the Finney and the Medicine Creek

is being explored; however, the results of the initial drilling, (completed since the first draft of this report), indicate that the large mass of coal, as in No. 1 Openpit, does not underlie the magnetometer anomaly. The geological mapping, (Fig. 3), suggests that the displacement of the block between the Finney and the Medicine Creek faults has been very major, in a right lateral and/or down direction; whereas, the bedrock south of the Medicine Creek Fault appears to be in the same relative position as that north of the Finney Fault.

The coal potential south of Medicine Creek is unknown. It should be appreciated that block faulting may have caused major displacements of the coal measure; therefore, the potential southward in the valley must be determined by progressive exploration from the north, using geological deductions and the magnetometer results as an auxilary assist.

BUDGET:

Stage 1 was completed overall below budget. The funds estimated originally for the rotary drilling were allocated to the geophysical surveys and only partly consumed. Overruns in other items were small and easily made up by underruns in many items and by the contingency fund.

A good deal of the money charged to Stage 1 was actually expenditure that would better be charged to Stage 2, i.e., winter camp, additional drilling etc. Actually, approximately 8000 feet of drilling, mostly west of No. 1 Openpit, have been completed by the Contractor as an overrun of the Stage 1 contract, and this amount has therefore been deducted from the Stage 2 proposal.

PART II

RECOMMENDED EXPLORATION PROGRAM

STAGE II

Hat Creek Coal

PART II

RECOMMENDED EXPLORATION, STAGE 2

Stage 1 drill program determined the general limits of the No. 1 Openpit coal deposit; however, it did not fully explore all possible repetitions of the coal deposit to the east and to the west, nor did it succeed in determining the stratigraphy of the coal measure. Also, the possible displaced portions of the coal deposit to the north and south have not been located. Thus, the complete assessment of the total coal resource of the north end of the valley requires additional exploration, the bulk of which must be by drilling.

Stage 2, the next phase of exploration of the coal deposits of the Upper Hat Creek valley, is designed to achieve the following objectives:

(i) Determine whether any other major openpit coal deposits occur anywhere in the valley south of No. 1 Openpit. This determination would be made on a reconnaissance basis to probe likely locations in the valley.

(ii) Determine the general limits of the western coal extensions from No. 1 Openpit.

(iii) Locate the displaced portion of the No. 1 Openpit deposit to the south, if it exists near the surface.

(iv) Probe for a possible displaced northern portion of the known deposit, although interest in this area is diminished by the deep overburden and restricted mining space there.

The principal targets for this Stage 2 exploration are described below, progressing outward from the No. 1 Openpit known coal.

POTENTIAL COAL AREAS: (Figure 1)

(1) No. 1 Openpit: The nature of the western repetition or continuation of the coal measure that forms the No. 1 Openpit deposit has not been determined. It is possible that the coal seams have been faulted back up to, or near to, the surface to the west, south of the Dry Lake Fault. Four vertical drill holes and one dipping hole, each 1500 feet in depth, are recommended to explore in this area. Three have been completed under the Stage 1 contract.

The continuity of No. 1 and 0 seams at depth along the Mag Fault has not been resolved. Contingent with this is the location of a possible faulted section of the coal measure to the east of the Mag Fault. One rotary drill hole is recommended to attempt to shed light on this problem and an additional deep hole may be useful in this area.

(2) Northern extension: There is a possible coal potential in the segment of Tertiary strata lying between the inferred West Boundary and Dry Lake faults. Stage 1 drilling has not enhanced this potential, therefore only two vertical holes are recommended to complete the reconnaissance exploration of this fault block. These are suggested to be done at this time only if no other more encouraging target areas are discovered to the south.

Also, there is a suggestion of the continuation of the coal measure at the extreme north end of the valley on the east side of the Dry Lake Fault. However, the great depth of overburden, (200 - 400 feet), and the close proximity of the Indian Reservation, suggest that a coal deposit in this area would definitely be of secondary economic importance to the No. 1 Openpit deposit. One deep exploratory hole has been recommended to probe this area, to be drilled if no other encouraging targets are found south in the valley.

(3) Possible Finney Creek Deposit: As shown in Figure 1, the magnetometer survey suggests the possible existence about one mile southwest of No. 1 Openpit of a coal deposit as large as that at No. 1 Openpit. Additional encouragement for this possibility has been introduced by the exposure of coal in two backhoe trenches on Finney Creek, one 40 feet in length. Certainly, the displaced portion of the No. 1 Openpit south of the inferred Finney fault should occur somewhere in the valley, provided of course that it has not been displaced upward and has thus been eroded away, (In such a case, the down-dip extension of the coal measure may still be available for mining.). This search for the displaced portion of the coal measure is encouraged by the fact that at 7000 N it is comprised of over 2000 stratigraphic feet of uninterrupted coal, dipping west and striking southward, and it is geologically unlikely that such a stratigraphic section pinches out within 2000 feet of strike length.

Accordingly, a fair portion of the Stage 2 drilling has been assigned to exploring for the possible displaced coal measure south of Finney Creek Fault. Five widely-spaced vertical diamond drill holes and two rotary holes have been suggested to test this area. Tentative locations for these holes are shown on Figure 1; however, it should be appreciated that these locations could be shifted extensively as data from the initial holes are obtained. Four of the diamond drill holes will have been completed by December 1, 1974.

If no encouragement is found in the Finney Creek area it will indicate that although the magnetometer anomalies may reflect the presence of coal, they may also reflect other non-coal rocks; therefore, the magnetometer results can only be viewed as a partial aid in the coal search.

(4) Upper Hat Creek Valley, South of Finney Creek: As shown in Figure 3, there is a length of about 14 miles of overburden-covered valley south of Finney Creek in which coal deposits could occur, since the valley is apparently entirely underlain by coal-bearing Tertiary formations. The only known comprehensive methods to explore this valley are by grid drilling or by stripping, neither of which is considered to be practical at this time; therefore, a reconnaissance program is recommended as a first pass down the valley. The recommended program is made up of the following components:

(i) Reconnaissance magnetometer traverses

The valley is being surveyed by ground magnetometer traverses spaced at 1000-foot intervals down the length of the valley south from Finney Creek. Each traverse is crossing the full width of the valley floor and lower terraces. If possible anomalous magnetic responses are encountered closer-spaced lines will be run for confirmation.

(ii) Drilling

Initially, reconnaissance diamond drill holes will probe the anomalous magnetometer areas, as well as the geologically promising targets areas, as disclosed by the mapping and the ERTS photo. Fourteen diamond drill holes have been assigned to this part of the program; this number includes some northern holes shifted to the south.

If the test rotary drilling included in the beginning of Stage 2 is successful, this method would be recommended for exploration to the south as well.

METHODS OF EXPLORATION; STAGE 2:

(i) DIAMOND DRILLING: As described above, a total of 24 exploratory diamond drill holes have been recommended for Stage 2. All but two of the holes will be vertical and each will be approximately 1500 feet in depth (if possible). The total footage for Stage 2 is thus 36,000 feet; however, approximately 9000 feet of this, mostly west of No. 1 Openpit, will have been completed under the Stage 1 contract.

The location of the diamond drill holes is contingent on the geological mapping and the results of the magnetometer survey; however, as shown on Figures 1 and 3, 5 holes have been tentatively assigned to the Finney Creek area, 5 holes to the area west of No. 1 Openpit and 14 holes to the area south of Finney Creek. Some drilling north of No. 1 Openpit would be geologically useful and could be done either under Stage 2 or Stage 3.

The principal advantage in the use of diamond drilling at Hat Creek at this time, versus rotary drilling, is that the core provides the best geological data for determining the complexities of the structural geology of the Tertiary strata.

(ii) ROTARY DRILLING: If it becomes necessary to grid-drill the valley to find coal, that is if no guidance is obtained from geology or geophysics, it will be desireable to use the fastest and least expensive reliable method possible. This would appear to be reverse circulation rotary drilling, where reliable cuttings are obtained and the hole can be checked by geophysical logging.

In order to determine the performance and cost of rotary drilling under Hat Creek conditions, a test program of four holes, R1 to R4, has been included in Stage 2, to be completed by Christmas. If the test program is successful, this method will be introduced on a larger scale into the program in the new year.

(iii) GEOPHYSICAL LOGGING OF HOLES: It has been found during Stage 1 drilling that because all of the drill holes tend to cave shut within hours following completion of drilling, it is necessary to have a geophysical logging unit standing by on site in order to log holes as quickly as possible. The stand-by charge for the total geophysical unit is approximately $13,000.00 per month, for a total charge of $52,000.00 for four months.

This amount has been included in the budget; however, it is recommended that this geophysical logging be carefully assessed during the initial phase of the program to determine its real worth for a reconnaissance exploration program such as Stage 2 and that its use be reduced if its benefits prove to be limited.

It should be appreciated that because core recovery is close to 100 percent, the only use at Hat Creek for geophysical logging of the holes is for geological correlation. Because the holes squeeze shut it is not recommended that the entire drill exploration at this stage be that of rotary holes with geophysical logging. Under such circumstances it is quite likely that some holes would cave, with or without a geophysical probe in them, and the only record of the hole would be cuttings. At least with core drilling the geological structures are determined and coal is obtained for analysis.

(iv) GROUND GEOPHYSICAL SURVEYS: The drilling at Finney Creek may or may not confirm the dependability of the magnetometer (low) anomaly as an indicator of coal in this area; in any case, it is the only ready tool presently available that seems to offer some guidance for the drilling; therefore, a reconnaissance magnetometer survey of the entire valley of Upper Hat Creek south of Finney Creek has been included as the initial part of Stage 2.

(v) TRENCHING & PROSPECTING: In view of the apparent shallow overburden cover in the Finney Creek area it would be most sensible to provide additional structural data, and possible coal samples, by bulldozer trenching. With shallow overburden this would not desecrate the landscape to the major extent as it would at No. 1 Openpit. Reclamation permits will be explored for this purpose and the cost of trenching is included in the budget.

Surface mapping and coal prospecting of the valley will continue as long as weather permits.

BUDGET

The preliminary estimate for the cost of Stage 2 is given in Table 2. The drilling costs have been determined from the best bid submitted, both for diamond and rotary drilling.

It is estimated that the Stage 2 program of 36,000 feet will take approximately 6 months, including the Christmas layoffs. This is estimated from the present rate of 7000 feet per month, with the possible disadvantage of winter drilling but with the definite advantage of vertical holes only.

The total budget for Stage 2 is estimated to be $893,500.00. Major primary increases in the budget from Stage 1 are in geophysical logging of drill holes and in drilling. The increase in drilling costs is a result of winter drilling, which requires haulage of drill water by truck, and of a recent union settlement that increased total drilling costs by approximately 8 percent.

BASIS OF ESTIMATES

The salient features of the principal budget items are:

(1) Diamond drilling - The lowest bid received is $12.87/ft. The charge for field cost items such as reaming, cementing, mud etc., which cannot be estimated precisely, have been running approximately $2.00 per foot to date; thus an overall drilling cost of $15.00/ft. has been budgeted.

(2) Rotary drilling - The rotary drilling Contractor has estimated that he will complete the 6 test holes in 24 days, working 24 hours per day. His charges total approximately $56 per hour and $3.00 per foot, for a total cost of $50,000. To this is added $5,000 for mobilization and demobilization and $5000 for sundry supplies and contingencies. Thus, if this rate can be attained and the holes completed the cost per foot for the test program will be $10.00, to which $2/ft. should be added for geophysical logging.

(3) Road building - Access to sites throughout the valley will probably require local road building and site reclamation.

(4) Analyses - Only proximate analyses are planned for this reconnaissance drilling. An estimate of 30 percent of the drilling being in coal is considered to be high.

(5) Geophysical logging - Standard monthly charge by Roke.

(6) Geophysical surveys - Lowest bid.

(7) Trenching - Possibly will not be used.

(8) Camp maintenance - Board for 3 men for 6 months is approx. $7000. Plus share of electricity, telephone etc.

(12) Salaries - One senior geological engineer, J. Rotzien, for 6 months, one other, M. de Quadros, for 3 months, and one helper for 5 months. Salaries plus 15% for U.I.C. etc.

(14) Administration - Includes accounting, stenography, office rental, stationery, management time of principal engineers and profit.

(15) Contingencies - At the completion of Stage 1 the contingency item was not used. It is doubtful if it will be in Stage 2; however, possible additional rotary and/or diamond drilling could be accommodated here.

(16) Engineering & supervision - Includes field management, report writing and data compilation by P. J. Street for 6 months and J. F. McIntyre for approximately 3 months. Both men have extensive sedimentary geology and coal experience.

(17) Consulting and reports - The time of the principals of Dolmage Campbell and Associates Ltd. spent in final report writing, meetings, etc.

TABLE 2

BUDGET ESTIMATE

STAGE 2

Hat Creek Coal Exploration

(1) DIAMOND DRILLING 36,000 ft. @ $15 per	$ 540,000.00
(2) ROTARY DRILLING 6,000 ft. (test) @ $10 per	60,000.00
(3) SITE PREPARATION & ROAD BUILDING	5,000.00
(4) COAL ANALYSES Estimate 10,000 ft. of coal @ 20 ft./sample @ $32 per	16,000.00
(5) GEOPHYSICAL LOGGING OF HOLES 4 months @ $13,000.00 per	52,000.00
(6) GEOPHYSICAL AND TOPO SURVEYS Magnetometer etc.	15,000.00
(7) TRENCHING	5,000.00
(8) CAMP MAINTENANCE Board @ $12.60/man/day, heating etc. (6 months)	8,000.00
(9) FIELD OFFICE & EQUIPMENT RENTALS Trailer rental @ $524/mon., etc.	5,000.00
(10) TRANSPORTATION & FREIGHT Vehicle rentals, core shipment etc.	7,500.00
(11) TRAVEL & COMMUNICATION	2,500.00
(12) SALARIES Field staff (2 geologists, 1 part time helper)	19,000.00
(13) SUNDRIES	1,000.00
	$ 736,000.00
(14) MANAGEMENT, ACCOUNTING & ADMIN. 8% (approx.)	59,000.00
	$ 795,000.00
(15) CONTINGENCIES (8%) approx.	63,500.00
	$ 858,500.00
(16) ENGINEERING & SUPERVISION	27,000.00
(17) CONSULTING & REPORTS	8,000.00
	$ 893,500.00

PART III

STAGE 3

RECOMMENDED DRILLING OF NO. 1 OPENPIT

Hat Creek Coal

PART III

DRILLING OF NO. 1 OPENPIT

It is evident from the Stage 1 drill results that considerable fill-in drilling is required in the No. 1 Openpit area to (1) properly define pit design, (2) correlate geological structures, (3) permit recalculation of reserves, (4) provide comprehensive coal analyses, and (5) provide test coal samples.

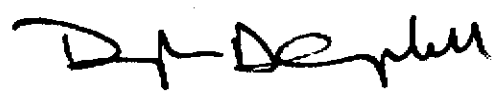
As described earlier in this report, the amount of coal reserve in No. 1 Openpit has been probably appreciably increased by Stage 1 drilling; however, the distribution of the reserves by "seams" or structures is not clearly understood. Thus additional drilling is required particularly at the south end of the block and along the east side.

The amount of this drilling is presently being assessed but it appears that approximately 20,000 feet of additional drilling will be required as a minimum program to serve all purposes. The total cost of such a program would be in the range of $500,000.00, depending on how much geophysical logging etc. would be done.

It is recommended that if possible this program be deferred until the results of Stage 2 are obtained. It is possible that the Finney Creek or other areas to the south may contain a more economic coal deposit than the No. 1 Openpit body, with less overburden and in a more suitable location; therefore, the Stage 3 drill program would more sensibly be done on such a deposit, with the follow-up definitive drilling of No. 1 Openpit being deferred until such time as that coal is required.

Respectfully submitted,

DOLMAGE CAMPBELL & ASSOCIATES LTD.



Douglas D. Campbell, P.Eng., PhD.

SCALE 1" = 800'

0 800 1600 2400 FEET

LEGEND

- OVERBURDEN
- CACHE CREEK GROUP (PRE-TERTIARY) MARBLE CANYON LIMESTONE

TERTIARY COAL

- COAL OUTCROP
- NO. 1 OPENPIT RESERVES
- OUTLINE OF DRILLED COAL

STRUCTURE

- KNOWN FAULT
- INFERRED FAULT
- 40 BEDDING ATTITUDE

DRILLING

- PRE-1974 DRILL HOLES
- 1974 STAGE 1 DRILL HOLES
- PROPOSED STAGE 2 DIAMOND DRILLING
- R1 PROPOSED STAGE 2 ROTARY DRILLING
- COMPLETED STAGE 2 HOLES

GEOPHYSICS

- AREA OF MAGNETIC LOW

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(1)

DOLMAGE CAMPBELL & ASSOCIATES LTD. CONSULTANTS
VANCOUVER, CANADA

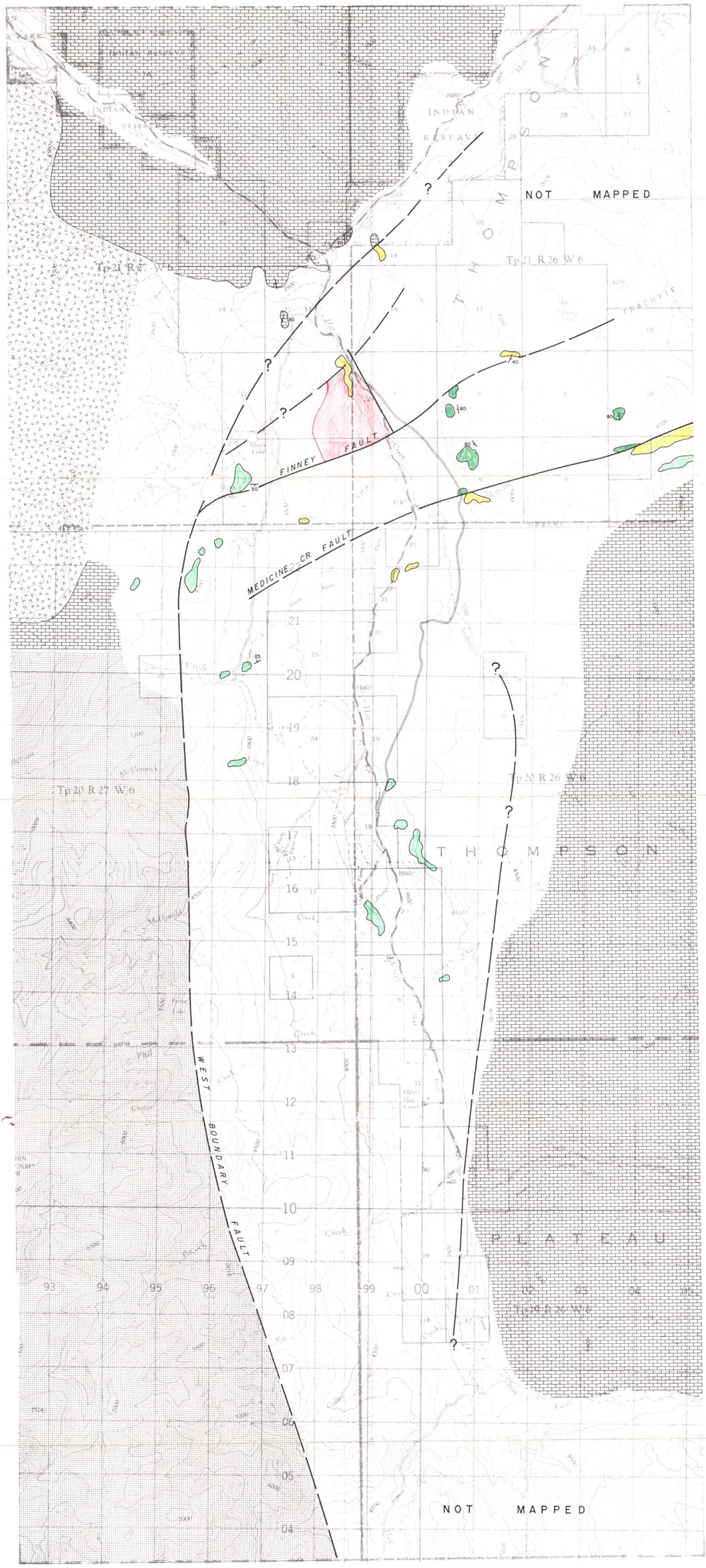
B.C. HYDRO & POWER AUTHORITY
VANCOUVER, CANADA

HAT CREEK PROJECT

STAGE 2 PROPOSAL
1974 EXPLORATION PROGRAM

SCALE 1" = 800' | NOV. 19/74 | FIG. 1

DWG. 0



RECENT
- OVERBURDEN – Includes Recent (?) or Late Tertiary (?) Volcanic rubble.

TERTIARY
- VOLCANICS – Basalts & agglomerates. Evidently overlie sedimentary strata unconformably.
- SEDIMENTARY ROCKS – Poorly indurated siltstone, sandstone, congl. & coal.

CRETACEOUS
- SPENCES BRIDGE GROUP – Volcanics.
- MT. LYTTON BATHOLITH – Granodiorite - diorite

PERMIAN (?)
- CACHE CREEK GROUP – Greenstone and metasediments.
- CACHE CREEK GROUP – Marble Canyon limestone.
- AREA UNDERLAIN BY COAL.

STRUCTURE
- 80 — Attitude of bedding.
- Fault
- Inferred fault.

HC 74148

GEOLOGY

UPPER HAT CREEK VALLEY

DOLMAGE CAMPBELL & ASSOCIATES LTD.

1974

P/C ②

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