July 7th, 1954

Mr. L. J. Lichty,
Quebec Metallurgical Industries Ltd.,
602-88 Metcalfe Street,
Ottawa, Ont.

Dear Mr. Lichty:

The accompanying report "Winter Drilling - Bugaboo Placers" is mainly a progress report. The reconnaissance churn-drilling program carried out during February, March and April, 1954, covered less than a tenth of the potential placer area, but the information gained has been and will be further used to re-evaluate the total potential of the Bugaboo Placers.

The total potential estimate in the Oct. 6th, 1953 preliminary report was 140 million yards at 60¢/yd (.2 Nb_2O_5/yd). This has now been reduced to 65 million yards averaging 45¢/yd (.15 lb. Nb_2O_5/yd), mainly because the drilling showed the existence of a significant proportion of very low grade granite alluvium in an area where all granite alluvium was expected to give economic recovery. All estimates have been based on panning recovery, and will have to be revised upward if present work by Ottawa Research Laboratories on fines recovery and crushing recovery is successful.

Dredging ground indicated by drilling on BB7 lease is 14 million yards with average panning recovery of .19 lb. Nb_2O_5/yd; of this, 4.3 million yards at .18 lb. Nb_2O_5/yd has been classed as "reasonably assured" and the rest as "indicated". The narrow portion of the valley at the upper end of BB7-8-9 lease area is considered to have an additional 3½ million yards at .2 lb. Nb_2O_5/yd, classed as "inferred."

The table of indicated and potential placer reserves below is based on the following assumptions:

Total value of products in black sand concentrate equivalent to .....$3.00/lb Nb_2O_5

Dredging cost ..... 20¢/yd.

Area	Class of Reserve	Volume Millions Cu.Yds.	Panning Recovery lb. Nb_2O_5/yd	Value	Profit millions dollars	Production millions lbs. Nb_2O_5
BB7 lease	Indicated	14	.19	57¢/yd	5	2.7
All Bugaboo Placers	Potential	65	.15	45¢/yd	16	10

Since values and costs are large undetermined, the profit figures above have no real meaning in the sense of "operating" or "net" profit. For the present it can be called "potential profit" without further definition.

Mr. L. J. Lichty - contd. July 7th, 1954

The missing data on cost and value are listed below. It would be of great assistance to know which of these will be investigated by Q.M.I. and which by St. Eugene Mining Corp.

1. Dredging Cost - to produce black sand concentrate (winter drilling experience indicates year round operation should be considered.)
2. Value of products in black sand concentrate.
3. Degree of separation necessary or desirable before shipping.
4. Shipping points and costs for various products.
5. Metallurgical treatment costs or penalties.
6. Economic possibility of mining granite (no results as yet on samples submitted).

Q.M.I. has requested a 1000 lb. bulk sample of placer concentrates for further testing. It is hoped that this work will cover points 2 to 5 above.

In view of lack of Data on cost and value, it is recommended that 1954 exploration be confined to that required under the Placer Mining Act. The total value required on all leases is $7,015. In addition, further prospecting is being carried out in other areas and will be continued in the general area of the leases.

If excess work on the Bugaboo Placers is decided upon, the reconnaissance drilling on BB7-8-9 leases can be completed at a cost of about $8,000., and the company drill moved down to the next placer on Vowell Creek, BB6.

Yours very truly,

Hugh D. Hughes
Geologist

HDH/EPG.

enclo.

cc. A. J. Anderson

R E P O R T

on

WINTER DRILLING

BUGABOO PLACERS

GOLDEN MINING DIVISION, BRITISH COLUMBIA

by

HUGH D. HUGHES, GEOLOGIST

Vancouver, B. C.

July 5th, 1954

R E P O R T

on

WINTER DRILLING

BUGABOO PLACERS

GOLDEN MINING DIVISION, BRITISH COLUMBIA

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Aerial Photographs.

West North

Bugaboo Granite Spires

Looking northwesterly from the southeast edge of the Bugaboo Stock

L A T E S U M M E R

Bugaboo Valley

Typical placer flat

Photos courtesy of T. P. Marston
B. C. Alpine Club.

REPORT ON WINTER DRILLING

BUGABOO PLACERS

GOLDEN MINING DIVISION, BRITISH COLUMBIA

GENERAL DESCRIPTION:

The Bugaboo placers occupy the flatter portions of three creeks flowing northeastward from the Purcell Range into the Columbia River. The source of the values is a series of granite stocks along the crest of the range. The most northwesterly of these, the Bugaboo stock, has given the name to the placers and is the source for those on Bugaboo and Vowell Creeks. To the southeast about 15 miles, the Horsethief stock supplies the values to three placer areas on Forster Creek. The White Creek stock, or batholith, another 40 miles to the southeast, carries some values, but does not supply sufficient load to the streams to provide placers. Other related stocks to the west have been investigated without success.

The Horsethief stock was partially mapped by the Geological Survey during work on the Windermere Map area (1921-24).[1] The rest of the general area has remained unsurveyed until recent work by J. E. Reesor of the Geological Survey, who has mapped the southern section including the White Creek batholith,[2] and is continuing with the mapping of all previously unmapped areas in the Purcell Range. In addition, the R.C.A.F. has re-photographed the area for topographic mapping.

1. Memoir 148, Geological Survey of Canada, Geology and Mineral Deposits of Windermere Map-area, British Columbia, by J. F. Walker, 1926.

2. Paper 53-25, Geological Survey of Canada, Preliminary Map Demar Creek, British Columbia, by J.E.Reesor, 1953.

Factors governing the deposition of potential placer ground are as follows:

1. Rapid physical weathering of granite source at altitudes over 8000 ft., plus glacial erosion.
2. Area of deposition close to source so that dilution from barren streams is small.
3. Sufficient gradient at time of deposition or reworking by stream action to provide concentration of heavy minerals.
4. Sufficient volume of deposition (area and depth).

The first and second factors have been approached indirectly during prospecting, by panning streams and noting the amount and nature of concentrates. This assumes that there is little likelihood of old buried placer of sufficient grade to warrant stripping or drift mining.

The third and fourth factors become important in staking and exploration. The drilling on BB7 lease indicates that the best gradient is greater than 0°30' but that concentration can be good on flatter gradients if deposition is slow and accompanied by continued stream action.

Factor 1, and to a lesser extent 2 & 3, differs from those generally accepted for gold placers (cf Lindgren), as would be expected considering the inferior resistance of the radioactive niobium minerals to chemical alteration and abrasion. These minerals have physical properties similar to monazite, although probably less resistant. No gradient data have been found in the literature on monazite placers.

The following table of equivalent gradients will assist comparison of gradients shown on the BB7-8-9 plan in degrees and minutes with data published in feet per mile:

0°20'	=	31 ft./mi.
0°30'	=	46 "
0°45'	=	69 "
1°	=	92 "
2°	=	184 "

The gradients on BB7-8-9 leases were estimated from apparent creek gradients and measured as closely as possible with Brunton compass. Gradients on other leases are in the same range.

The elevation of BB3-4 leases is about 2500 feet. The rest of the leases lie between 4500'± (BB2) to 5300'± (BB7-8-9). Several of the Bugaboo spires (granite) reach over 10,000' and the highest may be close to 12,000'. Corresponding elevations in the Horsethief stock around the head of Forster Creek would be 9,000' and 10,000'. The lowest granite outcrops are: Bugaboo - 5500', Horsethief - 4500', White Creek - 4000', and those to the west around Kootenay Lake - 2000'.

WINTER DRILLING PROGRAM ON BB7 LEASE:

Drilling:

A reconnaissance churn-drilling program was carried out during February, March and April, 1954. Twenty-one holes were put down averaging 50 ft. deep (total 1060 ft.) using a

Looking upstream - From SE end of air strip - Looking downstream

WINTER DRILLING

on Vowell Creek

Photos by F. T. Russell.

Fairbanks.Model 45

Churn Drill

Fairbanks Drill Co., "Sjolseth" Model 45 drill with 5" drive pipe. The drill was mounted on extra long and wide ski-skids so that it could be moved and operated on top of the snow, which averaged 5' deep after packing. Twelve five-foot lengths of drive pipe were available at the start; one length was required to penetrate the snow and one length was broken during drilling, so that 50 to 55 ft. was the maximum drilling depth. Any greater depth of drilling would have required special tools for pulling the pipe string from the bottom. The head driller, A. F. Brown, deserves credit for careful handling that allowed the program to operate with only one string of second hand drive pipe.

Sampling: The sampling technique was based on that developed by the U. S. Bureau of Mines for their reconnaissance drilling on the Idaho monazite placers.[3] The normal sample interval was five feet. Before and after pumping, the height of core in the drive pipe was measured by lowering the drill bit to the top of the core; the difference was called "core pumped" and this figure, together with the inside sectional area of the pipe, gave "core volume", the volume used in recovery calculations.

As the core was pumped, the sand pump, or bailer, was dumped into a collecting trough and much of the fines went to overflow, the remainder being caught in volume buckets. Because of winter conditions no attempt was made to settle fines from the overflow, and no sludge samples were taken.

3. United States Bureau of Mines, RMO - 908, Evaluation of Monazite Placer Deposits, by Mitchell H. Kline, April, 1952.

"Fines" has been used to include mixed silt and clay, since it is not accurately known what proportion of each is lost to overflow; about 50% of the silt and 90% of the clay would be a rough estimate. Fines overflow would probably be similar during dredging. "Clay" has been used to denote seams consisting wholly or mainly of clay.

Log Entries and Calculations:

The entries on the driller's log were made by the panner from rough notes kept by the driller showing depth of drive and pumping, character of the ground, etc; and from his own observations of bucket volume, percentages of materials in the bucket, weight of concentrate, and including sample number. Percentages of materials in the bucket were corrected for fines overflow in proportion to the ratio of bucket volume to core volume.

The log entry "plug after pumping" refers to the core left above the drive shoe after pumping. It varies from zero in hard ground, to a few inches in normal ground to prevent contamination from the outside material, to two or more feet to hold running ground. Some judgment is required to determine the actual sample interval and its true depth, but the errors are normally small and cancelling, and large errors show in the calculations; for example, if the core rises during pumping in running ground, and the driller fails to discard the surplus, then bucket volume will be anomalous and core volume and sample interval have to be adjusted.

An example of a log entry and calculation for a sin-

gle sample interval is taken from the log for hole 19, line 70:

Drive	Depth of Pipe	Total Core	Plug after Pumping	Depth of Pumping	Core Pumped	Core Volume
5'	34'	71"	2"	33'10"	69"	27 $\frac{Cu.Yd.}{1000}$

Bucket Volume	Wt. of Concentrate	Sample Number	Description of Formation
25 $\frac{Cu.Yd.}{1000}$	601 gms.	V387	55% gravel 45% sand

Calculations

$$\begin{array}{lll} \text{Depth of pipe} & 34' & \text{Total Core} \quad 71" \\ \text{- Plug after pumping} & 2" & \text{Plug after pumping} \quad 2" \\ \text{Depth of Pumping} & 33'10" & \text{Core Pumped} \quad 69" \end{array}$$

Inside diameter of drive pipe varies from 4.75" to 4.88"
Ave. " " " " " = 4.84"
X-sect, area = 18.4 sq.in.
Core Vol. per inch of core = $\frac{.395}{1000}$ cu.yds.

Core Vol. = 69" X $\frac{.395}{1000}$ cu.yd/in = $\frac{27}{1000}$ cu.yd.

Gravel = $\frac{25}{27}$ X 55% = 5 tenths

Sand = $\frac{25}{27}$ X 45% = 4 "

Fines = $\frac{2}{27}$ = $\frac{1}{10}$ "

$$\text{Recovery} = \frac{601 \text{ gms.}}{27 \frac{\text{cu.yd}}{1000}}$$

In order to weight the recovery to represent the sample interval, the above ratio is maintained but theoretical volume cut by the drive shoe is used as the base, and weight of concentrate is adjusted. Most factors for shoe volume as-

sume the effective diameter of a new drive shoe (6½"). In practice this diameter begins to decrease rapidly when the shoe is first used and more slowly as an outside taper is established. The first holes on B87 lease were driven with a badly worn shoe (5½" diameter) but this was replaced before any samples were cut. The new shoe showed slight reduction of effective diameter almost immediately, then very little change for the remainder of the drilling. As long as theoretical shoe volume is used merely as a weighting base it needs no accuracy. It will be used, however, in a discussion of results, and is frequently used in churn-drilling calculations in the literature; therefore an attempt has been made to obtain accuracy in choosing the shoe volume constant.

Ave. effective diameter of drive shoe = 6½"=

Ave. Volume cut per foot of drive = 8.0 $\frac{\text{cu.yd}}{1000}$

For the example above:

Shoe Volume for 4'10" sample interval = 39 $\frac{\text{Cu.Yd.}}{1000}$

Adj. Wt. of Concentrate = $\frac{39\ (\text{Shoe Vol.})}{27\ (\text{Core Vol.})}$ X 601 gms. = 870 gms.

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Q.M.I. Analysis on Sample No. V387 gave .72% Nb.

$$\frac{870\ \text{gms.}}{454\ \text{gms/lb.}} \times .72\%\ \text{Nb.} \times 1.43\%\ \frac{Nb_2O_5}{\%\ Nb} = 19.7\ \text{lb.}\ \frac{Nb_2O_5}{1000}$$

$$\frac{19.7\ \frac{\text{lb. } Nb_2O_5}{1000}}{39\ \frac{\text{cu.yd}}{1000}} = .50\ \text{lb. } Nb_2O_5/\text{cu.yd.}$$

Note that the grade figure would be unchanged if actual wt. of concentrate and core volume had been used, but the $\frac{\text{lb. } Nb_2O_5}{1000}$ figure would not have been weighted to the sample interval.

TO obtain average grade for a dredge section the lbs. Nb_2O_5 column is totalled and divided by the corresponding total shoe volume. These figures are not shown on the drill hole sections, but the same result can be obtained by totaling the products of grade and sample interval and dividing by the total interval.

Only the following data are shown on the drill hole section:

Core Pumped (materials in tenths)	Sample Interval	Sample Number	Grade lb. Nb_2O_5/Yd. (Panning Recovery)
5 gravel			
4 sand	4'10"	387	.50
1 fines			

If theoretical shoe volume had been used as the grade base instead of core volume (weighted to shoe volume), the above grade would be $\frac{27\ (\text{core})}{39\ (\text{shoe})} \times .50 = .35$ lb. Nb_2O_5/Yd, a decrease of 30%. The average decrease for line 70 (holes 18, 19, 20) would be 25% if shoe volume were used; i.e. average core volume = 75% of theoretical shoe volume.

Various shoe volume constants have been used in churn-drill sampling, the most common being the Radford factor, which assumes about 90% of theoretical shoe volume as the grade

basis. These factors have been developed mainly for gold placers, where contamination by fine gold from outside the hole is a common source of error. In general, the volume factor has been developed in each district and in each type of placer according to mining experience; but actual core volume obtained varies with (1) drilling technique (2) character of the ground (3) wear on the drive shoe; so that any shoe volume constant that can be developed to give a reasonably accurate average grade will still give large local errors.

The method used in these calculations should gave average results within 10% and relative local accuracy about the same. A correction factor should be developed as information and experience grow.

EVIDENCE AND CALCULATIONS FOR ESTIMATES:

As a basis for estimates the dredge area shown on the plan has been divided into areas considered more or less uniform. These areas are lettered on the plan.

Area A: In Area "A" nearly all the fill for the glacial "U" valley has come from the side streams draining barren country rocks and cutting through the lateral glacial moraine piles. On the sections this fill is called "barren side wash." The aerial photographs show a canyon cut through the terminal moraine in the vicinity of the northwest boundary of the lease area, indicating that part of the present flat was occupied by a lake for a time during retreat of the valley glacier. The bottom half to two-thirds of the valley fill is considered to be a lake deposit, including part of the "barren side wash" and

"granite alluvium below .1 lb. Nb_2O_5/yd." Toward the present surface the side wash assumes the form of low fans and the stream bed of higher grade granite alluvium has been meandering laterally and building upward.

The valley gradient is about 0°20' in Area "A".

Going downstream from Area "A" the creek flat narrows into the canyon and the creek is downcutting, hence granite alluvium will be narrow and shallow.

The area estimate for Area "A" is based on evidence on the sections, and on the ground and photographs, that the creek has moved laterally and upward leaving low swampy lakes in its wake, although other swampy lakes are caused by lack of fill by either side wash or granite alluvium. The "pay-streak" is assumed to average 350 ft. wide, and 10 ft. deep for 7000'. If it splits or becomes shallower where it widens it will be difficult to dredge; on the other hand, it may well maintain depth and grade in its wider portions to give more volume than the estimate.

Average depth and grade was calculated from drill holes 5 (line 20), 8 (line 30), and 11 (line 40), as follows:

Hole Number	Dredge Section	Grade lbs. Nb_2O_5/yd.	lbs. Area
5	10'	.153	1.53
8	9'	.190	1.71
11	10'	.116	1.16
	29'	$\frac{440}{29}$ = .15	4.40
Ave.	10' & .15 lb. Nb_2O_5/yd.		

Area B: Area "B" has only one drill hole intersection, 15, which shows a dredge section of 41 ft. with average grade .133 lb. Nb_2O_5/yd. This section does not correlate with those shown by drill holes 11 (downstream), 16 (upstream), or 14 (next hole on line 50), hence the limits of the area have been arbitrarily chosen, length 2000 ft. and average width 350 ft. It is probable that the boundaries between Areas A, B and C are gradational and that the average grades and depths in Areas B and C are closer together than is given by holes 15 and 16.

The valley gradient is about 0°30' for Areas B, C and E.

Area C: The limits for Area "C", length 1650 ft. and width 350 ft., are again arbitrarily chosen, as the only hole in the area, #16, does not correlate with adjacent holes. The average grade, .35 lb. Nb_2O_5/yd., the highest so far encountered, is probably due to concentrated stream action where Vowell Creek has been held over to the northeast side of the flat by the building of the fan from the side creek opposite. As shown on the drill line sections, the depth probably does correlate up and downstream, but farther from the edge of the flat than hole 16; in which case Area "C" will have greater depth and volume but not as high a grade.

Area D: The side creek through Area "D" heads in granite to the southwest and has built a low granite alluvium fan across the main creek flat and for about 2000 ft. downstream.

Area "D" includes only the thicker portion of this fan and roughly takes the form of half a low cone. The line 60 section can be considered as passing through the apex of the cone. The greater depth shown toward the apex has been ignored in the estimates because its area is small and because it may consist largely of wash from the side creek as it cut through the lateral moraine. Inspection of the bed of this side creek indicates that grade on surface increases slightly from hole 17 to the apex. For the estimate the area is taken as 1.1 million sq. ft., and depth and grade as shown by hole 17; 20 ft., and .18 lb. Nb_2O_5/yd.

The large area of lower grade granite alluvium that underlies part of the side fan in Area "D" and lies alongside Areas B, C and E, may be in part a lake deposit, and in any event represents a large tailings dump that has not been reworked by the main stream; probably because the side fan has kept the main stream toward the northeast edge.

Area E: Although the boundaries of Area "E" have not been accurately set, the estimate has been classed as "reasonably assured" because of the degree of uniformity shown by holes 18, 19 and 20. The length of the area is taken as 2300 ft., and the average width as 1000'. Average depth and grade were calculated as follows:

Hole Number	Dredge Section	Grade lb. Nb_2O_5/yd	lbs. area
18	49'6"	.226	11.2
19	45'0"	.148	6.7
20	48'4"	.180	8.7
	142'10"		26.6

Average 47'8" .186 lb. Nb_2O_5/yd.

Since holes 19 and 20 did not bottom and grade at the base of these holes was .14 lb. Nb_2O_5/yd, the average depth and grade assumed for the estimate are: Dredge Section 50 ft. - Grade .18 lb. Nb_2O_5/yd.

Although the area surrounding hole 21 has been considered low grade because of poor grade at surface and logs encountered before the hole was abandoned, there is still a possibility of higher grade at depth and that the logs may be very local. It was not determined whether the logs were in-situ or were part of an old log jam. In the latter choice the surrounding grade may be very good, but no allowance was made in the estimate as the driller thought he might be drilling a tree buried upright in-situ.

In general, logs are not likely to be large enough or common enough to cause serious trouble in dredging.

Area F: Area "F" has not been drilled but present assumptions are that the depth will be about the same as in Area "G" (50 ft. average), and that grade will continue to improve going upstream. The average grade used in the "indicated" estimate is .2 lb. Nb_2O_5/lb. Length is 3000 ft. and average width 1200 ft., or the full width of the flat, as indicated by downstream drilling and present spread of creek channels (best seen on aerial photographs).

The evidence for assuming no decrease in depth is that the material from the base of holes on line 70 has about the same or slightly finer size range than that near sur-

face, suggesting that the old stream had about the same or a slightly flatter gradient than the present stream. This seems reasonable because the valley fill at the upper end is in the form of a long narrow fan, building downstream, which now reaches line 70. The gradient of a fan must be greater than that of the old flat over which it builds, but not necessarily greater than that of the floor of the original glacial valley. The drilling line sections do not suggest any abrupt changes in the slope of the glacial valley floor under Area "F", but since only a few side holes reach that floor, it can be seen on the sections that the depth to the floor could be greater than is shown.

The surface gradient is about 0°45' in Area "F".

The evidence is quite strong for increasing grade going upstream from line 70. The best sample intervals on line 70, and on other drill lines, are in the coarser material, and the average size of material increases going upstream. In Area "F" this change is gradual on surface, and probably to full depth, so that the average grade could actually go as high as that in drill hole 16, .35 lb.Nb_2O_5/yd. This possibility will be considered under potential for areas F & G.

Area G: In its upper third the valley narrows considerably and along the west side the lateral moraine is missing, exposing steep bedrock and talus. Area "G" takes in the narrow flat in this portion from Area "F" to the south boundary of BB9 lease. On surface the proportion of boulders

increases rapidly across BB9 lease, and the gradient increases to about 3° at the south boundary. The average gradient for Area "G" is between 1° and 1°30'.

It is assumed that at some point in Area "G" the increase in grade with increase in size of material will reach a peak and begin to decrease as more of the potential value becomes locked in gravel and boulders. That point is unknown, but for the estimate it is assumed to be about one-third of the way from the lower end, giving an average grade similar to that for Area "F". No data is available as yet on cost of crushing vs. increased recovery.

Surface area is the only known factor for Area "G" so its estimate has a wide limit of error. The length is 7000' and average width 460'. Since the valley is narrower the depth figure has been reduced to 30' for the "inferred" estimate, and grade is taken to be .2 lb. NB_2O_5/yd, as for Area "F".

Potential for Areas F & G:

As an alternative, Areas F & G may be considered to have a potential much larger than the indicated and inferred estimates. An average depth of 60 ft., which may be a true depth even at line 70, and an average panning recovery of .3 lbs. Nb_2O_5/yd can justifiably be used to obtain a "potential" estimate for Areas F & G of 15 million yards at .3 lbs Nb_2O_5/yd plus crushing recovery.

Without considering crushing, the potential for Areas F & G is over three times the reasonably assured and indicated estimates for all other areas. The other areas have a

potential in excess of estimates but it is not large unless fines recovery can be improved. The benefit of crushing recovery would decrease downstream as material size decreases.

BB7-8-9 LEASES - VOLUME, GRADE & VALUE:

An estimate for BB7-8-9 leases based on panning recovery and lying between the two totals given on the table of estimates, would be 20 million yards averaging .2 lb. Nb_2O_5/yd., giving 4 million pounds of Nb_2O_5. In 1950 the U.S. imported about 1 million pounds Nb_2O_5 and produced about 1 thousand pounds from domestic sources.

The best concentrate that could be produced by physical means so far attempted would run 10% Nb_2O_5 or less. Subsequent treatment, recovery and cost are not known, but it is planned to send a 1000 pound bulk sample to Q.M.I. for tests.

The value, called "total equivalent value", of $3.00 per pound for Nb_2O_5, as used in the table of estimates, is based on a ratio of $\frac{Nb_2O_5}{U_3O_8} = 5$ with Nb_2O_5 at $2.00/lb. and U_3O_8 at $5.00/lb. This value was used, in conjunction with one analyzed sample as a radiometric standard, for evaluation of potential placer ground during staking. The original analysis has since been classed as unreliable and no further data is available. The value of thorium, titanium, the rare earths and zircon concentrates has not been assessed. The zircon and most of the titanium (in ilmenite and titanite) can be removed from the concentrate by careful magnetic sep-

aration, but these products include 10-20% of the radioactivity. It is not known whether such a separation is necessary or desirable before marketing.

RECOMMENDATIONS:

In view of lack of data concerning dollar value it appears best to confine 1954 exploration to development work required by the Placer Mining Act. The company owned drill is still on BB7 lease and should remain there since it is a light machine that cannot compete with larger machines in accessible areas, but is well suited to further drilling on the Vowell Creek placers, including the upper end of BB7-8-9, BB6 and BB5. There is a possibility that a larger track mounted drill will be available in the general area during the summer. Such a machine would be well suited to drilling on BB2 and BB3-4 leases which are readily accessible by road.

BB1 lease is accessible by 25 miles of "jeep road" and is a likely area for bulk sampling. Enquiry has been made regarding price and availability of the latest model portable gasoline driven concentrating table made by the Stephan Corporation of Sacramento, Calif. The description of this machine fits the requirement for producing bulk and drill sample concentrates.

Plans for minimum development work are as follows -

Lease or Group	Value Required	Proposed Work
BB1 – Part of Meade upstream Bugaboo	$ 975.	Bulk Sampling - Mapping & Surface sampling.
BB2 upstream Forster	975.	Few wide-spaced drill holes - Mapping & surface sampling.
BB3-4 Fan Forster.	1,875.	
BB5 Road work	1,140.	Trail Work - Mapping & surface sampling.
BB6 Road work	1,300.	
BB7-8-9 drilled on winter	-	Covered by Winter Drilling.
BB10-11-12 head Forster.	750.	Trail Work - Mapping & surface sampling
TOTAL	$7,015.	

If further consideration warrants, the reconnaissance drilling on BB7-8-9 leases can be continued to the southern boundary, and the drill moved to BB6 lease if desired. The remainder of the drilling on BB7-8-9 does not require winter conditions as it does not cover swamp areas. The program could be supplied by packhorse over the ridge from Bugaboo Rd., in summer and early fall. There is enough gasoline on the site to supply the drill. The cost of this program would be close to $8,000.

RE-EVALUATION OF POTENTIAL OF BUGABOO PLACERS:

The 1954 minimum development work program has been drawn up with the primary object of reviewing the potential of other lease areas in the light of results of drilling on BB7 lease. Other possibilities in the area that were not staked

will be reviewed on the same basis.

The present "potential" estimate based on BB7 panning recovery is that all other lease areas will give 30 to 60 million yards running better than .1 lb. Nb_2O_5/yd, and averaging .15 lb. Nb_2O_5/yd; giving an additional 4.5 to 9 million pounds Nb_2O_5.

The total panning recovery potential for all the Bugaboo Placers is in the neighborhood of 10 million pounds of Nb_2O_5. This figure might be doubled through improved recovery by crushing and improved fines recovery. The potential in granite is tremendous if it could be considered ore.

Vancouver, B. C.

July 5th, 1954

H. D. Hughes

Hugh D. Hughes, Geologist.

APPENDIX
BUGABOO PLACER DRILLING - BB7 - 8 - 9

TABLE OF ESTIMATES - VOLUME AND GRADE (Panning Recovery)

Area Letter (on plan)	Class of Reserve	Area in Millions Sq. Ft.	Dredge Section Depth in Feet	Volume in Millions Cu. Yds.	Average Grade lbs. Nb_2O_5/yd (panning recovery)	Average Value Assuming total value equivalent $300/lb.$Nb_2O_5$	PROFIT Assuming Dredging Cost = 20¢/yd.
A	Indicated	2.4	10	.9	.15	45¢/yd.	$0.2 million
B	Indicated	.7	40	1.0	.13	39¢/yd.	.2 "
C	Indicated	0.6	20	.4	.35	$1.05/yd.	.4 "
D	Indicated	1.1	20	.8	.18	54¢/yd	.3 "
E	Reasonably assured	2.3	50	4.3	.18	54¢/yd	1.5 "
F	Indicated	3.6	50	6.7	.20	60¢/yd	2.7 "
G	Inferred	3.2	30	3.6	.20	60¢/yd	1.4 "
BB7-8-9	Reasonably assured, Indicated & Inferred.	13.9	35' (Ave.)	17.7	.19	58¢/yd.	6.7 million
	Alternatively Areas F & G may be considered to have a more optimistic "potential".						
F & G	Potential	6.8	60	15.0	.3 Plus crushing recovery	90¢/yd. Plus crushing recovery	10 plus crushing profit
BB7-8-9	Reasonably Assured, Indicated & Potential	13.9	Ave. 44'	22.4	.25	76¢/yd	13 " " "

BUGABOO PLACER DRILLING - BB7 - LINE 10

HOLE 1

core pumped

swamp

11'

silty clay

barren
side wash

50'

slate qtz. &
cgl. pebbles
sand & clay

(panned pyrite)

58'

HOLE 2

core pumped

swamp

13'

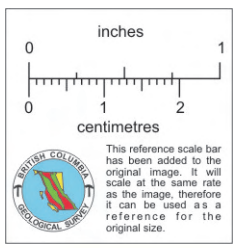
silty clay

33'6"

barren
side wash

(water pressure from lower portion of hole made small artesian spring at surface when pipe pulled)

qtz. pebbles
sand & clay



BUGABOO PLACER DRILLING - BB7 - LINE 20

HOLE 5

Core Pumped

(materials in tenths)

Sample Interval	Sample Number	Conc. & Assay lb. Nb_2O_5/yd.
5'	301	.15
5'	302	.15
5'	303	.050
5'	304	.004
5'	305	.018
5'	306	.029

Swamp

7'6"

Dredge Section 10'

1 gravel

6 sand

3 fines

37'6"

Clay

Barren side wash

53'6"

Panning recovery for 10' dredge section

= .153 lb. Nb_2O_5/yd.

HOLE 4

Core Pumped

Swamp

11'6"

slate & qtz. pebbles

sand & clay

29'6"

Barren side wash

Clay

51'2"

HOLE 3

Core Pumped

Swamp

11'

Slate, qtz., & greenstone pebbles

sand & clay

Barren side wash

(panned pyrite)

51'

Granite boulders

55'

Glacial moraine

BUGABOO PLACER DRILLING - BB7 - LINE 30

HOLE 8

Core Pumped

(materials in tenths)

Sample Interval	Sample Number	Conc. & Assay lb. Nb_2O_5/yd.
5'	312	.21
4'	313	.17
Not panned		
5'	314	.022
4' 10"	315	.030

Swamp 6'

Dredge Section { 9' 3 gravel, 5 sand, 2 fines } 15'

5 swamp, 5 clay 24'

8 sand, 2 fines 33'10"

Clay

Barren side wash

55'

Panning Recovery for 9' dredge sect.

= .190 lb. Nb_2O_5/Cu.yd.

HOLE 7

Core Pumped

(materials in tenths)

Sample Interval	Sample Number	Conc. & Assay lb. Nb_2O_5/yd.
barren side wash (from Camp Creek)		
8'	307	.005
5'	308	.020
5'	309	.003
5'	310	.003
3'	311	.034

Swamp

clay

slate pebbles 15'

2 gravel, 2 sand, 6 fines 23'

7 sand, 3 fines 28'

4 sand, 6 fines 38'

2' barren clay, 1' granite sand 41'

clay

barren side wash

54'

No Dredge Section

HOLE 6

Core Pumped

Swamp 3'

Clay, slate pebbles, qtz. sand

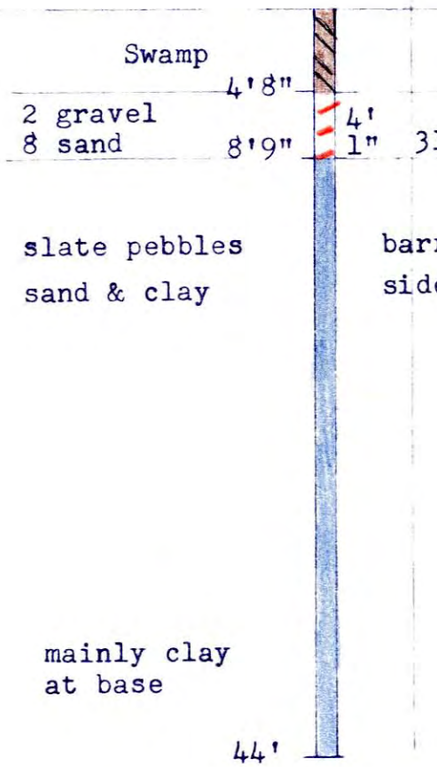
barren side wash

52'6"

No Dredge Section

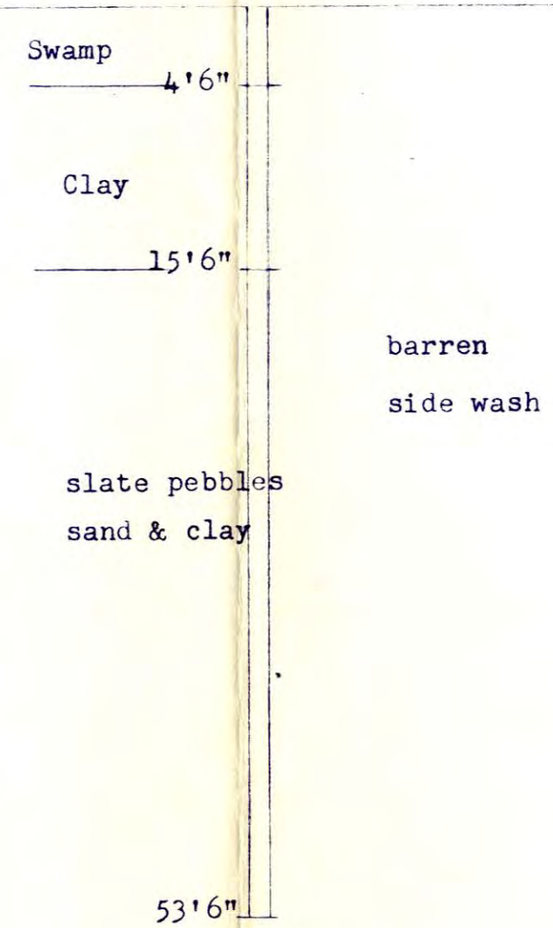
BUGABOO PLACER DRILLING - BB7 - LINE 40

HOLE 9



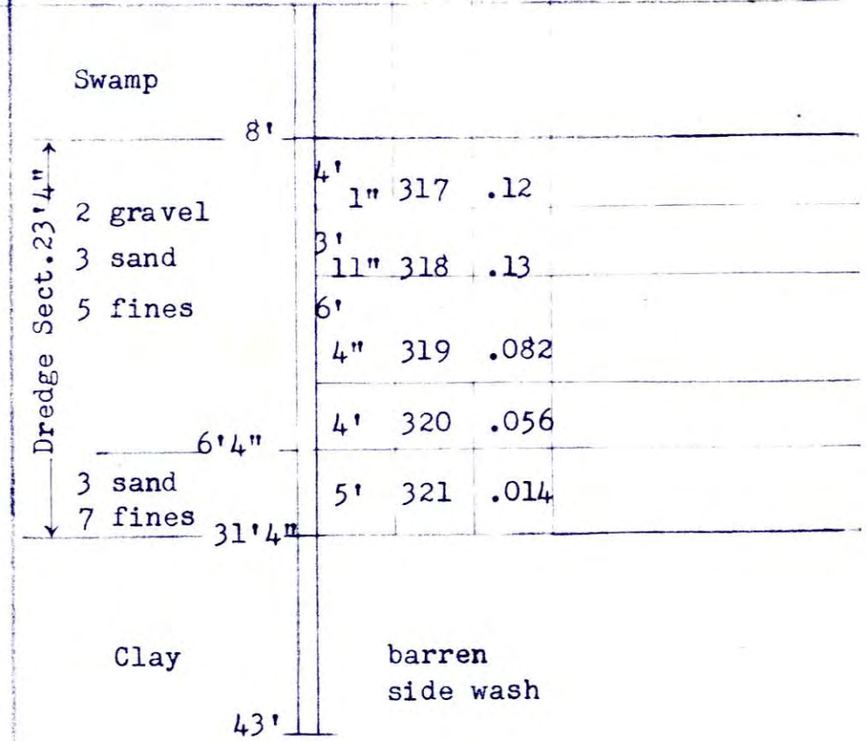
No Dredge Section

HOLE 10



No Dredge Section

HOLE 11



Panning Recovery for 23'4"

Dredge Section = .077 lb. Nb_2O_5/yd.

For top 10' Sect. = .116 lb. Nb_2O_5/yd.

BUGABOO PLACER DRILLING - BB7 - LINE 50

HOLE 15

Core Pumped (materials in tenths)	Sample Interval	Sample Number	Conc. & Assay lbs. Nb_2O_5/yd.
1 gravel 3 sand 6 fines 4'	4'	348	.078
	5'	349	.12
2 gravel 5 sand	5'	350	.11
3 fines	5'	351	.11
	5'	352	.17
	5'	353	.11
	5'	354	.13
	3' 6"	355	.15
37'6" – gravel	3' 6"	356	.24
8 sand 2 fines 47'	6'	357	.013
clay 54'	barren side wash		

Dredge Section 41'

Panning Recovery for 41' of Dredge Sect. = .133 lbs. Nb_2O_5/yd

HOLE 14

Core pumped (materials in tenths)	Sample Interval	Sample Number	Conc. & Assay lbs. Nb_2O_5/yd.
10 swamp - sand 6'			
- swamp - gravel 4 sand 6 fines 16'	5'	339	.007
	5'	340	.004
10 fines 19'6"	3' 6"	-	Tr.
- swamp 1 sand 9 fines 24'5"	4' 11"	341	.003
-g,3s,7f 27'11"	3' 6"	342	.009
1 sand 9 fines 36'	5' 7"	343	.002
1 gravel 4 sand 5 fines 42'8"	4' 8"	344	.027
	4' 6"	345	.059
4 sand 6 fines	7' 4"	346	.005
54'	4'	347	.009

Dredge Section 36'8"

Panning Recovery for 36'8" of Dredge Sect.= .014 lbs. Nb_2O_5/yd

HOLE 13

Core pumped (materials in tenths)	Sample Interval	Sample Number	Conc. & Assay lbs. Nb_2O_5/yd.
9 swamp - sand 1 fines 7'11"			
3 swamp 2 sand 5 fines 12'	5'	329	.010
	5'	330	.004
2 sand 8 fines	5'	331	.003
	2'	332	.006
	8'	333	.009
32'	5'	334	.018
1 gravel 4 sand 5 fines	5'	335	.011
	5'	336	.018
	4'	337	.032
51'	3'	338	.004
5 sand 5 fines 54'			

Dredge Section 44'

Panning Recovery for 44' Dredge Sect.= .012 lb. Nb_2O_5/yd

HOLE 12

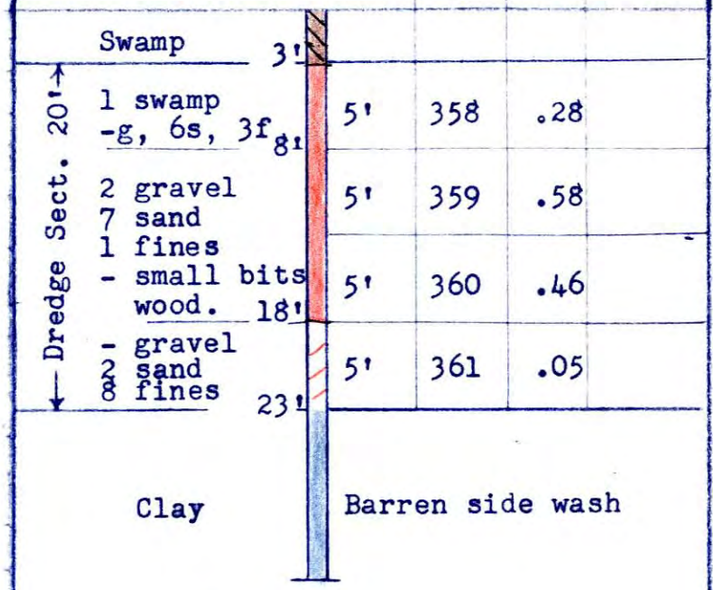
Core pumped (materials in tenths)	Sample Interval	Sample Number	Conc. & Assay lbs. Nb_2O_5/yd.
9 swamp - sand 1 fines 5'			
	3'	322	.013
	5'	323	.022
- gravel	5'	324	.010
3 sand	5'	325	.009
7 fines	4' 8"	326	.020
32'4"	4' 8"	327	.030
some thin clay seams	5'	328	.004
37'4" non-granite gravel, etc.	barren glacial moraine		
Boulders 46' at base.			

Dredge Section 27'4"

Panning Recovery for 27'4" Dredge Section = .016 lbs. Nb_2O_5/cu.yd.

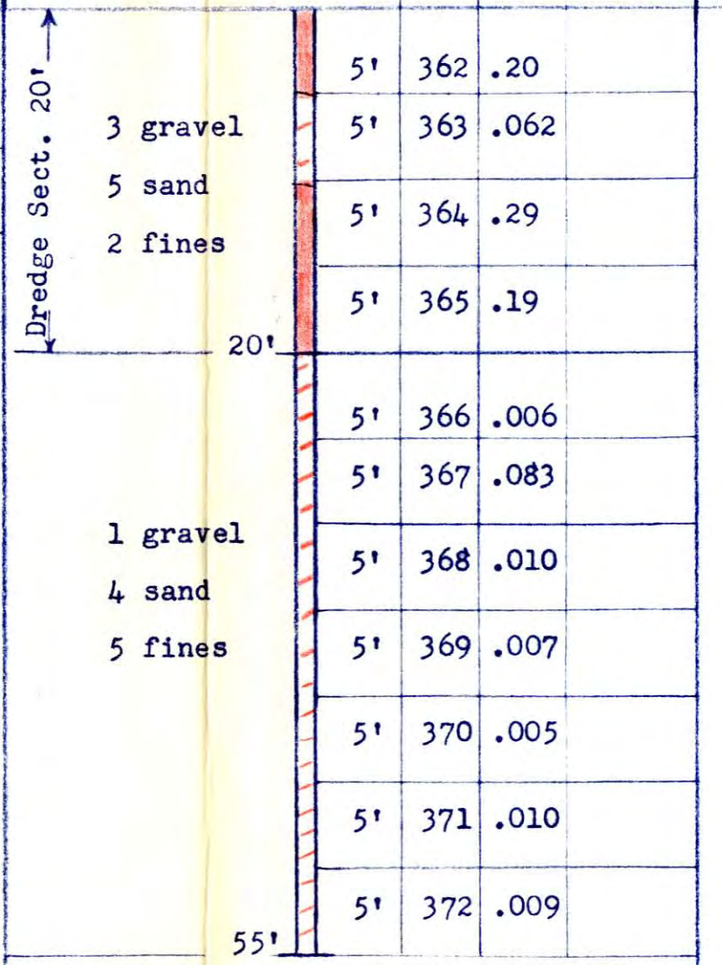
BUGABOO PLACER DRILLING - BB7 - LINE 60

HOLE 16



Panning Recovery for 20' dredge section = .346 lb. Nb_2O_5/cu.yd.

HOLE 17

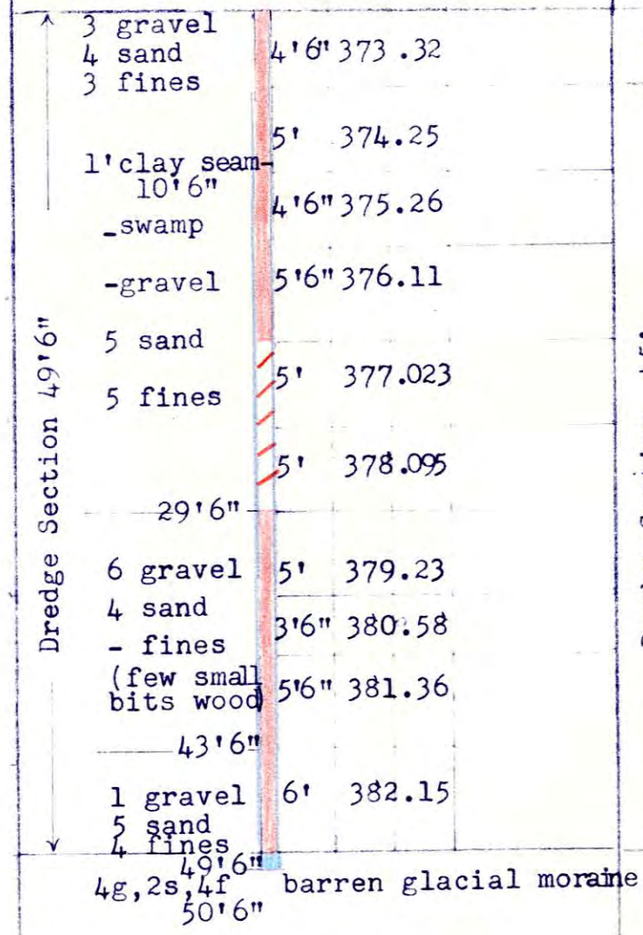


Panning Recovery for 20' dredge sect. = .185 lb. Nb_2O_5/cu.yd.

S.W. portion of side fan assumed to be of same grade as Hole 17.

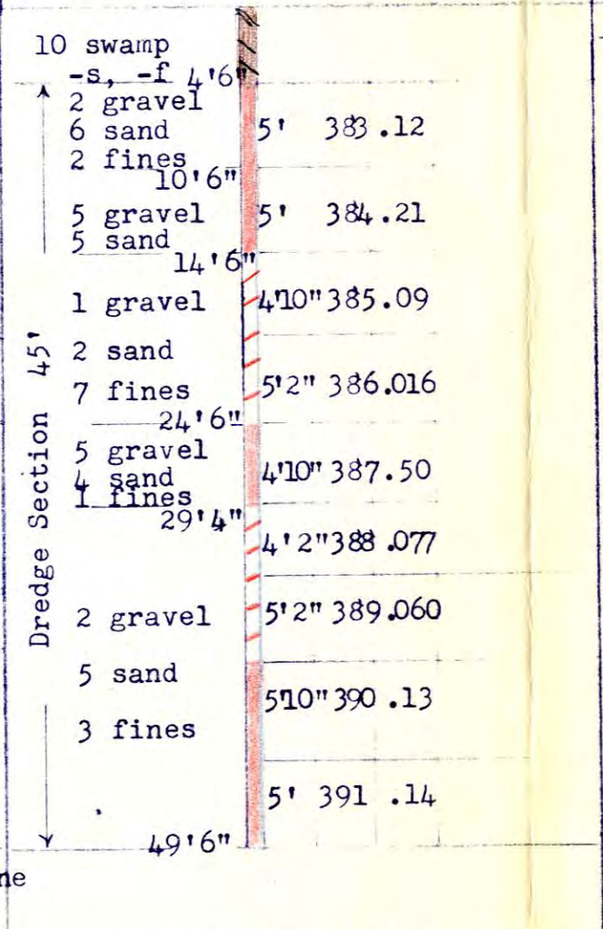
BUGABOO PLACER DRILLING - BB7 - LINE 70

HOLE 18



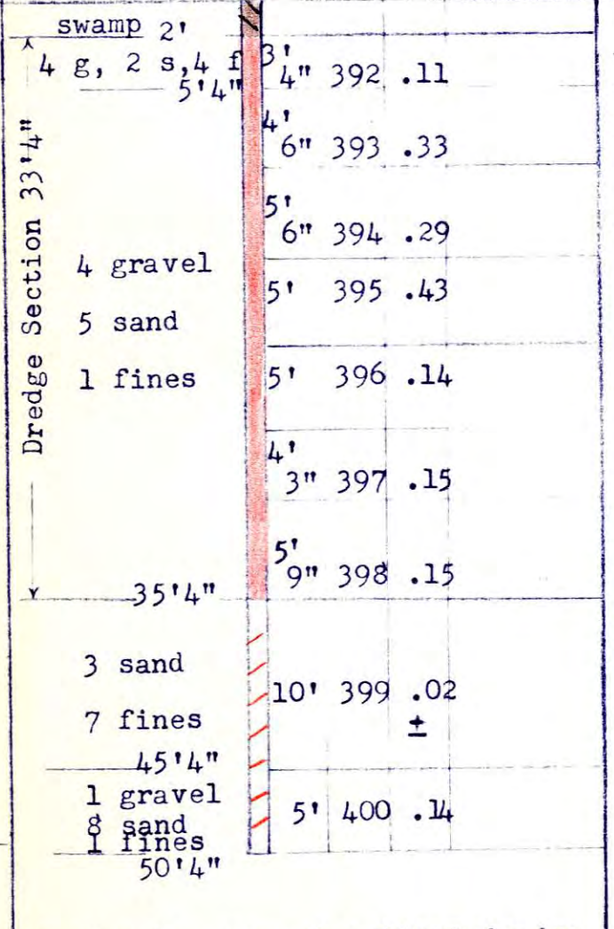
Panning Recovery for 49'6" dredge sect. = .226 lb. Nb_2O_5/yd.

HOLE 19



Panning Recovery for 45' dredge sect. = .148 lb. Nb_2O_5/yd

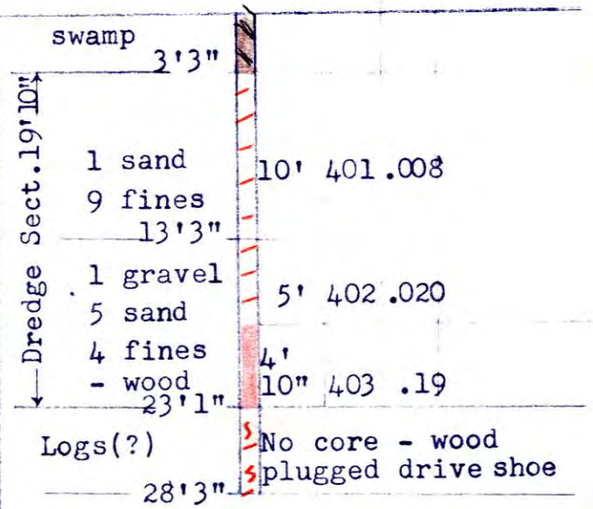
HOLE 20



Panning Recovery for 33'4" dredge sect. = .233 lb. Nb_2O_5/yd

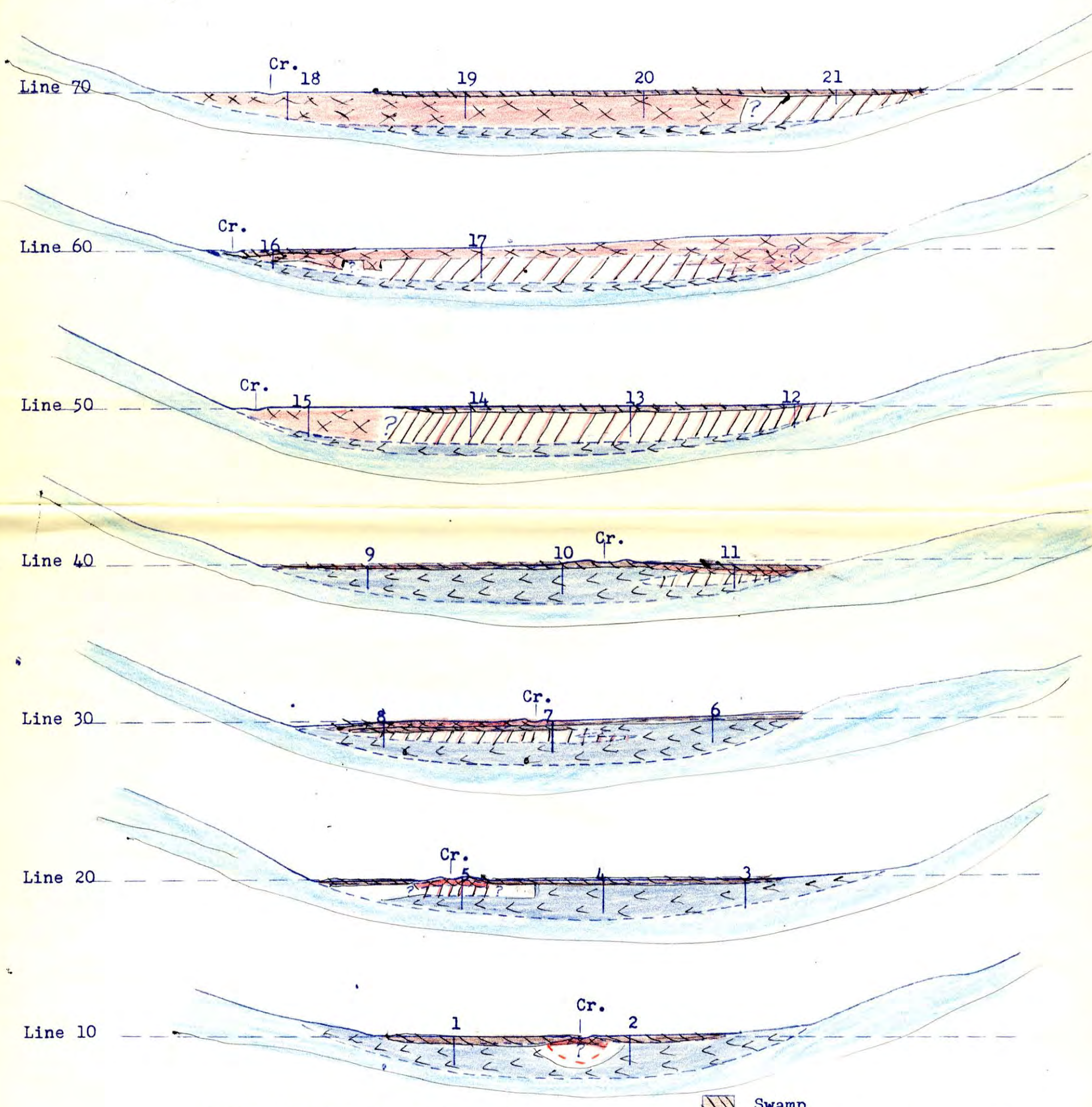
for 48'4" sect. = .180 lb. Nb_2O_5/yd

HOLE 21



(Broken drill stem prevented going deeper)

Panning Recovery for 19'10" dredge sect. = .056 lb. Nb_2O_5/yd.



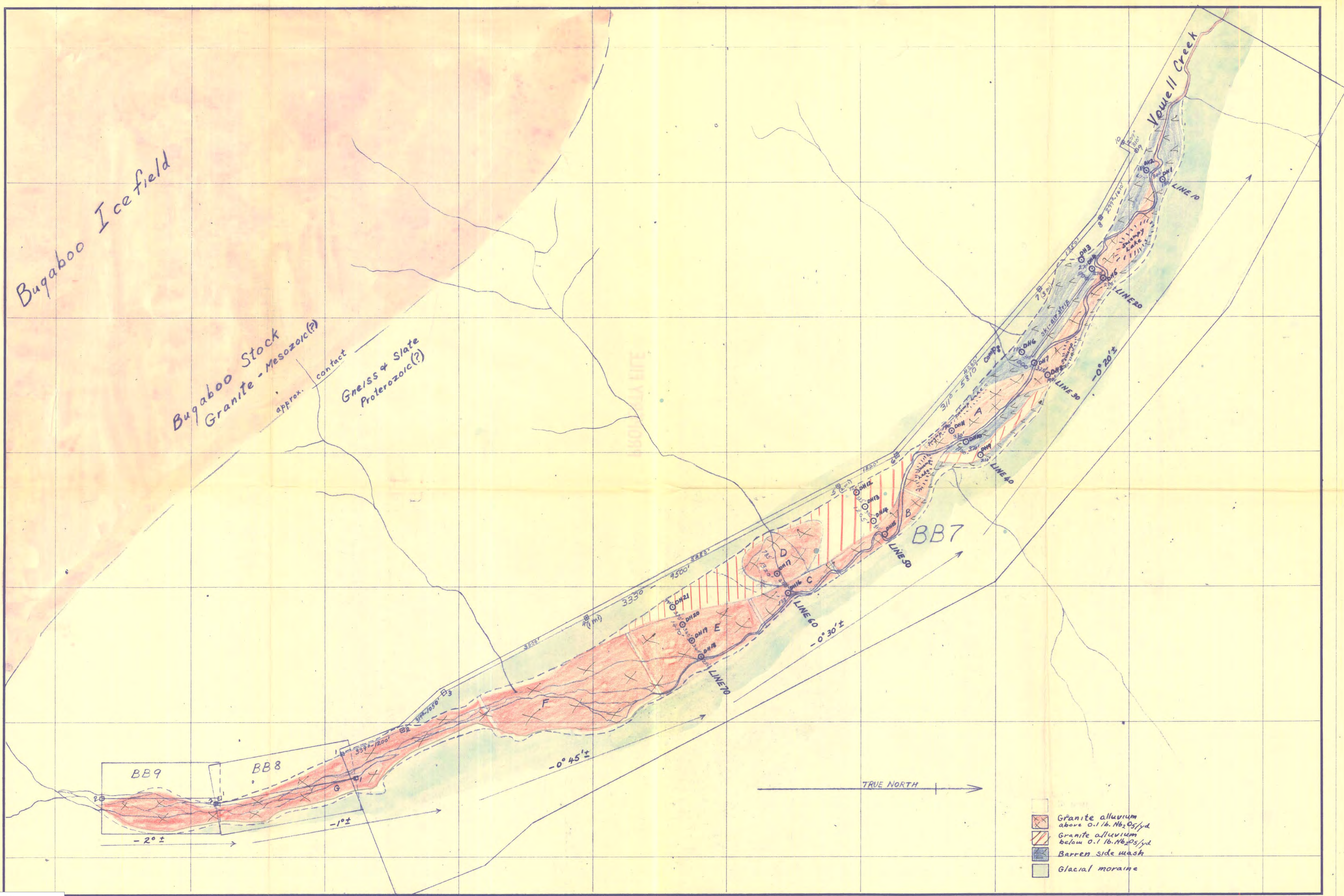
BUGABOO PLACER DRILLING - BB7

VERTICAL SECTIONS ON DRILLING LINES

Looking southeast upstream

Horiz. & Vert. Scale: 1 inch = 200 feet

- Swamp
- Granite alluvium above 0.1 lb. Nb_2O_5/yd. } Panning
- Granite alluvium below 0.1 lb. Nb_2O_5/yd. } Recovery
- Barren side wash
- Glacial moraine



SCALE 1 INCH TO 1000 ft.

COMPANY St. Eugene Mining Corp. WORKING PLACE Vancouver DATE May 26, 1954

PROPERTY Bugaboo Placers - BB7-8-9 DRAWN BY [illegible]

LOCATION Vowell Creek - Golden, B.C. Mining Division TYPE OF MAP Winter Churn Drilling Plan MAP NO. 4

Mountain Minerals Ltd
Brisco Deposit
Decline Stope

Drawn By: D.A.S	Plan No. 9C
Date : Oct. 23, 1973	Revised: May 23, 1974
Scale : 1" = 20'	Revised: Nov. 18, 1974
	: Aug 14, 1975
	: Aug 19, 1976
	: June 27, 1977