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Geological & Mining Engineers

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April 3, 1984

861436

Mr. Ed Asp
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DEASE LAKE
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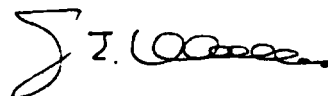
Dear Ed:

Re: Thibert Project

Enclosed are 10 copies of your Thibert Project Report. Detailed examination of the property coupled with evaluation of the available records for Thibert Creek indicates that the proposed project will be economically viable.

Before embarking on the proposed development program, it is an absolute necessity to complete a limited drilling program. An expenditure of approximately \$55,000 will confirm the grade of the gravels, define the boundaries of mineable channel gravels and firm up the stripping ratios. Definitive answers to these questions will aid in spending development monies wisely and will contribute greatly to the overall profitability of the project.

Regards,



J.E. Wallis, P. Eng.

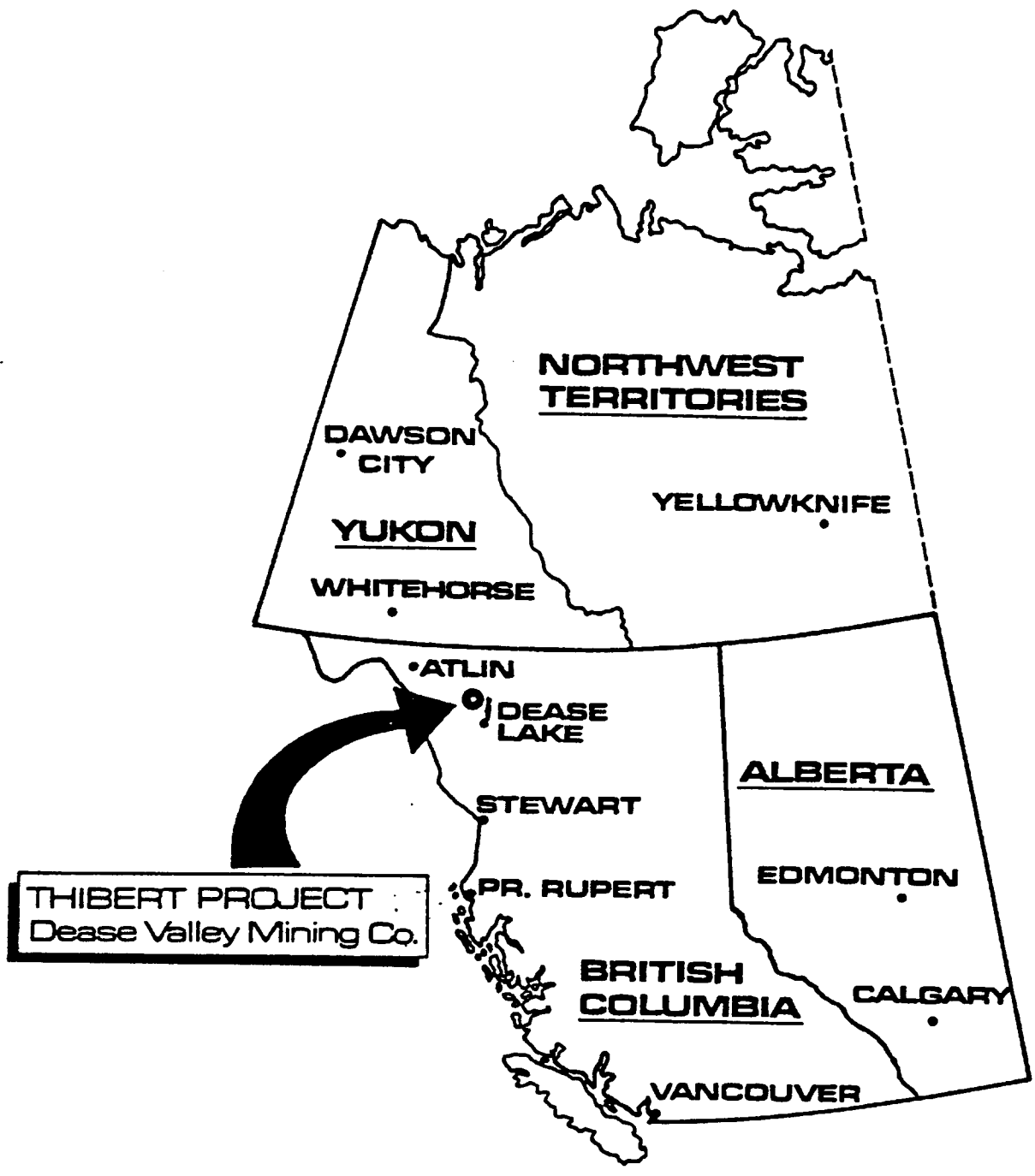
Enclosures:

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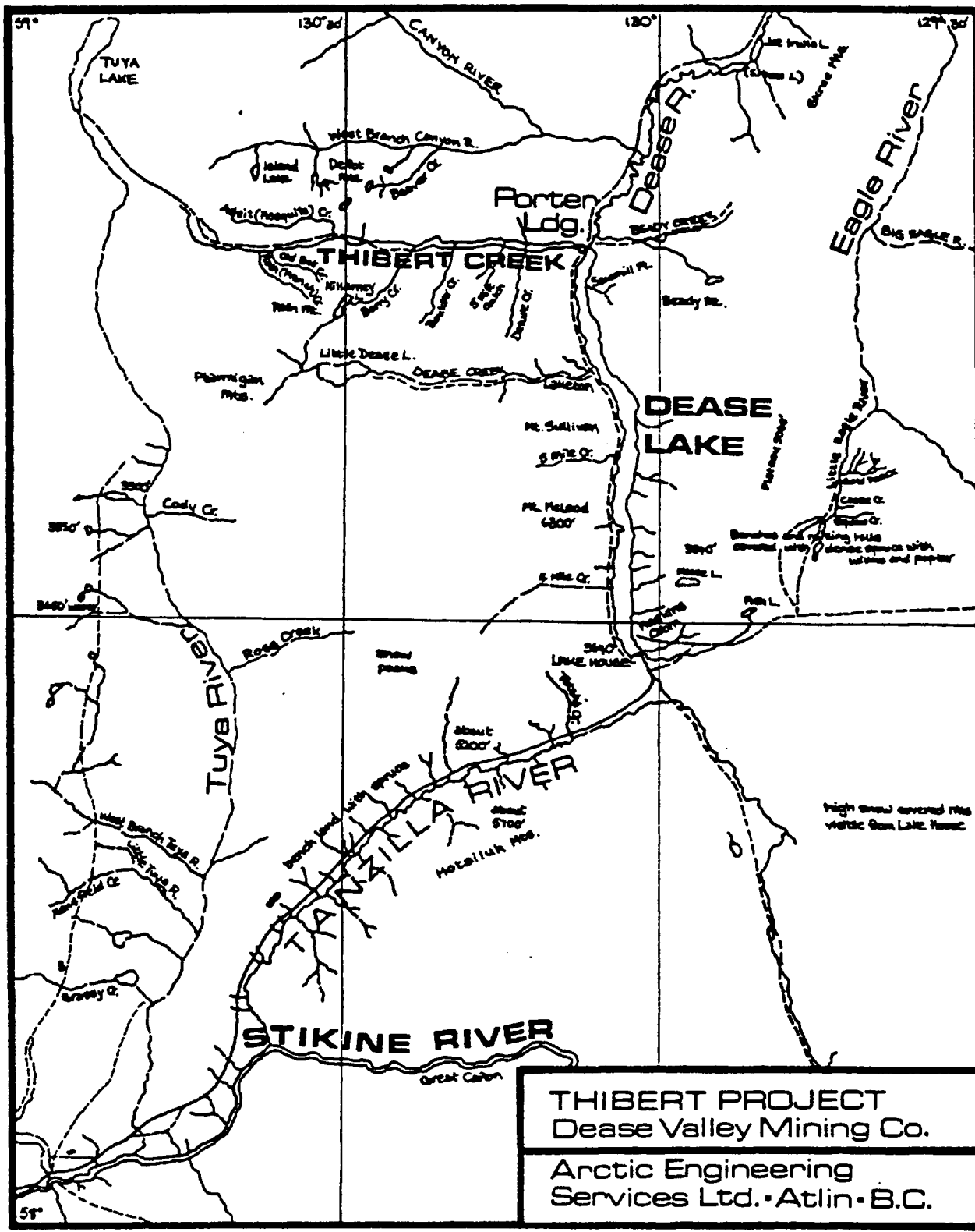
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LOCATION MAP

Arctic Engineering Services Ltd.
Atlin - British Columbia



THIBERT PROJECT
 Dease Valley Mining Co.
 Arctic Engineering
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Location and Access

Thibert Creek is located centrally in the Dease Lake designated area of northern British Columbia and is approximately 130 road miles west of Watson Lake, Yukon.

Geographical co-ordinates of the property are 58°50' north latitude and 130°10' west longitude.

Access to the north end of Dease Lake is readily available by good all weather gravel road from Smithers, B.C. and Watson Lake, Yukon, via the Stewart-Cassiar Highway. A tote trail crosses the Dease River to China Bar on Thibert Creek.

Climate

Annual precipitation in the Dease Lake District varies from 25 to 30 inches with slightly more at the higher elevations. Temperatures vary from -50°C in winter to +25°C in summer. Winter snowfall varies from 3 to 5 feet on the ground. Dease Lake is normally free of ice near the first of June. High water in the spring usually occurs in the first week of June with several periods of high water during the summer due to heavy rains in the mountains.

Physiography

The Dease River valley is a major north-south valley dissecting the Cassiar range of mountains.

High peaks in the Cassiars exceed 7,000 feet and as a result total relief exceeds 4,500 feet. Thibert Creek is one of the larger creeks in the area draining a portion of the range to the west of the Dease valley. Drainage is into the Dease River which flows northerly to join the Liard River.

Vegetation consists primarily of spruce and pine with large areas of heavy willow in swampy areas.

Water Flow

Thibert Creek has a steady year round flow of water. Old records indicate that normal summer flow varies from 4,000 to 5,000 miners inches or 115 to 140 cu. feet/second. During stages of spring flood water flow can be expected as high as 225 cu. feet/second.

Early History

Discovery of placer gold on Thibert Creek in the early spring of 1873 is credited to Henry Thibert, a trapper and prospector from Minnesota. Thibert and a companion left Minnesota in 1869 with the intention of trapping on the Mackenzie River for a few seasons, then crossing the Rockies and traversing British Columbia to the coast. The winter of 1872-73 found the two trappers on Bucks Bar on the Stikine River. They parted company in February 1873, Thibert's partner left for the Vancouver coast and Thibert retraced some of their earlier route to prospect and explore. That same spring he was rewarded for his efforts when he found coarse gold on the bedrock of a creek flowing in the Dease River. Records indicate that the initial discovery was

paying two to three ounces per pan at depths of one to three feet.

By August of 1873 twenty miners were at work on Thibert Creek. Miners working the Caribou and Omineca Districts heard the news of the strike and by 1874 the population had increased to 1600. Laketon at the mouth of the Dease River sprang into existence that year and became the centre of activity in the District.

The first Gold Commissioner, J.P. Sullivan, was appointed in Laketon in 1874, the year of the creation of the Provincial Department of Mines. He issued 825 licenses that season and reported activity on nearly all the streams in the district. Some creeks were averaging \$20 a day to the man, one company took 200 ounces in a week while two men working together recovered 50 ounces in a day.

By 1878 the rich diggings were becoming worked out and the population dwindled to 1500, a third of whom were Chinese, who generally worked the ground the white man had worked and abandoned. Most of the miners continued to work on Dease, McDame and Thibert Creeks. In 1895 there were a dozen white men and fifty Chinese in the camp.

Recorded Production

Recorded production from Thibert Creek in the annual reports of the Gold Commissioners from 1874 to 1915 is listed on the following page:

Year	\$, Thibert	ozs, Thibert
1874	400,000	31,250
1875	150,000	11,720
1876	139,700	11,000
1877	173,700	13,500
1878	65,600	5,000
1879	71,000	5,550
1880	57,900	4,520
1881	29,900	2,340
1882	39,600	3,100
1883	29,000	2,270
1884	30,000	2,340
1885	12,600	980
1886	14,200	1,100
1887	10,000	780
1888	6,700	520
1889	10,800	840
1890	10,000	780
1891	10,000	780
1892	6,500	500
1893	4,400	340
1894	4,000	300
1895	4,000	300
1896 - 1915	121,250	9,470
TOTAL	\$ 1,400,850	109,280 ozs Au

It should be remembered that raw placer gold was the medium of exchange in the mining district. Wages were paid with it and it was squandered over the bars and hoarded. Accurate figures for production were virtually impossible to maintain, as such, recorded production of 109,280 ounces of placer gold is probably at least 20 percent low. Nevertheless, recorded production from Thibert Creek between 1874 to

1915 of approximately 110,000 ounces Au at today's price of \$380/oz U.S. would be valued at approximately \$33.5 million U.S.

General Geology

The geology of the Dease Lake country has been well documented by G.M. Dawson in Geol. Surv. Canada Pub. 629.

As a result of the major north south rift through the Cassiar Batholith formed by the Dease Valley, the complete section of rocks shown in the following "Table of Formations" can be found in the Thibert Creek drainage.

Table of Formations

Recent	Alluvium	
Pleistocene	Glacial Drift	
	--- erosional unconformity ---	
Late Tertiary or	Tuya Formation	Gravels, Basalt
Early Quaternary		Dykes
Upper Cretaceous	Beady Formation	Conglomerate
	--- erosional unconformity ---	
Lower Cretaceous	Cassiar Batholith	Granite, Gabbro Granodiorite
	--- angular unconformity ---	
Jurassic	McLeod Formation	Conglomerates, Tufts, Breccias Argillite, Quartzite, Slate
	--- angular unconformity ---	
Triassic	Thibert Series	Conglomerate Serpentine, Limestone

Economic Geology

Placer gold in economic quantities has been mined from Thibert Creek since 1873, with the peak production years ending about 1885.

Examination of sluice box concentrates indicates that the bulk of the black sands recovered with the gold are composed of the minerals arsenopyrite, pyrite, magnetite, ilmenite, and rutile.

In 1900, a Mr. Hamfield of the Thibert Hydraulic Mining Company gave a sample of the non-magnetic black sands recovered from Thibert Creek to the Provincial Mineralogist for analysis. The B.C. Department of Mines Report, 1902 shows the results as follows:

<u>Sample #2923</u>	<u>Concentrate from Thibert Creek, Cassiar</u>
Platinum	12,864.5 ozs troy per ton = 44.1%
Osmiridium	3,475.5 ozs troy per ton = 11.9%
Total	16,340 ozs troy per ton = 56%

Obviously, Thibert Creek gravels contain not only significant placer gold values but also significant amounts of the platinum minerals which are recoverable.

The large amounts of sulphide minerals in the concentrate indicates that the gold was concentrated as a result of pre-Pleistocene erosion of sulphide rich quartz veins which probably occur in the McLeod Formation and the Thibert Series of rocks. The platinum minerals undoubtedly originate from erosion of the more basic rocks in these same formations.

Detailed examination of the Thibert Creek gravels shows quite clearly that placer gold occurs in three distinct ways over the length of the creek. In order of importance, these are:

- (a) Preglacial or Tertiary gravels which rest on bedrock in the old high level channels. These gravels vary in thickness from 2 to 8 feet and are cemented.
- (b) Glacial and interglacial gravels which partly filled the high level channels. Ice erosion of old placers included gold in glacial drift which was reconcentrated by stream action in the upper portions of the channels.
- (c) Post glacial gravels in the existing channel of Thibert Creek where the new stream channel cut through the Tertiary high level channel or where side streams cut through the high level channel.

The most significant reserves of minerable grades are those gravels remaining in a one mile section of the high level bench channel between Fork Gulch and Five Mile Creek, Figure 1.

High Level Bench Channel

The creek valley between Deloire and Berry Creeks is approximately 800 feet wide and 300 feet deep. Distinct rock benches marking the high level channel are continuous along the south side of the creek over this full distance. The gradient of this old channel is considerably less than the gradient of the present creek. At the mouth of Berry Creek the old channel is 90 feet above Thibert Creek and at Fork Gulch it is 190 feet above the creek.

Between Berry Creek and Five Mile Creek the channel was partially bound by rock benches on the south side and exposed to the Thibert Creek valley on the north side. This section was mined hydraulically during the early years of the Thibert camp as a hydraulic grade could readily be maintained to the creek. The old records indicate that the ground was averaging 0.04 ozs Au/yd³. Considerable difficulty was experienced in hydraulicing due to problems of maintaining a flume along Thibert Creek and excessive mud slides into the pit.

Just east of Five Mile Creek the high level channel passes south of a high rocky knob and continues downstream to Fork Gulch where it rejoins the present creek channel. Through this one mile section the channel appears to be contained on both sides by rock walls. Because the gradient of the channel is very flat throughout this section and a hydraulic gradient could not be maintained, the section was drifted on and partially mined by underground methods (Bluebell Mine). The only record of drilling on this section is recorded in the Minister of Mines Report, 1931, and shows a hole abandoned in the upper glacial gravels which returned 0.008 ozs Au/yd³ over a length of 116 feet. Several years ago a previous operator started a small cut on the Fork Gulch end of the high level channel and sluiced approximately 4,000 yds³ of gravels from the lower 30 feet of the channel. A total of 259 ozs of placer gold was recovered, the largest nugget weighing 17 dwt with the bulk of the gold being rice sized. Considering the gold to be 800 Fine, the calculated grade of this section of gravels is 0.05 ozs Au/yd³ or \$23.37 CAN/yd³ at \$380 U.S. Au. This is slightly higher than the overall grade of the channel from old records.

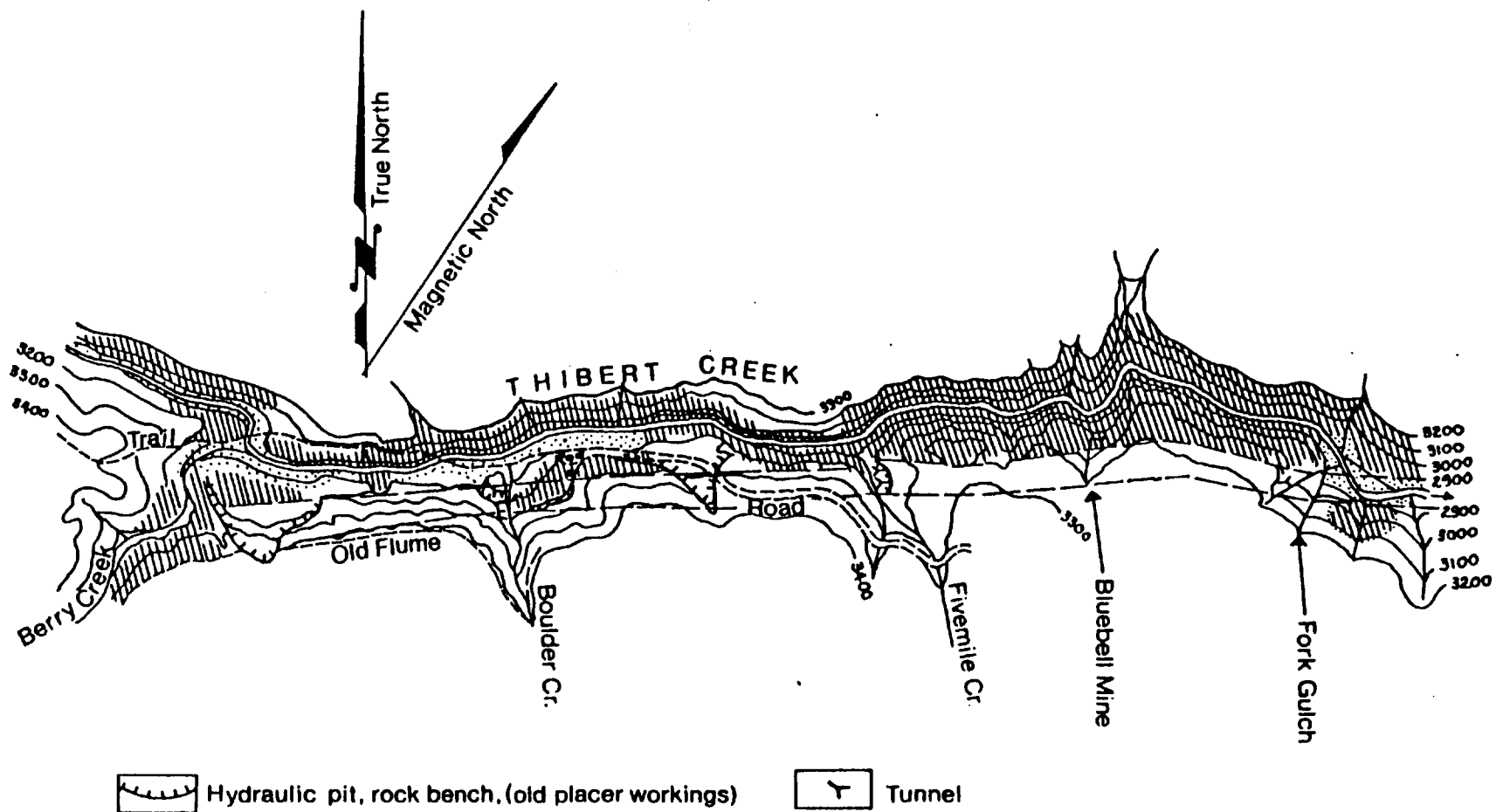


Figure 1 -- Boundaries of the High Level Bench Channel

Post Glacial Gravels

Close examination of the existing Thibert Creek channel indicates that most sections of the creek that trace the high level channel were mined in the early days by wing damming and diverting the creek. However, the bend in the creek immediately below Fork Gulch does not appear to have been mined, probably because of high water flow and an inability to divert the creek at this point. Reconcentrated placer gold values from the high level channel should be present in the existing creek gravels in this section.

Calculated Reserves

Total calculated reserves on P.M.L.'s 3166, 1597, 1598 and 5970 based on this study are as follows:

1. High Level Channel - Five Mile Creek to Fork Gulch
Category: Probable - Proven

Length - 4,500 ft.

Width - \pm 200 ft.

Thickness - 30 ft.

Overall Stripping Ratio - 3:1

Grade - 0.03 to 0.04 ozs Au/yd³

Total Mineable Gravel - 1,000,000 yds³

Recoverable Gold - 30,000 to 40,000 ozs Au

Recoverable Platinum - ?

Value @ \$380 U.S. Au - \$11.4 - \$15.2 million U.S.

2. Post Glacial Gravels - Creek channel below Fork Gulch

Category: Possible

Length - 2,400 ft.

Width - 100 ft.

Thickness - 15 ft.

Overall Stripping Ratio - 0.33:1

Grade - 0.03 to 0.05 ozs Au/yd³Total Mineable Gravel - 130,000 yds³

Recoverable Gold - 3,900 to 6,500 ozs Au

Recoverable Platinum - ?

Value @ \$380 U.S. Au - \$1.48 - \$2.47 million U.S.

PROPOSED DEVELOPMENT AND MINING PLANS

Phase I

Logical development and mining of the high level channel gravels on Thibert Creek is contingent on preparing sufficient settling pond capacity and waste disposal areas. With this in mind, the following Phase I priorities have been established:

1. Construction of a good all weather access road from China Bar to Fork Gulch.
2. Construction of a 2,000 foot long diversion channel to move Thibert Creek over to the north side of the valley opposite Fork Gulch.
3. Construction of 2 large settling ponds sufficient for a recirculating sluice system.
4. Mining and sluicing the post glacial gravels in that portion of the stream bed dried up by the diversion channel.

Access Road

Approximately 2 miles of new access road will have to be constructed from China Bar along the north side of the Thibert valley to a point opposite Fork Gulch. The ground is well drained but will require the installation of approximately 8 culverts. The estimated cost of this construction is \$12,500, detailed as follows:

2 - D8 Dozers for 1 week	
100 machine hours @ \$100/hour	\$ 10,000
Culverts	<u>2,500</u>
Total	\$ 12,500

Diversion Channel

A diversion channel cutting across a bow in Thibert Creek directly opposite Fork Gulch is a necessity. This will move Thibert Creek to the northern edge of the valley and will provide the necessary space for a series of settling ponds downstream from the east end of the high level channel. In addition it will permit the mining of the reconcentrated post glacial gravels in a portion of Thibert Creek which could not be mined in the early days of the Dease Lake rush.

The planned diversion channel is approximately 2,000 feet in length and 36 feet wide. Rip rap for the diversion will be sorted from a large rock slide along the north edge of the diversion ditch itself.

Details of the excavation are listed as follows:

1. 20,000 yds³ material excavated
2. 20,000 yds³ of rip rap placed
3. Grade of diversion, approximately 0.75 per cent

The time required to complete the diversion along with its projected cost is as follows:

120 hours - D8 Dozer @ \$100/hour	\$ 12,000
40 hours - 988 loader @ \$100/hour	4,000
installation of timber truss bridge	<u>5,000</u>
Total	\$ 21,000

Construction of Settling Ponds

Two settling ponds with a connected weir must be constructed adjacent to the diversion ditch to provide 48 hour retention time for a recirculating sluice water system. Considering a sluice system requiring 3,000 gpm of sluice water the ponds must have a capacity of:

$$3,000 \text{ g/min} \times 60 \text{ min/hr} \times 48 \text{ hr} = \underline{8,640,000 \text{ gal.}}$$

Two ponds 200 ft x 200 ft x 15 ft deep x 7.48 gal/ft³ have a capacity of 8,976,000 gallons. A total of 45,000 yd³ of material will be excavated to construct the ponds. Excavated material will be utilized to strengthen the berm on the south side of the diversion channel. The projected cost and time required to build the ponds is calculated as follows:

100 hrs D8 @ \$100/hr to move 45,000 yd ³	\$ 10,000
100 hrs D8 @ \$100/hr to place fill on berm	10,000
planking for weir 2,000 bf	600
labour for installation	<u>500</u>
Total	\$ 21,100

Stripping Post Glacial Gravels

It is estimated that the surface area of mineable post glacial gravels is 2,400 ft long and 100 ft wide. This will

necessitate stripping an area 2400 ft long x 150 ft wide and 5 ft deep, for a total excavated volume of 67,000 yd³. Based on past experience stripping with a 631 Cat scraper this should be moved for \$1.50/yd³ for a total cost of \$100,000. See detailed calculations for Total Stripping Costs, No. 1 Pit - High Level Channel.

Mining and Sluicing Post Glacial Gravels

It should be recognized that these gravel reserves are not defined or confirmed by old records. They are geologically inferred reserves.

There is an estimated 130,000 yds³ of mineable gravels in this block. Normal mining and sluicing cost of these gravels should not exceed \$3.00/yd. Total estimated cost is: \$3.00/yd x 130,000 yd³ = \$390,000.

Installation of Sluice Plant

Sluice plant, pipe and pump installation will require 2 man weeks and 20 hrs 980 loader time. Estimated cost is:

Labour, 2 man weeks	\$ 3,000
20 hrs 980 @ \$100/hr	<u>2,000</u>
Total	\$ 5,000

Total Estimated Cost of Phase I

Phase I includes building the access road to the mining site, diversion ditch, construction of settling ponds,

installation of plant, stripping, mining and sluicing and cost of fuel. Total Phase I costs are tabulated as follows:

ITEM	Cost
Access Road Construction	\$ 12,500
Diversion Ditch	21,000
Settling Ponds	21,000
Stripping	100,000
Mining and Sluicing	650,000
Fuel, 6,000 gal. @ \$2/gal	<u>30,000</u>
Sub total	846,500
Contingency 10%	<u>84,500</u>
Total	<u><u>\$ 930,000</u></u>

Time required to Complete Phase 1

Total time required to complete Phase 1 is calculated on the basis of time required for construction of access and mining facilities. Time required for sluicing of mineable gravels is based on a mining rate of 150 yd³/hr. utilizing 2 - 10 hour shifts.

Mobilization of Equipment	10 days
Construction of Access Road	12 days
Diversion Channel	16 days
Settling Ponds	14 days
Stripping	21 days
Mining	<u>65 days</u>
Total	<u>138 days</u>

If construction of access roads can be initiated early in April, actual mining and sluicing could feasibly begin by July 1st and would be completed in early September. Resetting of pipe and the sluice plant in preparation for mining the elevated bench channel could be completed early in September. It is highly unlikely that mining of the upper gravels would begin until June 1st, 1985. Any time that is available in September or October 1984 can readily be utilized in stripping some of the upper gravels on the elevated bench section. Snow will probably signal the termination of stripping operations in late September or early October.

Phase 2

Phase 2 stripping operations could well begin in September 1984. Stripping costs in September and early October can be anticipated to be approximately 15 per cent less than the cost of stripping in early spring. This cost differential is due to lower ground engaging tool costs per yd³ of strip and better daily strip yardage due to lack of frozen ground. The actual decision should be a management decision based on availability of equipment and operating capital. For the sake of this report, Phase 2 will begin in September 1984 and terminate October 1, 1984.

Stripping - Upper level Channel, Pit No. 1

Due to the relatively large stripping ratio of 3:1 on the high level channel, it is compulsory that stripping begin in September of 1984 to ensure that a steady feed rate to the sluice plant be maintained during the 1985 mining season. To ensure that stripping will not interfere with the settling

ponds and pumping facilities, it is planned to strip with 631 Caterpillar Scrapers. Side slopes will be maintained at 1:1. With an initial pit planned 1200 feet in length, calculated strip material is calculated as follows: (Figure)

$$\frac{1150 \text{ ft. long} \times 250 \text{ ft. wide} \times 90 \text{ ft. deep}}{27 \text{ cu. ft./yd}^3}$$

$$= 958,000 \text{ yds}^3$$

With an average swell factor of 25 per cent, total strip material in the initial pit will approximate 1.2 million broken yds³.

Cycle Time

Average cycle time for a 631 Scraper travelling on a 3000 ft. return haul is calculated to be 7.0 minutes.

Daily Production per Machine Day

Considering a machine day to be 18 hours (2 - 10 hour shifts) with a 7 minute average cycle time and hauling 25 yd³ per trip. Daily production per 631 scraper should be:

$$\frac{25 \text{ yd}^3/\text{trip} \times 60 \text{ min}/\text{hour} \times 18 \text{ hours}/\text{day}}{7 \text{ min}/\text{trip}}$$

$$= 3800 \text{ yds}^3/\text{day}.$$

Equipment Required

With approximately 1.5 months prior to and at the end of the sluice season available for stripping, 4 - 631 Cat Scrapers will be required. Actually one spare should be on site, for a total of 5 - 631 Cat Scrapers. These scrapers will require 2 push dozere for a total of 2 - D8 Dozers.

Total Equipment Operating Cost

All equipment issued on the project is anticipated to be leased equipment. Caterpillar D8 Dozers and 631 Scrapers are available at an hourly rate of \$100/hr. which includes operator. Fuel and lubricants are extra.

2 - D8 Dozers; 20 hrs/day for 90 days	\$ 360,000
4 - 631 Cat Scrapers, 20 hrs/day for 90 days	720,000
Fuel - Dozers 10 gal/hr:	
180 gal/day x 2 dozers x 90 days	= 32,400
Scrapers @ 9 gal/hr:	
162 gal/day x 4 scrapers x 90 days	= <u>58,320</u>
Total	@ \$2.00/gal 90,720 = <u>181,440</u>
TOTAL	\$ <u>1,261,440</u>

Camp Costs

Although the bulk of the workers on site will be contractors' men, a camp with facilities for 20 men will have to be maintained on site. Camp costs are estimated at

\$50 per man day. Resident manpower during the stripping operation will be made up of the following personnel:

- a) 9 Scraper Operators
- b) 4 Dozer Operators
- c) 1 Cook
- d) 1 Welder
- e) 1 Mechanic
- f) 1 Oiler - General Labourer

Total: 17 Men @ \$50/man day for 90 days

Project Cost: \$ 76,500

Total Stripping Costs
No. 1 Pit, High Level Channel

Total stripping costs for the 1st seasons production from the high level channel is calculated to be:

1) Total Equipment Operating Cost	\$ 1,261,440
2) Camp Costs	<u>76,500</u>
TOTAL	\$ <u>1,337,940</u>

Stripping costs on a bank yard basis then become:

Total stripping costs/bank yards stripped

$$= \$ 1,337,940 / 958,000 \text{ yd}^3$$

$$= \underline{\$ 1.40 / \text{yd}^3}$$

bedrock and cuts cannot be picked or cleaned to advantage after this date, but there is nothing to prevent the washing of gravel to continue until the 20th of November. The best plan to adopt would be to so arrange it that the first two weeks in the season were devoted to washing off the top dirt. This would only require a few men, who could be picked up in the country. When the bulk of the working crew came in, which would be in the commencement of June, the heavy ground (bottom with boulders), should be attacked. After the last cleanup, this crew could then be sent out, and only the original men retained, when the last two weeks would again be devoted to running top gravels. It would thus be possible to get a working season of 150 days with the smallest amount of expense.

"The small amount of water used (475 miner's inches per 24 hours) was caused partly because half the time we were obliged to work with only one of the small monitors, and partly from the fact that the season's water supply was very short. We have two large monitors, capacity 600 inches each, and two small ones, each 400 inches. By being compelled to work the small ones half the time, we, of course, lost a great deal of water during the time when the supply was good. In my five years' experience in the country I must admit that this has certainly been the worst one for water, and even old inhabitants, who have been here for 25 years, say that it has been the driest they have known. This is very unusual for this country, as the watershed here can really be considered very good. It is to be remembered that so far we have done almost nothing to improve the water supply in Berry creek, either by leading other creeks into it, or by building dams so as to preserve what water there is, but are entirely dependent on the natural flow. Therefore, a great deal, from two to three times as much as we can use, goes to waste during the first two months of high water, and even later in the season when we have rains we can, of course, only use a 'head,' and the balance has again to run down the creek. Our present supply (475 miner's inches) is not altogether inadequate, when we have to wash banks as high as 150 feet. For this purpose we ought to have not less than 1,000 inches and as much more as can be got. There are three different propositions for supplying the mine with water, each one quite feasible from a topographical standpoint and within the limits of a reasonable expenditure of money. By having longer sluices and perhaps a series of undercurrents a closer saving of the gold could be effected.

"No saving was attempted of the osmiridium of which there is a certain amount present. This should and could easily be remedied if the mine were put in a better working shape, for it is often in the close saving of gold that profit becomes possible.

"Although operating with an entirely insufficient supply of water during a very short season, and labouring under other disadvantages, such as bad grades, we have still managed to make a small profit. If the mine was worked on a scale commensurate to its size there would be effected a very large saving in the expenses for each dollar of gold produced, so much so that this saving would in itself be a very good profit, even if none had been made under present conditions. The body of gravel is quite large enough to ensure the life of the mine for a lengthy period, even when worked on a large scale."

A very large portion of the Cassiar District is but little known, and there exist new fields for the prospector that have never yet been entered by white men. The great necessity of the district is the advent of railways and transportation facilities.

Nothing other than the usual amount of assessment work necessary to hold them has been done on any of the mineral claims in this district during the season, and no new locations have been recorded.

1985 Sluicing Costs

Pit No. 1, High Level Channel

Stripping of the 1st Pit on the high level bench will have provided a pit area 200 ft. wide by 1000 ft. in length. Pay gravels will average 30 ft. in depth.

Mining Rate

Assuming a 100 day sluicing season beginning June 1st, 1985 with 220,000 bank yds³ of pay gravels available, the average daily through put in the sluice plant will be 2200 bank yd³ per day or 1100 bank yds³ per 10 hour shift. Considering actual running time of the plant at 9 hours per shift this converts to 125 bank yd³/hour or: 125 bank yd³/hour x 1.25 swell factor = 155 broken yds³/hour.

Equipment Required

With an average haul distance of 500 feet, one 631 Scraper can readily supply the required 155 broken yds³/hr. to the sluice plant. However, one extra 631 should be on site to provide back-up in case of breakdown.

One 988 loader will be required at the plant to clean rocks from the grizzly and help with tailings.

Equipment Operating Cost

By unit, the operating costs of the running equipment is calculated as follows:

a)	D8 Cat Dozer	
	<u>Direct Costs</u>	
	20 hrs/day x 100 days x \$100/hr	\$ 200,000
	<u>Fuel & Lubricants</u>	
	Fuel: 10 gal/hr x 20 hrs/day	
	x \$2.00/gal x 100 days	40,000
	Lubricants:	4,000
	Total	\$ 244,000
b)	980 Loader	
	<u>Direct Costs</u>	
	20 hrs/day x 100 days x \$100/hr	\$ 200,000
	<u>Fuel & Lubricants</u>	
	Fuel: 8 gal/hr x 20 hrs/day	
	x \$2.00/gal x 100 days	\$ 32,000
	Lubricants:	3,200
	Total	\$ 235,200
c)	2 - Caterpillar Pumps 10 x 12	
	<u>Direct Costs</u>	
	Leased @ \$3,000/month	\$ 21,000
	<u>Fuel & Lubricants</u>	
	10 gal/hr x 20 hr/day x 100 day x \$2.00/gal	40,000
	Total	\$ 61,000

Total equipment operating costs for a 100 day mining season are calculated to be \$540,200.

Sluice Plant Operators

Two sluice plant operators will be required for the duration of the mining season, one for each shift. Plant operators are available for \$3,000/month. Wages are calculated to be: \$21,000.

Service Vehicle

One 4 x 4 pick-up should be available on the minesite. Rental fees of \$1,000/month can be expected with an additional \$700/month allotted for fuel and lubricants. Total costs can be expected, of: 3-5 months x \$1,700/month = \$6,000.

Camp Costs

Resident manpower on site during the mining season will consist of the following:

- a) 2 Scraper Operators
- b) 2 D-8 Operators
- c) 2 Sluice Plant Operators
- d) 2 980 Loader Operators
- e) 1 Cook

Total in camp: 9 men

Cost: 9 men @ \$50/day for 100 days = \$45,000

Total Costs of 1985 Mining and Sluicing

Total costs expected for the 1985 sluicing season are calculated as follows:

a) Equipment Operating Cost	\$ 540,200
b) Sluice Plant Operators	21,000
c) Service Vehicle	6,000
d) Camp Costs	<u>45,000</u>
Total	\$ 612,200

Cost per Bank Yard Sluiced

With a planned 220,000 bank yd³ sluiced during the 1985 season at a cost of \$612,200, calculated cost of each yd³ sluiced is \$2.78/yd³.

Total Costs for 1985 Season

Total operating costs for the 1985 season are calculated to be \$1.95 million CAN.

Expected Revenue 1985 Season

Revenue based on current gold prices of \$380 US per oz. calculated on an expected grade of 0.04 ozs. Au/yd³ show:

$$220,000 \text{ yd}^3 @ 0.04 \text{ oz. Au} = 8,800 \text{ ozs. Au} @ \$380 \text{ US} \\ = 3.34 \text{ million US} = \underline{\$4.1 \text{ million CAN}}$$

Projected Operating Life

At a planned operating capacity of 220,000 sluice yds.³ per year the high level channel contains sufficient reserves to last 4 and possibly 5 years. Life of the property could feasibly be extended a year or two if lower grade gravels could be mined after the first 2 years of production.

Gold Price

Effect on Cut-off Grade and Profitability

There is much conjecture today over tomorrows gold price, depending on the source of information, the price over the next few years is predicted to be somewhere between \$400 and \$2,000 per oz. Any upward swing in bullion prices is bound to have a tremendous affect on the grade of the gravels that can be mined and the overall profitability of the project. The following chart has been prepared to indicate the effect of changing gold prices on planned 1985 production:

(See Table 1)

Sluice Plant Requirements

It is apparent that the Thibert Creek gravels contain a high proportion of recoverable fine gold and platinum. Optimum recovery of these values is possible using a relatively simple, modified sluice plant. It is recommended that the plant be a totally gravity system utilizing the following components:

- 1) sizing to a 6 inch diameter
- 2) prewash - 30 feet in length
- 3) 30 feet of undercurrent box utilizing 1/2 inch diameter neoprene coated punch plate 4 feet wide.
- 4) 30 feet of 4 x 3 riffles, 3 feet wide.

The minus 1/2 inch material from the under current box should be washed in a 30 foot section of 2 - 3 foot wide boxes with 3 decks of expanded metal on top of unbacked nomad carpeting.

Sluice Water

The proposed sluice plant will utilize between 3,000 - 4,000 Imperial gallons of water per minute.

TABLE 1

Effect of Varying Grade and Gold Bullion Prices
Planned Annual Production, 220,000 yds³

Gross Value of Production - \$ U.S., Millions/\$ CAN, Millions

Grade	Ounces	Au \$380 US	Au \$400 US	Au \$450 US	Au \$500 US
0.06	13,200	5/6.15	5.28/6.49	5.94/7.3	6.6/8.1
0.05	11,000	4.18/5.14	4.4/5.4	4.95/6.09	5.5/6.8
0.04	8,800	3.35/4.12	3.52/4.33	3.96/4.87	4.4/5.4
0.03	6,600	2.51/3.08	2.64/3.25	2.97/3.65	3.3/4.1
0.02	4,400	1.67/2.05	1.76/2.16	1.98/2.44	2.2/2.7

Total estimated production costs, 1984 season: \$1.95 Million CAN.

CONCLUSIONS AND RECOMMENDATIONS

Evaluation of all the available records combined with a detailed field examination of Thibert Creek drainage indicates that approximately 1.15 million yards³ of placer gravels exist on placer leases 1597 and 1598. Historical data combined with recent test results on the high level bench channel gravels at Fork Gulch shows that an overall grade of 0.04 ozs. Au/yd³ should be attainable. Possible reserves of recent creek gravels outlined in Phase 1 could exceed this grade by as much as fifty per cent. Detailed cost studies based on mining 220,000 yds³ of pay gravels annually, utilizing leased scrapers, dozers and one 980 loader, shows that a good profit could be realized at today's gold price. Any increase in mining grade and/or gold price would greatly enhance the overall profitability of the project.

To minimize the overall risk of a sizeable investment, it is compulsory that both the grade and quantities of gravel reserves be confirmed by drilling. Access to both the Phase 1 and Phase 2 areas is readily available in March. The estimated cost of the proposed drill program is \$55,000 as detailed below:

Phase 1 - Creek Gravels	10 holes, 35 feet deep ---	350 feet
Phase 2 - High Level Bench Channel	10 holes, 120 feet deep ---	<u>1,200 feet</u>
Total		1,500 feet

Overall drilling cost: 1,500 ft. @ \$32.00/ft =		\$ 49,000
	Contingency	<u>5,400</u>
		\$ 55,000

BIBLIOGRAPHY

B.C. Minister of Mines Reports

Thibert Creek - B.C.

In Cassiar, in 1876, the number of Miners employed was certainly one-fourth more than in 1875, and the results have been, to judge from general report and from the reports of the Gold Commissioner herewith published, very satisfactory, and the prospect for the future season excellent.

In Cariboo the rich claims on Lightning Creek have not nearly equalled in yield that of last year. In other claims there appears not to be much difference.

Omineca is almost deserted, and Kootenay would appear to have declined considerably, the yield of Gold being \$16,000 under last year.

A new Gold field has been discovered on Cherry Creek, and Mr. C. A. Vernon, the neighbouring Commissioner, is impressed with the idea that favourable results will ensue.

ACTUAL YIELD.

The amount actually exported by the Banks in 1876 is over \$500,000 less than in 1875, and the total estimated yield of Gold for the whole Province is \$1,786,648 50, as against \$2,474,904 in 1875, or \$688,255 50 less.

This falling off, as before mentioned, is chiefly owing to the impossibility of working the rich claims on Lightning Creek, the fact that the hydraulic claims were not washed up, and a decrease at Cassiar. However the yield is still in excess of that for the years 1872, 1873, and 1874.

CASSIAR.

The yield of Gold in this section is estimated by Mr. Commissioner Vowell at \$556,474 for the year 1876, as against an estimated return of \$800,000 for 1875.

1,500 miners and others visited the Cassiar diggings in 1876, while only 1,000 went up in 1875. A larger yield of gold might therefore have been anticipated, but it is generally believed that 1,500 miners were more than could be profitably employed; this opinion is forcibly expressed by Mr. Vowell in his letter of the 31st August, annexed.

A favourable indication for the future success of Cassiar is the fact that the benches of McDame and Thibert Creeks prospect richly, and only require a supply of water (which is being provided) to produce excellent results.

Mr. Vowell reports that nuggets up to 18 oz. in weight have been found in what is supposed to be the old channel in Thibert Creek, and that sanguine expectations have been formed of the workings for 1877.

If Cassiar has not realized the perhaps over sanguine expectations formed of it, it is at least satisfactory to know that it affords employment for 1,000 men, and has this year produced as much gold as Cariboo.

The Commissioner's reports annexed contain much valuable and interesting information, and will repay a careful perusal.

"LAKETON, CASSIAR,
"29th June, 1876.

"SIR:

* * * * *

"It is satisfactory to be able to report that some seven discoveries have been already made in the district this season; they are as follows:—On the upper portion, some 20 miles from mouth of Thibert Creek; and on Berry, French, Bear, California, and Merritt gulches, paying diggings have been discovered. The four first mentioned gulches are on Thibert Creek; the latter on the west side of Dense Lake, about half a mile below Laketon. A valuable discovery has been made at the foot of Snow Creek, a tributary of McDame Creek, and some eighteen miles from the mouth of latter. The discoverers are Sylvester, Vital, and Fred Black, all well-known prospectors, and deserving of the claims which they now hold, and which have paid, up to within a short time since, from \$40 to \$50 per day to the hand; the last accounts showing a much larger return.

on Rosella creek, in Liard Mining Division, and two are on the First North Fork of Clearwater river in the Stikine Division. Other than this, nothing of any apparent worth has been recorded.

The Rosella creek property is in the hands of certain residents of Rosella Creek. Victoria. It has from early days been thought that the creek is rich in gold, and that it would certainly pay if worked in a proper manner. This will require some capital, as it will be necessary to operate on a large scale, and the remoteness of the district will render the transportation of the machinery, etc., though perfectly feasible, a matter of considerable expense. Once, however, the value of the ground for hydraulic mining is recognised the prospects of the locality seem bright.

The First North Fork of Clearwater river has attracted some attention during the season, and several placer claims have been recorded and gold taken out. The gravel does not prove to be rich, though the interested parties think it sufficiently so to pay if it is worked on a different plan to the ordinary method of shovelling into sluice-boxes, and they have therefore secured leases covering the ground.

THIBERT CREEK MINING Co.

A very unfortunate accident occurred to this company, the workings being completely buried by a large landslide. Luckily this occurred in the night, when only two men were in the mine, and these escaped unhurt. Prior to the slide everything was looking favourable for a big clean-up this fall (1902), but owing to three out of the four monitors being buried, the greater part of the employees had to be dismissed, the remainder being kept on to clear out the works in readiness for the coming spring. Mr. Hamfield, who was formerly manager of the property, but who has now himself leased it from the company for a term of years, informed me that though the slide had caused a serious drawback to the season's operations, yet no serious damage had been done, and that, practically speaking, it had left the pay gravel uncovered.

NOTE BY PROVINCIAL MINERALOGIST.—The following account of the working of this company during the year 1902 has been extracted from the admirable report of the manager, Mr. Alexander Hamfield:—

The property of the company consists of 7 hydraulic mining leases of 80 acres each, consolidated, and having a total frontage on Thibert creek of 10,500 feet. After deciding last spring to install 2 new No. 4 monitors, 2 new 12-inch water-gates, and 600 additional feet of 12-inch pipe, no time was lost in forwarding this apparatus, and on the 25th June rivetting the new pipe had so far progressed that washing could be begun.

It was noted last year that the block of ground between Nos. 1 and 2 pits gave some trouble by slipping, and, notwithstanding the precautions taken, the whole of this deposit, containing thousands of tons of boulder clay and mud, slipped into the mine, filled the pits mentioned and covered 3 monitors, 2 gate valves and 400 feet of pipe, besides taking out the 3 lower sluice-boxes in No. 2 pit. Though this accident was unfortunate in delaying operations, it has effectually disposed of the most difficult ground to be mined. The débris has now been removed, machinery and pipe fixed up and boxes re-set. The machinery was luckily not destroyed, and everything is in readiness for operations next spring. Two new pits, with rock cuts and the necessary sluice-boxes, were opened up during the year, and 2 monitors are now placed so that a fifth pit can be easily begun, thus making five different openings from which to wash gravel.

After two years' trial the undercurrents have been taken out, as they show only 1% of the recovery from the sluices, and this will not pay for making them or keeping them running.

It is safe to say that the first two boxes (21 feet) gave 85 % to 90 % of the total gold recovered in the sluices, and this is due to an exceptionally good and heavy quality of gold which is easy to save. Although in hydraulic mining this is a very great advantage, this same quality of gold has, on the other hand, a tendency to "rob the sluices," so that a very large percentage settles in the rock-cuts and in all the crevices on bedrock and is not recovered till the latter is "picked up" and cleaned. The flume, which caused trouble last year by settling and consequent leakage, has now found a solid and permanent foundation.

From the work done during the season the value of the bottom between Nos. 1 and 2 pits is demonstrated, and as good gravels have also been found in pit 3, it proves that the rich paystreak continues all down the channel. The width of the channel has been shown to be much greater than was expected, and this increased width has given an increased height of bank to wash.

After two years' prospecting, it is shown that the value of the gravels is from 12 to 25 cents per cubic yard, and the management is entirely satisfied with the results of operations and the future possibilities of the mine.

The work done during the year is summarised as follows:—

Two new large monitors, two water gates, and 600 feet additional pipe have been brought into the mine and installed. Two new pits have been opened, making four now ready from which to take gravel, and a monitor placed so that a fifth can be readily started. Cuts made and sluice-boxes set. Flume refixed so that it will now run water continuously without having to stop for repairs. Rich paystreak in the bottom gravels proved to be obnoxious wherever the channel has been opened. Some of the top gravels as high as 80 to 120 feet above bedrock run off and shown to pay for taking down, and a great deal of bottom gravel made ready for taking out. It has been shown that gravel of a low grade, if economically washed, can be mined here at a good profit. The report deals in detail with questions of water supply and points out the importance of this factor in regulating the output of gold.

Mr. Hamfield left with the Provincial Mineralogist a small sample of the platinum sand which he had collected from the undercurrents, and from the black sands in the sluice boxes. This sample was, of course, a concentrate, and it was analysed by the Provincial Assayer, Mr. Carmichael, who reports as follows:—

No. 2,923—Concentrates from Thibert creek, Cassiar:

Platinum =	12,864.5 oz. troy per ton =	44.1 %
Osmiridium =	3,475.5 " " =	11.9 %
Total.....	16,340 " " =	56.0 %

Little or none of this sand is saved, which seems a pity, considering its great value.

A company of Scotchmen has been engaged during the past three summers trying to bottom deep ground on Little Deloire creek, which is a tributary of Thibert creek. So far they have not been successful, but they have faith in the ground and intend to try it again next season.

Nothing other than the usual amount of assessment work necessary to hold them has been done on any of the mineral claims in this District during the season, and there has been only one new location recorded.

As near as I have been able to ascertain, the output of gold for the season does not exceed \$16,000. This includes all divisions in the District. I hope and expect to see a marked improvement in mining activity in the District before a corresponding date next year.

NORTHERN PORTION OF CASSIAR DISTRICT.

(INCLUDING TESLIN, LLARD AND STIKINE MINING DIVISIONS.)

Under date of the 30th December, 1903, the Gold Commissioner of the District, Mr. James Porter, reports as follows:—

I am not able to report a very marked improvement in the mining industry, although when comparing the season's operations with those of the past year (1902) an advance is perceptible, as shown by the yield of gold, which may safely be placed at \$35,000 for 1903, an increase over last season's output of nearly \$20,000.

In the early part of the summer two miners from Atlin outfitted at Telegraph Creek, and with the aid of pack-horses proceeded over what is known as the Ashcroft trail to the Second South Fork of the Stikine river, spending some time there in prospecting for gold. When they returned in the fall they did not record anything, but they seemed to be very well satisfied with the country, for they assured me that they intended returning there better equipped as soon as it is possible to travel next spring. The locality is one that has so far received but little attention, and it is to be hoped that it will in time prove to be of some worth. Other than this, but little outside prospecting has been undertaken here this season, the prospectors as a rule, having confined their labours to the already discovered localities.

One creek and five hydraulic leases have been granted during the season, but not yet executed. They are situated on Dease creek, near its entrance to Dease lake. The ground covered has since early days been considered rich, but owing to the many obstacles standing in the way, such as drainage, the excessive expense that would necessarily have to be incurred in reaching the locality with suitable machinery, &c., &c., it has remained idle all this time. I feel confident that when machinery can be put on the ground for anything like reasonable cost there will be a large amount of gold taken from the hills that now hide the old channels of Dease, Thibert and McDame creeks.

THIBERT CREEK HYDRAULIC MINE.

NOTE BY PROVINCIAL MINERALOGIST.—Mr. Alex. Hamfield, the Manager of the Thibert Creek Hydraulic Mine, has kindly placed his official report of the season's work at the disposal of the Provincial Mineralogist, and by permission the following extracts have been made therefrom:—

"The Thibert Creek Mine is on an old river channel on the south side of the modern creek following the same general direction west to east. From the junction of Berry creek for about two miles it has not been touched by the present stream, but remains intact, and here is situated the seven claims, each 1,500 feet long, or a total of 10,500 feet, which comprise the mine. It is hard to give any exact measurements of its width and height, but judging from where we have worked at the upper end, and where the channel has been exposed in two places at its lowest portion I should estimate it to have an average width of 400 feet, and a height which of course varies greatly in places, of something over 100 feet. Our work has been done on one of the most difficult portions of the channel, the banks now being 150 feet, where a large part of the overlie was composed of mud and boulder clay. This latter does not occur anywhere else, gravel taking its place.

"The present water supply comes from Berry creek, which carries from 2,000 inches during the spring freshet and as little as 500 inches in extreme low water. Besides these there are four more—but smaller—water rights granted by the Government, not yet utilized. The water is carried to the mine from Berry creek, by a flume $1\frac{1}{2}$ miles long. Its size is 30 inches

by 30 inches, on a grade of 40 feet to the mile, with a capacity of 1,000 miner's inches in 24 hours, giving a head of about 300 feet from intake of pipe-line to the bedrock in the mine.

"The height of bedrock in the old channel to the modern creek is 85 feet at the upper end of the mine, and increasing down stream. The valley of the present Thibert creek is from 100 to 600 feet wide, and as the mine is opened up by cuts into the side of the old channel, there is always plenty of dump for tailings and grade for cuts. The cuts through which the gravel is washed are at present three, in which the sluices for the saving of gold are cut. The latter are 5 feet by 3 feet, paved with wooden blocks 12 inches high, and run on a grade from 9 to 11 inches.

"The equipment consists of: 2,000 feet of No. 13 B. W. G. pipe graduated from 14 to 10 inches, with necessary elbows and Y branches; two No. 2 monitors; two No. 4 monitors (ball bearing); two valves for 12-inch pipe; two valves for 10-inch pipe; five rock cars; one mill, capacity 6,000 feet per day; one 20 horse-power boiler; one 15 horse-power engine; one blacksmith outfit; a certain quantity of lumber, hardware and supplies, and a few buildings. One miner's inch = about 1.5 cubic feet of water per minute. One working day means 24 hours.

"During the two previous years washing was carried on for about 100 days, with from 300 to 500 inches of water—450 inches can probably be set down as a fair average per day—and during this time \$13,500 worth of gold was recovered, or 30 cents per miner's inch. This is less per inch than recovered this season, but when we remember that during a great part of this time the water was used for opening up the mine, it can readily be accounted for. When starting on a side hill, as we did, where no previous work of any kind had been done, it will be easily understood that water can not be utilised to its best advantage, and that when as small a head as 200 inches is used, the efficiency of the inch is immensely reduced. It is almost impossible to give a correct estimate of the cost of production during this time, as it was so much mixed up with the cost of construction and other work. However, the running expenditures were about covered by the \$13,500 gold taken out.

"Statement of operations for the year 1903: Number of days worked (1 day = 24 hours), 74; amount of water used per 24 hours, 475 miner's inches; total of water used during season, 14,550 miner's inches; amount of gold recovered during season, \$*; working cost for one year, \$17,400; profit per one year, \$*; working cost for \$1 of gold recovered, \$0.83; profit for \$1 of gold recovered, \$0.17; amount of gold recovered per miner's inch, \$0.45; working cost per miner's inch, \$0.37; profit per miner's inch, \$0.08; approximate amount of gravel washed, cubic yards, 162,925; approximate amount of gravel per miner's inch, cubic yards, 13; approximate value of gravel per cubic yard, \$0.13.

"The shortness of the season's run—98 days—is accounted for by two facts. First, because the pipe-line not being laid, machines or valves not set, washing operations could not commence until June 13th. Second, because after the last clean-up, which took place the first day of October, we did not desire to incur any more expense for this season, from which profit could not have been derived until next year, and therefore we closed down earlier than necessary.

"If the mine were put into proper working shape, it would be quite possible, when pipe-line and machines are in place, to commence washing not later than May 20th. It will always be necessary to have the final clean-up about October 1st, as, on account of cold weather,

*NOTE BY PROVINCE MINERALOGIST.—The amount of gold recovered and the profit made are withheld, inasmuch as the property is worked by a private syndicate to which alone this information belongs. I am unable to say, however, that a material profit was made, which, considering the conditions, was a very fortunate one.

bedrock and cuts cannot be picked or cleaned to advantage after this date, but there is nothing to prevent the washing of gravel to continue until the 20th of November. The best plan to adopt would be to so arrange it that the first two weeks in the season were devoted to washing off the top dirt. This would only require a few men, who could be picked up in the country. When the bulk of the working crew came in, which would be in the commencement of June, the heavy ground (bottom with boulders), should be attacked. After the last clean up, this crew could then be sent out, and only the original men retained, when the last two weeks would again be devoted to running top gravels. It would thus be possible to get a working season of 150 days with the smallest amount of expense.

"The small amount of water used (475 miner's inches per 24 hours) was caused partly because half the time we were obliged to work with only one of the small monitors, and partly from the fact that the season's water supply was very short. We have two large monitors, capacity 600 inches each, and two small ones, each 400 inches. By being compelled to work the small ones half the time, we, of course, lost a great deal of water during the time when the supply was good. In my five years' experience in the country I must admit that this has certainly been the worst one for water, and even old inhabitants, who have been here for 25 years, say that it has been the driest they have known. This is very unusual for this country, as the watershed here can really be considered very good. It is to be remembered that so far we have done almost nothing to improve the water supply in Berry creek, either by leading other creeks into it, or by building dams so as to preserve what water there is, but are entirely dependent on the natural flow. Therefore, a great deal, from two to three times as much as we can use, goes to waste during the first two months of high water, and even later in the season when we have rains we can, of course, only use a 'head,' and the balance has again to run down the creek. Our present supply (475 miner's inches) is not altogether inadequate, when we have to wash banks as high as 150 feet. For this purpose we ought to have not less than 1,000 inches and as much more as can be got. There are three different propositions for supplying the mine with water, each one quite feasible from a topographical standpoint and within the limits of a reasonable expenditure of money. By having longer sluices and perhaps a series of undercurrents a closer saving of the gold could be effected.

"No saving was attempted of the osmiridium of which there is a certain amount present. This should and could easily be remedied if the mine were put in a better working shape, for it is often in the close saving of gold that profit becomes possible.

"Although operating with an entirely insufficient supply of water during a very short season, and labouring under other disadvantages, such as bad grades, we have still managed to make a small profit. If the mine was worked on a scale commensurate to its size there would be effected a very large saving in the expenses for each dollar of gold produced, so much so that this saving would in itself be a very good profit, even if none had been made under present conditions. The body of gravel is quite large enough to ensure the life of the mine for a lengthy period, even when worked on a large scale."

A very large portion of the Cassiar District is but little known, and there exist new fields for the prospector that have never yet been entered by white men. The great necessity of the district is the advent of railways and transportation facilities.

Nothing other than the usual amount of assessment work necessary to hold them has been done on any of the mineral claims in this district during the season, and no new locations have been recorded.

Four samples of black-sand concentrates submitted by Mr. A. E. Austin, from Strathcona, Alberta, in 1918, gave the following assays:¹

- (1) Gold, 26.01 ounces a ton; platinum, 0.21 ounce a ton.
- (2) Gold, 12.04 ounces a ton; platinum, 0.15 ounce a ton.
- (3) Gold, 19.89 ounces a ton; platinum, 0.16 ounce a ton.
- (4) Gold, 33.56 ounces a ton; platinum, 0.21 ounce a ton.

W. L. Uglow (1920) carried out a series of drill tests of the Douglas gravels, 15 miles northeast of Edmonton, for the Munitions Resources Commission in 1918, and submitted twenty-two samples of black-sand concentrates to the Dominion Assay Office, Vancouver. All but one of these samples showed some platinum, but only three ran 0.1 ounce a ton or better; half of them showed merely a trace of platinum. The highest total value in gold and platinum a cubic yard of gravel was 11.64 cents and fourteen holes averaged under 1 cent. Owing to the disappointingly low results of the assays, the work was discontinued.

BRITISH COLUMBIA

Platinum has been noted in numerous localities in British Columbia, both in solid rock or lode deposits, and in placers. There has, for many years, been a small but continuous production from placers in Similkameen district, and a more or less sporadic recovery of small amounts from placers in other parts of the province, as on Quesnel and Fraser Rivers. In recent years, some palladium and a little platinum have been recovered as by-products of refining lead-zinc ores at the Trail plant. Production from this province during 1928 was as follows:

	Platinum	Palladium
	\$	\$
Fialay River, Omineca mining division.....	76
Tulameen River, Similkameen division.....	2,743
Trail plant.....	1,730	22,270

For convenience, the descriptions of occurrences are here arranged under the mining divisions in which they occur and progress through the province from northwest, to northeast, to central, to south-central, to southeast, and finally to southwest. Occurrences in placers on Fraser River are all described, in order not to separate them, at the end of the section on placers.

Placers

LIARD MINING DIVISION

Thibert Creek

Thibert Creek flows from the west into Dease River at the outlet of Dease Lake (Johnston, 1925; Kerr, 1925). Gold was discovered on it in 1873 and since that time much work has been done on the lower 8 miles

¹ Assays at the Dom. Assay Office, Vancouver.

of the valley. Very little gold has been found above Berry Creek and most of the production has been from an old channel on the south side of the present stream. Extensive hydraulic operations have been carried out at and below the mouths of Berry and Boulder Creeks. The richest gravels in the old channel are only a few feet thick and rest on bedrock. They are cemented in places and are probably pre-Glacial (late Tertiary) and are covered by 100 feet or more of glacial or interglacial gravels and boulder clay, in which small amounts of gold are also found. Platinum occurs in the gold-bearing gravels on Thibert Creek, but is not known elsewhere in the district.

The only recorded attempts to determine and save the platinum values were made in operations in the old stream channel immediately below the mouth of Berry Creek. At this place the old channel averaged about 400 feet in width. In 1900 the Thibert Creek Hydraulic Mining Company set undercurrents in their sluice boxes to recover the fine gold, but the recovery did not pay for installation and working. However, the black sand remaining in the sluice boxes and undercurrents was known to contain platinum and a sample was saved and later analysed by the Provincial Assayer, who reported as follows (B.C. 1902, pt. H, page 44):

"Contents from Thibert Creek, Cassiar

Platinum.....	-12,864.8 ounces troy per ton...	-44.1 per cent
Osmicidium.....	- 2,475.5 "	-11.9 "
Total.....	15,340 ounces per ton.....	-56.0 "

"Little or none of this sand is saved, which seems a pity, considering its great value."

The water supply of about 450 inches was not considered sufficient for economical working, so in 1904, when the property was taken over by the Berry Creek Mining Company, an additional supply of water was brought in from Dease Creek. Mr. Hamfield, who continued as manager, conducted experiments to find out whether the platinum minerals were present in sufficient amount to be of importance. He reported as follows (B.C., 1905, pages 77-78):

"Experiments were made to concentrate the black sands containing minerals of the platinum group. For this purpose an undercurrent, and a series of tables covered with cocoa-matting, canvas, and burlap, were installed at the end of No. 2 sluice.

"Although it was this year largely experimental, the mechanical concentration was quite satisfactory. During the twenty-one days that the concentrating plant was in operation, it yielded 250 pounds of concentrates, and this amount could have been greatly increased by a man in attendance with some experience in concentration.

"Assays of these concentrates, made at the B.C. Government Assay Office, gave 60 ounces of platinum to the ton of concentrates and assays obtained in San Francisco gave up to 15 ounces of platinum and 7 ounces in gold per ton. These results were obtained almost entirely from top gravel, and as the bottom gravels will naturally contain more of the heavier minerals, the concentrates from the latter should be very much better than this year's output."

creek just above Bucks gulch. Another is on the north side about three-fourths mile upstream. A third, which, however, has been largely cleaned off, is on the north side between Bucks and Lyons gulches. The benches are probably the upstream continuations of the McCrimmon channel. They were not specially examined and the extent of the minable ground by hydraulicking is not known. A difficulty is that the benches occur on both sides of the creek and are not very extensive at any one locality. Facilities for disposal of the tailings are not so good as lower down on the creek because the benches are considerably lower. G. M. Dawson¹ stated regarding mining in the early days on the upper parts of the creek, "a few isolated good claims were found, particularly the Cariboo Company's claim, 8 miles up, from which much heavy gold was obtained. This claim has been worked over four times."

THIBERT CREEK

Thibert Creek delta (Figure 5) is much larger than that of Dease creek, although the creek is only a little larger, the reason being that the delta was built into the valley at the foot of Dease Inke, which was already partly filled with glacial drift. Two "islands" of glacial drift occur in the delta and rise 50 to 100 feet above the general surface. The inner part of the delta is in the form of an alluvial fan, the highest part of which, where the creek issues from a rock canyon, is 46 feet above the lake. There is a drift-buried channel of the creek on the south side of the canyon, that probably has nearly the same depth as the present channel and is separated from it by low rock outcrops. It leaves the present channel about 800 feet upstream from the mouth of the canyon. The ground in the present channel in the canyon as shown by borings has a maximum depth of about 35 feet. There is a drift-covered rock bench on the north side at the canyon that is nearly 200 feet above the level of the creek and marks an old channel of the creek where it flowed at a much higher level. This old channel is cut off abruptly by the deeply eroded Dease Lake valley. Rock benches 5 to 50 feet above the level of the creek occur in places on one side or the other up to the mouth of Deloire creek. In this stretch the highest rock bench has been mostly cut away. The rock benches, even the lowest, are or were, before mining was done, covered with at least a thin veneer of glacial drift.

The part of the creek valley (Figure 4) between the mouth of Deloire creek and the mouth of Berry creek 8 miles upstream is, for the most part, broad and 300 to 500 feet deep. Rock benches marking the old high-level channel are continuous along the south side for long distances (Plate I B). Small remnants of the old channel occur on the north side about one-half mile above the mouth of Deloire creek, and just above the mouth of Five-mile creek. The old channel has a lower gradient than that of the present stream. At the mouth of Berry creek the old channel is 90 feet above the level of the creek; one mile below the mouth of Five-mile creek it is 190 feet above the level of the stream. In the lower part of the creek, where there are only a few remnants of the channel, the gradient is about the same as that of the present stream. The old channel crosses a rock point near the creek just above the junction of Berry creek and farther upstream

¹ Geol. Surv., Canada, Pub. No. 629, p. 77.

gradually descends to near the level of the present stream, but is mostly cut away. Small remnants occur on the north side $\frac{1}{2}$ to 1 mile above the junction of Berry creek. The old channel has been hydraulicked out for 1,000 feet downstream from the mouth of Berry creek, at the mouth of Boulder creek, and for 2,500 feet downstream from this creek. The longest, continuous, preserved stretch of the old channel is below the mouth of Fivemile creek where it extends behind a high, rounded rock hill and continues down stream nearly parallel to the present creek. It appears to come out into the present valley near an old cabin on a forked creek $1\frac{1}{2}$ miles above the mouth of Deloire creek. If so, the stretch is about 4,600 feet long. The part of the present stream valley opposite the buried channel is a narrow, deep, rock canyon. The old channel was mined over in part, if not throughout its length, by drifting. The old mine at the upper end of the channel was known as the Blue Bell.

The geological history of the creek is probably very similar to that of Dease creek as already recounted. The fact that the old stream channel of Thibert creek where it is cut off abruptly by Dease Lake valley is 200 feet above the level of the lake, whereas that of Dease creek is only about 100 feet, seems to show that the main stream in Dease Lake valley flowed south, that is the drainage in the main valley into which the ancient streams of Dease and Thibert valleys flowed was in the opposite direction to what it is now. The facts that the rock bottoms of the present streams at their mouths, as well as the old high-level channels, are hanging with respect to the main valley and that Dease Lake basin has a maximum depth of nearly 400 feet show that nearly all the deepening of the main valley below the present lake-level was probably due to glacial ice erosion. If the valley had been formed by stream erosion it must have had an outlet as low as the deepest part and the tributary streams would have been at least fairly evenly graded to the bottom of the valley. But the valley is only a mile wide, so that the tributary streams would have extraordinarily steep gradients in their lower parts. It seems improbable that there is any drift-buried outlet channel as low as the deepest part of the lake basin, although this is not definitely known. In any case it is possible that the buried channel at the south end of the lake, which extends through to Tanzilla valley, was also deepened by ice erosion. All the stream valleys tributary to Dease Lake valley are hanging with respect to the main valley, but some of the streams tributary to Dease River valley, for example Beady creek a short distance below the foot of the lake, are graded to a somewhat lower level than the present valley flat. These valleys are mostly in Cassiar mountains and may have been overdeepened by valley glaciers. Deepening of the main valley by stream erosion would have caused the tributary streams to be graded to the bottom of the main channel; ice erosion of the main valley would have left them hanging as they are. The only other possible cause for the overdeepening of Dease Lake valley is faulting. There is no evidence of faulting at the mouths of Dease and Thibert creeks and it is very improbable that faults occur along both sides of the lake and were of such character that downfaulting of the whole lake basin occurred so uniformly.

The main significance of these partly hypothetical considerations, so far as the occurrence of placer gold is concerned, is that rich pay-streaks

are not likely to occur in the bottoms of the glaciated river valleys and that bedrock in the deltas of the creeks is likely to be at a considerable depth. On the other hand there is the remarkable fact that the old high-level channel of Thibert creek is preserved for considerable stretches in spite of the effects of glaciation. The bedrock in the new channel is fresh, whereas that of the old channel is deeply weathered, and in places in the bottom of the channel partly cemented gravels occur, which are probably preglacial in age. The old channel was partly filled with glacial drift and as pointed out in the case of Dease creek was protected from erosion by the ice, because the glaciers moved across and not down the valley. That the old channel is the source of most of the placer gold on the creek is shown by the fact that no paying deposits of gold were found in those parts of the present creek alongside of the stretch where the old channel is intact, but were found in the parts where the channel has been partly or entirely cut away by the present stream.

The total production of gold from Thibert creek is about the same as that of Dease creek. Very little gold was found on the stream above the mouth of Berry creek, and unlike Dease creek most of the production was from the benches or old channels. Bedrock is exposed in the bed of the creek at only a few places. There is now a considerable filling of tailings in most parts of the creek below the mouth of Berry creek and even on the delta. The ground, before hydraulicking began, was somewhat deeper than on Dease creek and it is an open question how much of the bed of the stream was mined by wing-damming. It is probable that most of the rich parts were mined in this way, but there is a short stretch in the canyon at the mouth and above it which may not have been mined because of the volume of water in the creek even at low water. The creek appears to be as large—8 to 10 miles—upstream as it is at the mouth and it is probable that there is a considerable underground flow of water in the lower part.

The absence of placer gold in the upper parts of the creek above the mouth of Berry creek is probably due to two factors: (1) the gold was derived locally and the bedrock in the lower part of the creek valley contained more gold-bearing veins than in the upper parts; and (2) a valley glacier moved down the valley nearly to the mouth of Berry creek and transported downstream or mixed with the glacial drift any old placers that existed in the upper parts of the creek.

Mining by drifting of the buried channel on the south side of the canyon at the mouth of the creek (Figure 5) is being attempted by Thomas Hebson and William Noel. The upper part of the ground was drifted in the early days from the White tunnel. An inclined tunnel at Hebson's cabin 1,000 feet south of the mouth of the canyon was run, but did not reach the channel. An attempt by Hebson to deepen the incline failed because of water pressure. At present an inclined tunnel is being run just south of the rock rim of the channel at the mouth of the canyon. During the freshet the workings are flooded. It is proposed to install a pump to drain the ground. Whether the ground can be drained sufficiently to permit of mining depends on whether the materials between the channel and the creek are sufficiently impervious to prevent rapid inflow of the creek water. The materials filling the channel are glacial sands and gravels with some silt and clay. The part of the channel that remains to be mined

is 300 to 500 feet long; the part that was mined is said to have yielded well. A shaft 1,000 feet northeast of the tunnel was sunk 31 feet by Hebson, but no pay gravels were found.

The delta flats and the lower part of the creek are held under dredging leases by the Cassiar Dredging Company, Limited. In 1913 three borings to determine the depths and value of the ground for dredging were made by W. M. Ogilvie. The deepest of these holes, which was located about 500 feet upstream from the mouth of the canyon, is said to have been 33 feet deep and to have shown values of 60 cents a yard. The other two are reported not to have reached bedrock, but to have shown about the same average values. There is a stretch of the creek 5,300 feet long from the mouth of the canyon up to where the rock rims of the creek are only 65 feet apart. Taking the average width of the pay in this stretch as 100 feet, the average depth as 27 feet, and the average value as 60 cents a yard—probably much too high averages—the total value of the ground would be \$318,000. The ground, therefore, is not sufficiently extensive to justify the installation of a dredge. There is a large area of ground in the delta which probably contains a little gold. The results of borings in the Dease Creek delta, however, do not favour the view that the ground is rich enough to pay for dredging. Moreover, there would be difficulties in dredging because of the presence of buried timber. Deltas and alluvial fans are not very favourable places for the occurrence of paying deposits of placer gold, for only the gold fine enough to be transported by the stream is deposited, the stream tends to shift its course from one part of the fan to another so that there is little opportunity for concentration of the gold by erosion of the deposits, and practically no gold is deposited below the level of the water body into which the delta is built. All the gold in Dease and Thibert Creeks deltas has been deposited post-glacially and because of the short period of time involved—only a few thousand years—and the lack of extensive erosion of the stream channel, it is not to be expected that paying deposits occur in the deltas, except possibly near the heads of the alluvial fans.

Mining in the stretch of the creek valley from the mouth of Fivemile creek to the mouth of Berry creek (Figure 4) has been done by hydraulicking on a fairly large scale and by drifting in the early days. Practically the whole of the old channel on the south side of the creek in this stretch has been hydraulicked out. The part of the channel (described above) below the mouth of Fivemile creek forms the only remaining hydraulic ground of importance on the creek, except that at the mouth of Deloire creek. The channel at the summit opposite the high, rounded hill 1,000 feet below the mouth of Fivemile creek is filled with glacial drift to a maximum depth of about 215 feet. Much of the material at the surface is boulder clay; but no good sections are exposed. Judging by the sections in the old hydraulic pits it is probable that the boulder clay is of no great thickness and is underlain by glacial gravels. ~~The average gold values in the ground are not known, but the drift mining in the early days is said to have paid well and, therefore, it is generally held that the ground still contains considerable gold.~~ In attempting to determine whether the ground is worthy of investigation as an hydraulic proposition it is important to consider the history of hydraulicking of the nearly similar ground higher up on the creek.

Hydraulicking by several companies was done during fifteen seasons, or parts of seasons, from 1901 to 1922. Water from Berry creek, amounting to about 500 inches, was obtained at first. This proved insufficient and in 1906 additional water from the second fork of French creek and from the second tributary of the north fork of Dease creek was diverted into Berry creek by a ditch 2 miles long. One of the best water supplies obtainable anywhere in the district, amounting to about 1,000 inches, was thus secured. The total amount of gold recovered was about \$160,000 and the total expenditure was at least \$250,000. In only a few years did the value of the gold recovered exceed the operating cost, which amounted on the average to about \$10,000 a season. Judging by the size of the excavations approximately 3,000,000 yards of ground, including slides, was handled. The average value of the ground, therefore, must have been very small. The manager reported¹ that in 1915, 452,777 yards of ground was handled, but the gold recovery was only about \$25,000. Testing of parts of the ground, before work was begun, seemed to show that it would average about 50 cents a yard, but the extra amount of ground that had to be put through the sluice-boxes because of slides into the pits was not taken into consideration. It is probable, however, that, regardless of the slides, the average value was considerably less than 50 cents a yard. There were other difficulties. Because of the steep slopes a flume instead of a ditch was necessary for the whole distance from Berry creek, about 3 miles. It proved expensive and difficult of upkeep at first, because of settling when the frost went out of the ground, and later when slides occurred. If an efficient water supply had been obtained in the first place and care taken to avoid the ground susceptible to slides, it is possible that the work would have paid, although the profit in any case would have been very small. The cost of transporting heavy machinery, about \$270 a ton from the coast to the mine, was excessive. It is only slightly less at the present time.

The ground in the old channel below the mouth of Fivemile creek, if hydraulicking be attempted in it, probably would be affected by slides to a somewhat less extent than the ground in the old hydraulic pits above, because the channel is enclosed in places by rock sides. The length of the unworked part of the channel is about 1,000 feet longer than the parts hydraulicked out above the mouth of Fivemile creek. In order to make the work pay the value of the ground would have to be considerably higher than in the parts already hydraulicked, which does not seem very probable, but the question can be determined only by systematic drilling. Water for hydraulicking would have to be obtained either by reconstructing the old flume from Berry creek and extending it a mile or more downstream or by a pipe-line or flume from Thibert creek itself. There would be difficulty in reconstructing the flume, because slides have removed it in places and left very steep banks, and because of the scarcity of trees for lumber in the vicinity. The sawmill used by the old companies was, for a time, located on Berry creek, but was removed to the point on the east side of Dease lake above Porter landing, where standing timber was more abundant and where it remains in a partly dismantled condition. Lumber is said to have been produced at the mill at a cost

¹ Ann. Rept., Minister of Mines, B.C., 1915.

The following season brought fewer miners and conditions were generally better. Walsh and Rogers came in over the Ashcroft trail from Fort Fraser with 300 head of cattle. The total production of gold was almost up to the million mark of the year before and most of the claims were yielding from 1 to 3 oz. to the man.

Following the death of Mr. Sullivan on the steamship "North Pacific," A. W. Vowell succeeded to the office of Gold Commissioner in 1876. At that time there were twenty-five recorded claims on Dease creek; about half a dozen on McDame and forty-four on Thibert, with twenty-five men at work on Berry creek and twelve on Boulder. The Telegraph Creek trail was now employing 430 pack-animals and more were expected. The cost of packing was reduced to 15 cents that year. It was still further reduced in 1877 and in 1878; when the steamer "Lady of the Lake" was put into service it dropped to 7 cents and even lower.

THE DECLINE.

But there were far too many miners for the country to support and the claims, most of them, were paying little better than wages. In 1878 the population stood at 1,500, a third of whom were Chinese, who generally worked the ground which the white man had worked and abandoned. Other creeks were found, enjoyed a brief notoriety, and were left. Most of the prospectors continued work on Dease, McDame, and Thibert. By 1879 it was known that the diggings were becoming worked out and the population commenced to fall off. Perhaps other strikes elsewhere, like Granite creek in 1885, or the beginnings of lode-mining in 1886, made possible by the coming of the Canadian Pacific Railway, enticed the miners to more profitable fields. When the Cassiar country was visited by G. M. Dawson in 1888, most of the claims were not even paying wages, although the population had dwindled down to but 125 and nearly all of these were Chinese. In 1895 there were a dozen white men and fifty Chinese on the creeks and production had fallen to scarcely more than \$22,000.

PRODUCTION OF GOLD IN LIARD MINING DIVISION.

The sudden rise and gradual subsidence of gold production during the period is shown by the tabulation below:

Year.	Dease.	Thibert.	McDame.	Various.	Total.
1874	\$400,000	\$400,000	\$200,000		\$1,000,000
1875	350,000	150,000	300,000	\$30,000	830,000
1876	160,300	189,700	163,700		463,700
1877	81,200	178,700	144,800		399,800
1878	62,800	65,600	101,300	200,000	519,700
1879	56,000	71,000	118,200	165,000	405,200
1880	60,900	67,900	120,000	60,000	298,800
1881	37,600	29,900	95,000	36,500	198,900
1882	29,000	59,600	70,500	43,700	182,800
1883	14,000	22,000	65,000	11,000	119,000
1884	10,000	30,000	49,100	12,500	101,600
1885	12,400	12,600	16,500	9,200	60,700
1886	21,500	14,200	20,800	7,400	63,700
1887	18,400	10,000	22,800	4,000	55,200
1888	13,600	6,700	19,000	4,000	43,300
1889	11,200	10,800	28,400	4,500	54,900
1890	12,000	10,000	18,000	4,000	44,000
1891	12,000	10,000	13,000	5,000	40,000
1892	8,700	6,500	8,500	5,300	29,000
1893	6,500	4,400	8,800	3,200	22,900
1894	8,300	4,000	9,700	700	22,700
1895	8,500	4,000	8,600	600	22,600
	\$1,894,900	\$1,279,600	\$1,397,500	\$696,500	\$4,698,500

From 1896 to 1915 \$410,040 was produced, of which \$121,250 came out of Thibert creek.

These figures have been taken mainly from the annual reports of the Gold Commissioners, which appear in the published reports of the Minister of Mines. It should be remembered that gold in its raw, uncoined state is always the medium of exchange throughout placer-diggings. Wages are paid with it, balances with the trader are settled with it, and it is squandered over

HISTORICAL.

THIBERT CREEK.

The story of Cassiar is largely the story of Thibert creek. Two distinct periods are noted. First, the period from 1873 to the eve of the Yukon rush. Those were the days of shallow diggings and the individual miner who needed no other capital than his pan and grub-stake. Second, that period following the Yukon rush and extending to the present—a period that witnessed the passing of the rocker and the wing-dam, the coming of machinery and the hydraulic miner, and the advent of capital and business methods. This latter is more truly the period of the Thibert Creek hydraulic workings.

THE DAYS OF SHALLOW DIGGINGS.

THIBERT'S DISCOVERY.

Prospectors had been taking gold from the sands and bars of the Stikine for more than a decade before the strike on Thibert creek in 1873. But these takings were small and the Cassiar goldfields still awaited their discoverer—a stranger coming from the far Mackenzie. In 1860 Henry Thibert left Minnesota with one companion, intending to hunt and trap along the Mackenzie river for a few seasons, then cross the Rockies and traverse British Columbia to the coast. His journey was one of hardship and privation. In the spring of 1872, having crossed the Rockies during the autumn of the year before and wintered at a Hudson's Bay post on the Deloire, he was in the company of McCulloch, another intrepid explorer, making his way down that stream to the Liard. Together they followed the Liard to the northern boundary of British Columbia and then struck out for the Stikine by way of the Dease river and Dease lake. They spent that winter at Buck's bar on the Stikine, and here Thibert parted with McCulloch in February (1873) to retrace his steps and do a bit of prospecting.

Finally, at the mouth of the creek which bears his name, his efforts were rewarded and he found coarse gold on the bed-rock, running 2 or 3 oz. to the pan at a depth of little more than 18 inches.

Another party, in 1872, left Victoria, deciding to try their luck in that little-known Cassiar country; they were William Moore and his two sons, John and William. The elder Moore was later known as Captain Bill Moore, and I believe the White pass to the Yukon was discovered by him.

Moore and his party met Thibert and McCulloch at the head of Dease lake and went down the lake together. Moore and his sons stopped at the mouth of the first large creek they came to flowing into the lake from the west. Thibert and McCulloch went on to what is now Thibert creek.

THE STAMPEDE.

By August of that year twenty miners had arrived. In Cariboo and in Omineca the miners heard the news and left their diggings. By 1874 the population of the district had increased to 1,600; perhaps 2,000 persons in all visited the country that year. Other streams, now called after their discoverers, were prospected and proved as rich as Thibert creek. Claims on Dease creek averaged \$20 a day to the man. One company took out 200 oz. in a week; another, \$2,700 in five days. A single pan went \$49, while two men together washed 50 oz. in a day. Laketon, at the mouth of Dease creek (or "Laketown," as it was called in the seventies), sprang into being overnight and became at once the centre of the district's activities. During the summer, rumours spread that Thibert creek was "spotted." This led to further explorations and resulted in the discovery of gold on McDame creek, some 90 miles north of Laketon and a tributary of the Dease. Of all the miners arriving in that season, scarcely a hundred remained to face an Arctic winter, and these suffered great hardship from disease and lack of food.

SUBSEQUENT EVENTS.

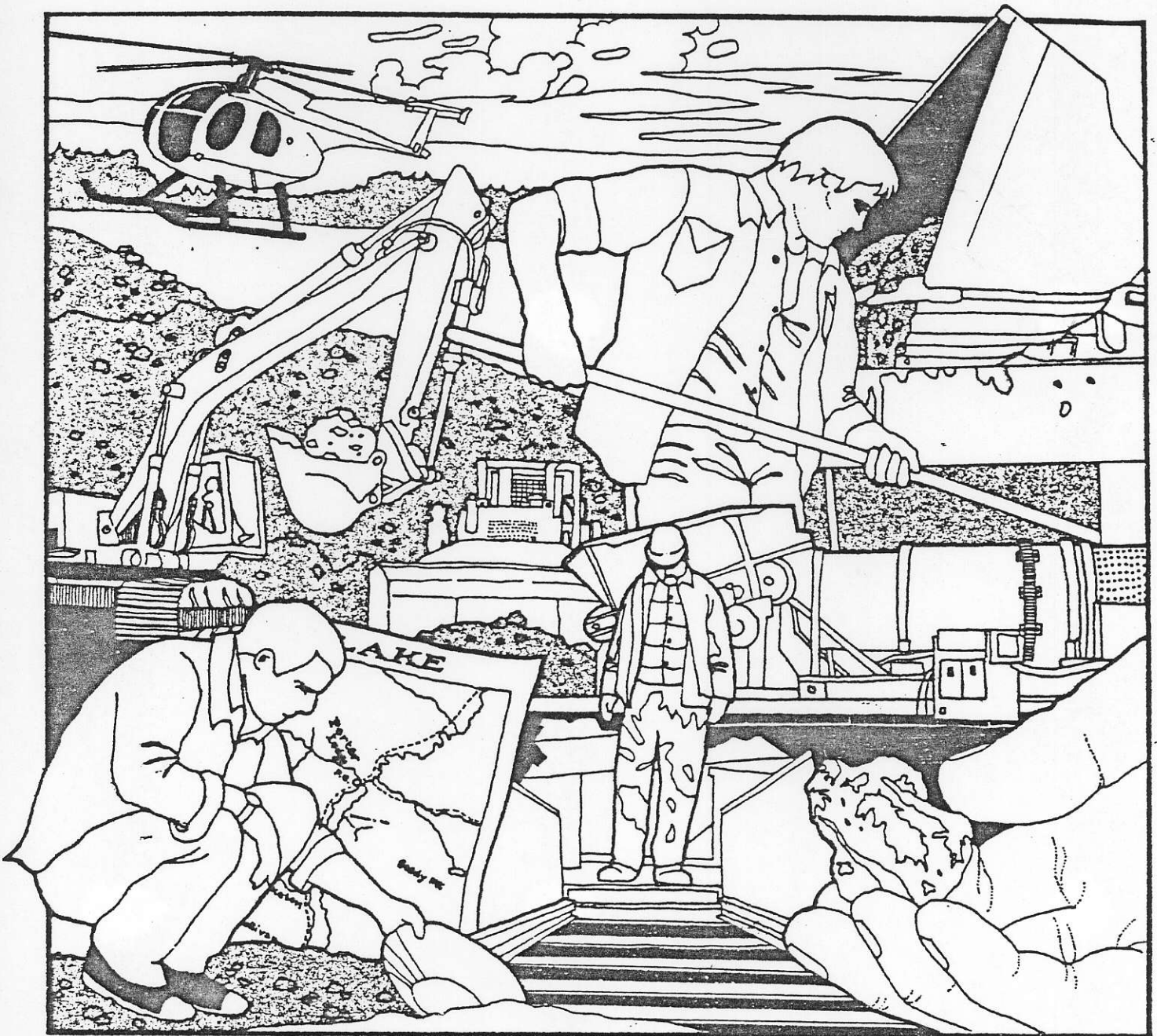
The first Gold Commissioner, J. P. Sullivan, was appointed in 1874, the year of the creation of the Provincial Department of Mines. He issued 825 licences that season and reports especially on the difficulties of the trail and the excessive cost of transportation. The charge from Wrangell to Telegraph Creek was \$110 a ton, and it cost 45 cents a pound to move stuff from there to Laketon. Labour received generally about \$9 a day, but in some cases as high as \$16 was paid where the diggings were remote from the mining camp.

THIBERT PROJECT

PLACER GOLD PRODUCTION PROPOSAL - JANUARY 1984

Dease Valley Mining Company

Dease Lake · B.C.



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