MAP NO:105D/11

ASSESSMENT REPORT: X

PROSPECTUS:

CONFIDENTIAL: X

OPEN FILE:

DOCUMENT NO: 093323

MINING DISTRICT: Whitehorse

TYPE OF WORK:Auger Drilling

REPORT FILED UNDER:B.Scott

DATE PERFORMED:June 1994

DATE FILED:January 25, 1995

LATITUDE:60 38 30

AREA:Whitehorse Copper

LONGITUDE:135 03 30

VALUE:$1600

CLAIM NAME AND #:FYDB 1-16 (YB46593)

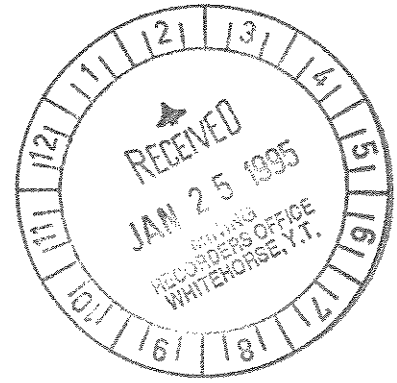
WORK DONE BY:B. Scott

WORK DONE FOR:B. Scott

DATE TO GOOD STANDING	

REMARKS:Seven shallow auger holes were drilled and samples of tailings material from the old Whitehorse Copper Mines tailings pond sampled.

093323



FYDB 1-16 CLAIMS

YB46593 - YB46604 YB46665 - YB46668

105 D 11

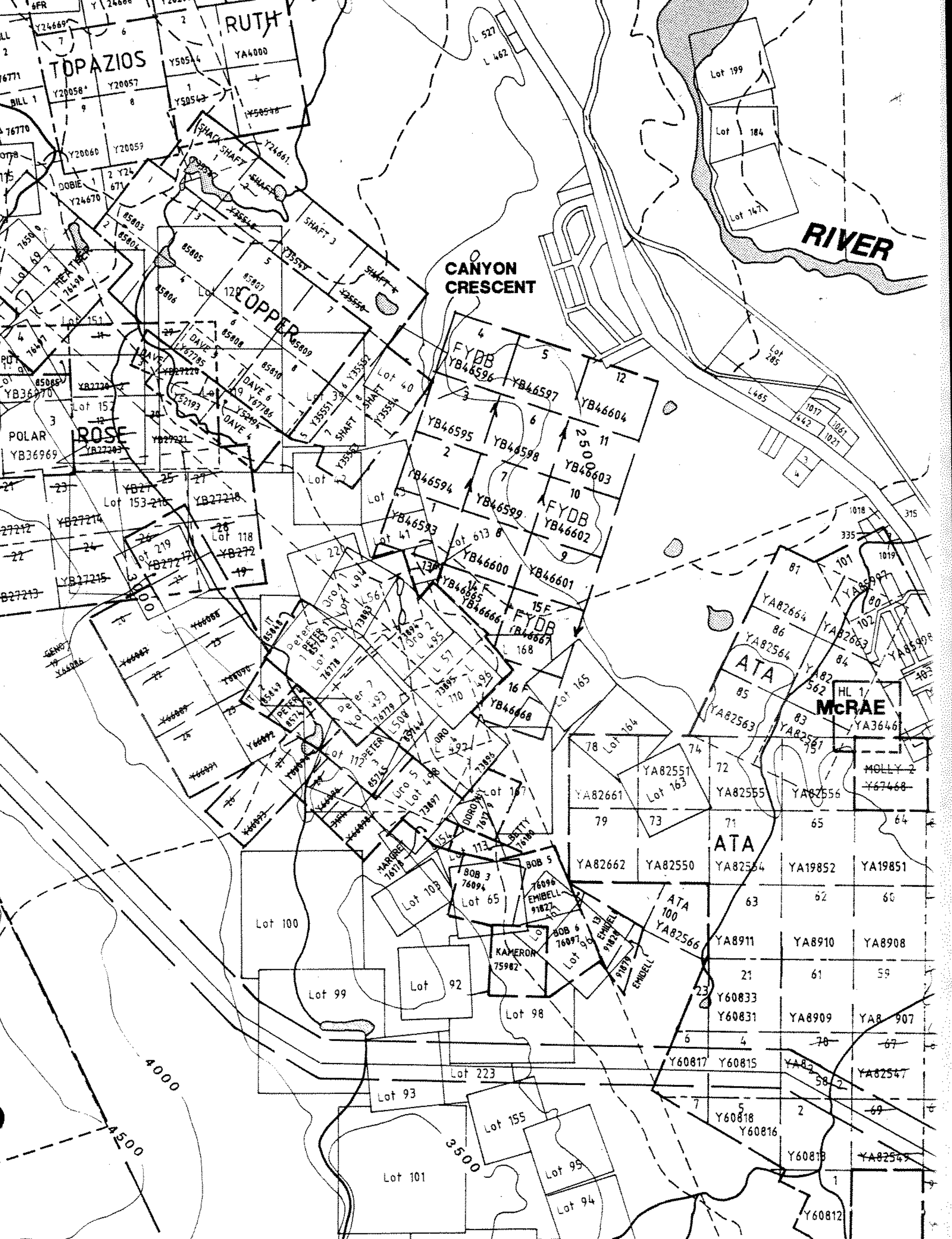
60 38' 30 135 03' 30

REPORT PREPARED BY:

BRIAN SCOTT - CLAIMHOLDER

This report has been examined by the Geological Evaluation Unit under Section 53 (4) Yukon Quartz Mining Act and is allowed as representation work in the amount of $ 1600.

for Regional Manager, Exploration and Geological Services for Commissioner of Yukon Territory.


RIVER
CANYON CRESCENT
TOPAZIOS
RUTH
COPPER
ROSE
POLAR
HEATHER
FYDB
ATA
McRAE
MOLLY 2
Lot 199
Lot 184
Lot 147
Lot 285
Lot 120
Lot 151
Lot 157
Lot 153
Lot 118
Lot 219
Lot 39
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Lot 93
Lot 223
Lot 155
Lot 101
Lot 95
Lot 94
L 527
L 462
L465
L 220
L 168
BOB 3
BOB 5
BOB 6
EMIBELL
KAMERON
MARGRET
DOROTHY
BETTY
PETER
Oro
SHAFT 3
2500
3000
3500
4000
4500

INTRODUCTION:

The FYDB 1-16 claims cover the tailings impoundment area of Whitehorse Copper mine, which has been inactive for approximately 14 years. During this time, the tailings have been tested by different operators for gold and magnetite extraction. Currently, there is renewed interest in reprocessing of mine tailings, using new technology to extract residual mineral values and to alleviate potential environmental concerns.

The current claim holder is evaluating the tailings with a view to developing a reprocessing procedure that will produce multiple marketable commodities.

Based on historical data, Whitehorse Copper's 10,000,000 tons of tailings grade .2% copper, (1) 20% magnetite (2) and contains at least 1500 kg of gold (3).

1994-95 PROGRAM:

To confirm reported values, the 94-95 program consisted of obtaining representative samples for assay. Six grab samples were collected in June 94 from the Old Pond area covered by FYDB 1 - YB46593, FYDB 7 - YB46599, FYDB 8 - YB46600, FYDB 10 - YB46602. Two were submitted (#1 Mag, #2 Pit Tailing) to TSL Labs for 30 element ICP, as well as 28 element Neutron activation. Four grab samples (WC-OP #1, WC-OP #4, WC-OP #5, WC-OP #6) were analyzed for Ga and Co using neutron activation at Lakefield Research. To check

surface oxidation and provide samples from a greater depth, a modest auger drill program was undertaken in January 95. Seven shallow 4" diameter holes were drilled along the pipeline berm on FYDB #8 - YB46600 in the Old Pond Impoundment Area. Assays are pending.

CONCLUSION:

Assays from the 1994 sampling program tend to confirm historic values and also indicate a cobalt content of .02%. Further sampling and metallurgical work is required to prove reserves and to determine how much of the contained values are extractable.

1994-95 PROGRAM COSTS:

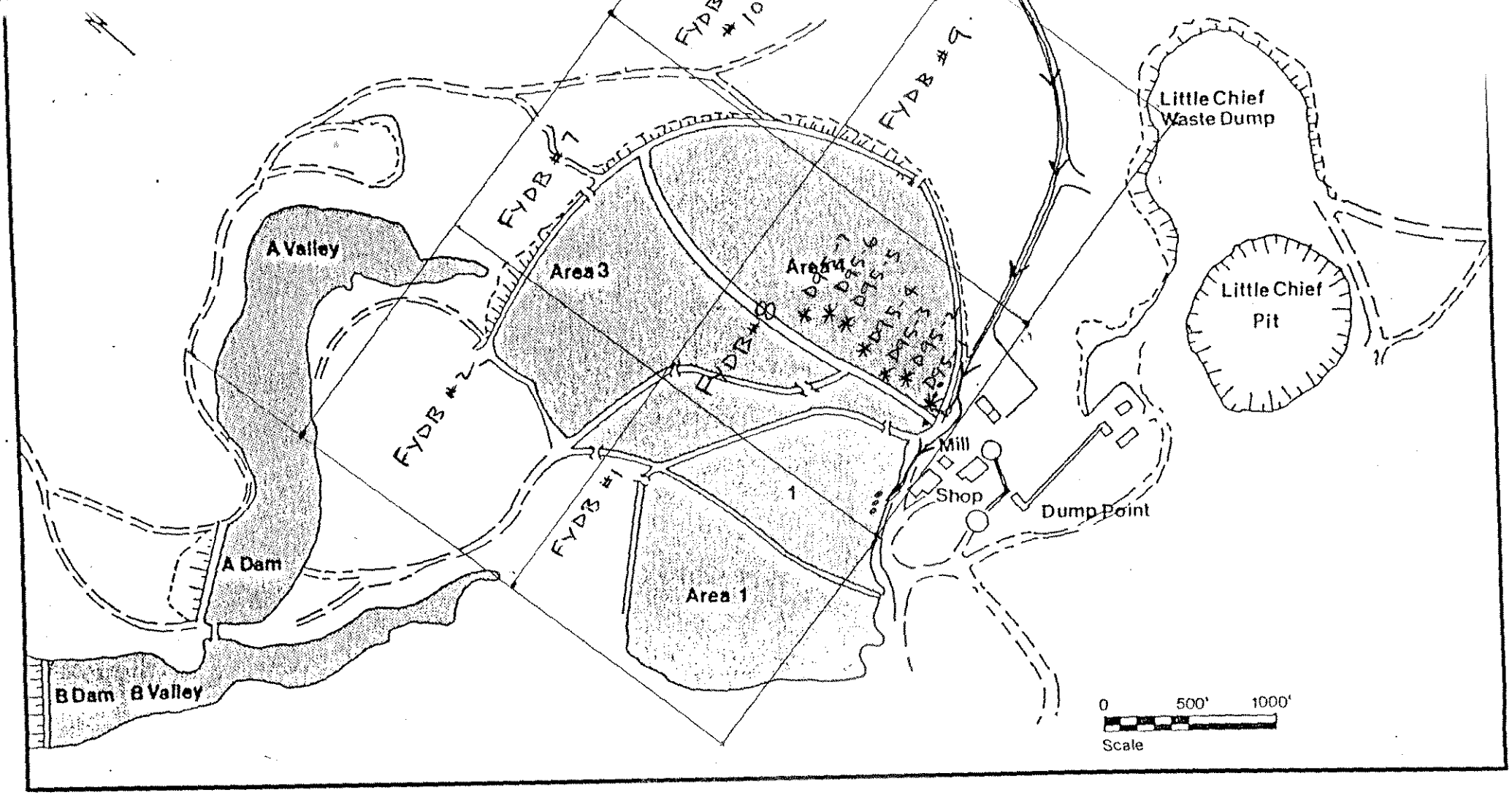
Assays - TSL Labs	$285.79
Assays - Lakefield Research	182.97
Auger Drilling - Total of 74' @ $13.00 per foot	962.00
Report Preparation	200.00
Total	$1630.76

REFERENCES:

(1) The Whitehorse Copper Belt: Mining Exploration and Geology (1967-1980)
by: D. Tenney

(2) Recovery of Magnetite from Whitehorse Copper Tailings
by: Kilborn Ltd. for Denison Mines - 1984

(3) Hudson Bay Mining and Smelting Internal Report
by: Andy Hureau - 1985



1995 AUGER DRILL PROGRAM.

D95-1 : 4" DIA - 10' DEPTH.
D95-2 : 4" DIA - 10' DEPTH.
D95-3 : 4" DIA - 10' DEPTH.
D95-4 : 4" DIA - 10' DEPTH
D95-5 : 4" DIA - 10' DEPTH.
D95-6 : 4" DIA - 12' DEPTH
D95-7 : 4" DIA - 12' DEPTH.

Denison Mines Limited
Magnetite Project
Site Plan

Northern Analytical Laboratories ltd.

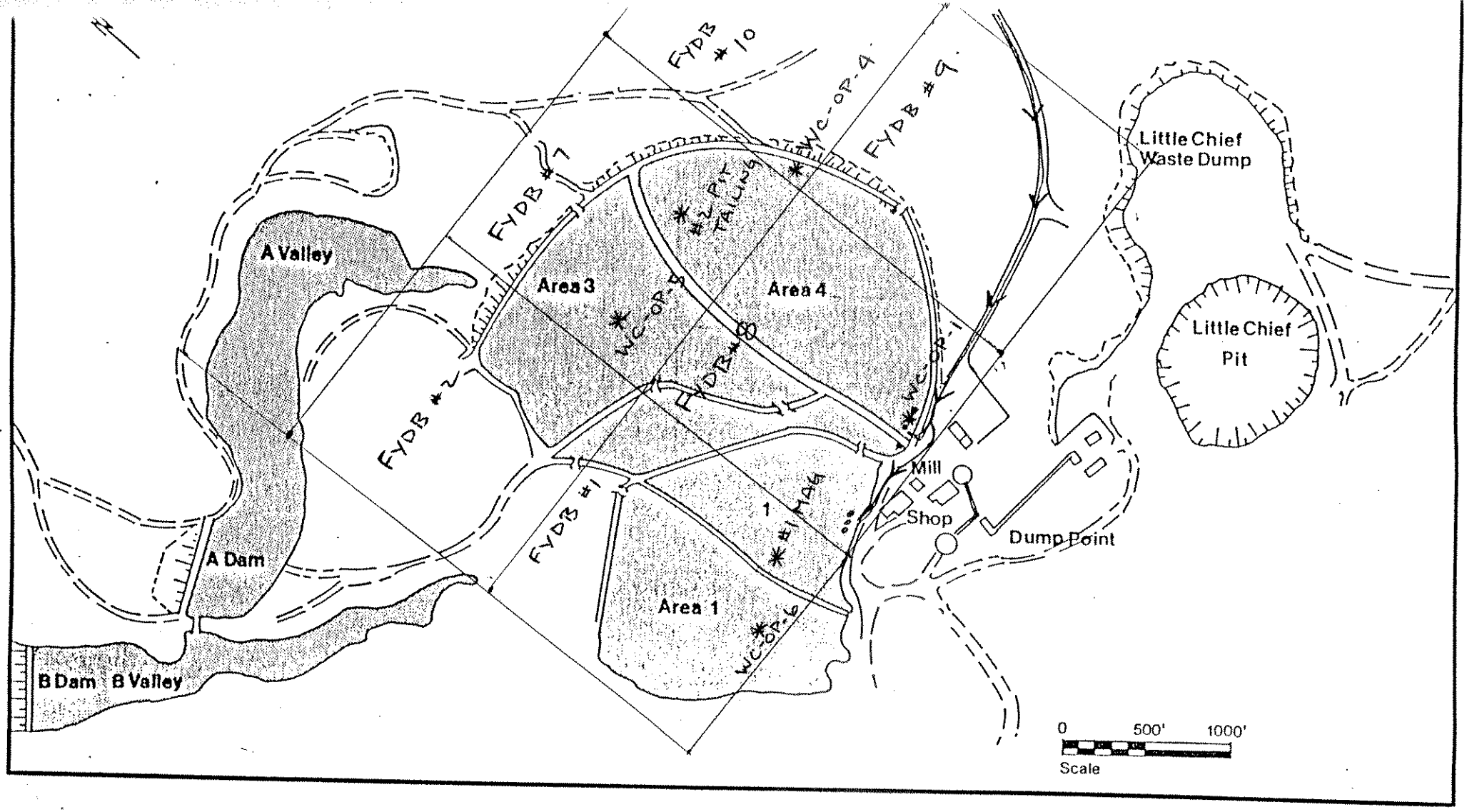
17/10/95 Assay Certificate Page 1

Brian Scott WO#15388

Sample #	Au oz/ton
WC - A 1	0.005
WC - A 2	0.008
WC - A 3	0.004
WC - A 4	0.010
WC - A 5	0.004
WC - A 6	0.006
WC - A 7	0.013

Certified by

105 Copper Road, Whitehorse, YT, Y1A 2Z7 Ph: (403) 668-4968 Fax: (403) 668-4890



'1994 GRAB SAMPLE LOCATIONS.

Denison Mines Limited
Magnetite Project
Site Plan

TSL LABORATORIES

2 - 302 - 48th STREET, EAST
SASKATOON, SASKATCHEWAN
S7K 6A4
(306) 931-1033 FAX: (306) 242-4717

CERTIFICATE OF ANALYSIS

SAMPLE(S) FROM TSL Mining
Unit 3 - 1270 Fewster Drive
Mississauga, Ontario
L4W 1A4

REPORT No.
S5994

SAMPLE(S) OF Pulp

INVOICE #:
P.O.:

REMARKS: Steven Scott

	Au ppb
#1 Mag	15
#2 Pit Tailing	40

COPIES TO: Ramiz Saad
INVOICE TO: TSL Mississauga

Feb 07/94

SIGNED Ramiz Saad

CTA

For enquiries on this report, please contact Customer Service Department.
Samples, Pulps and Rejects discarded two months from the date of this report.

STEVEN SCOTT

TSL/ASSAYERS Laboratories

1270 FEWSTER DRIVE, UNIT 3 MISSISSAUGA,ONTARIO L4W-1A4

PHONE #: (905)625-1544 FAX #: (905)206-0513

REPORT No. : **M3107**
Page No. : 1 of 1
File No. : FB04MA
Date : FEB-04-1994

I.C.A.P. PLASMA SCAN

Aqua-Regia Digestion

SAMPLE #	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Sc	Sn	Sr	Ti	V	W	Y	Zn	Zr
	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
#1 MAG	2	2.4	< 5	20	27	< 1	< 5	2.5	< 1	37	96	680	17	1.8	980	< 2	0.01	75	330	< 1	5	10	< 10	69	1900	130	< 10	11	74	< 1
#2 PIT TAILING	1	2.2	5	20	38	< 1	< 5	2.5	< 1	30	92	1100	11	1.8	920	< 2	0.01	65	400	< 1	5	8	< 10	74	1500	100	< 10	10	72	< 1

A .5 gm sample is digested with 2 ml of 3:1 HCL/HNO3
at 95 C for 90 min and diluted to 10 ml with DI H2O
This method is partial for many oxide materials

TSL/94

SIGNED :

Activation Laboratories Ltd. Work Order: 6150 Report: 6084

Sample description	AU PPB	AG PPM	AS PPM	BA PPM	BR PPM	CA %	CO PPM	CR PPM	CS PPM	FE %	HF PPM	HG PPM	IR PPB	MO PPM	NA PPM	NI PPM	RB PPM	SB PPM	SC PPM	SE PPM	SR %	TA PPM	TH PPM	U PPM
#1 MAG	50	<5	5	330	<1	4	49	180	0.5	12.8	0.8	<1	<5	6	11100	280	<20	0.8	27	<5	<0.05	<1	1.1	<0.5
#2 PIT TAILING	67	<5	9	287	<1	5	39	150	1.0	10.7	1.0	<1	<5	<5	9060	<50	<20	0.8	21	<5	<0.05	<1	2.1	1.1

Activation Laboratories Ltd. Work Order: 6150 Report: 6084

Sample description	W PPM	ZN PPM	LA PPM	CE PPM	ND PPM	SM PPM	EU PPM	TB PPM	YB PPM	LU PPM	Mass g
#1 MAG	<4	132	4.3	10	6	1.6	0.6	<0.5	1.6	0.25	2.138
#2 PIT TAILING	<4	89	6.1	13	7	1.6	0.4	<0.5	1.3	0.20	2.016

SAMPLE DESCRIPTION	GE PPM	GA PPM
#1 MAG	1.5	1
#2 PIT TAILINGS	1.1	1

Activation Laboratories Ltd. Work Order: 6150 Report: 6084C

Sample description	OS PPB	IR PPB	RU PPB	RH PPB	PT PPB	PD PPB	AU PPB	RE PPB	Mass g
#1 MAG	<2	<0.1	<5	0.4	17	15	11	<5	40.00
#2 PIT TAILING	<2	<0.1	<5	0.7	<5	14	30	<5	30.00

.AKEFIELD RESEARCH
Division of Falconbridge Limited
O. Box 4300, 185 Concession St., Lakefield, Ontario, KOL 2HO
ion: 705-652-2000 - FAX : 705-652-6365

cott, Brian
ox 66
agish, Yukon, Y0B 1T0

Lakefield, July 18, 1994

Date Rec. : June 24, 1994
LR. Ref. : **JUN9099.C94**
Reference : ---
Project : LR9446352

CERTIFICATE OF ANALYSIS

No.	Sample ID	Ga g/t	Co %
1	WC-OP #1	10	0.02
2	WC-OP #4	13	0.02
3	WC-OP #5	13	0.02
4	WC-OP #6	9	0.02

Russ Calow

A MEMBER OF IAETL CANADA

Accredited by CAEAL for specific tests registered with the Association

TSL / ASSAYERS INC.

Whole Rock Division
Contact Person: Ramiz Saad
GST Number: R132862640
Invoice Number: 90279
Date: March 4, 1994
Our Report No.: M3107
Customer I.D: S002

INVOICE

TO:
Steven Scott
460 Winona Dr. #507
Toronto, Ontario
M4W 3V2

Attention: Steven Scott

CUSTOMER ORDER	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	AMOUNT
	2		PGM'S	$73.40	$146.80
	2		RARE EARTHS	$12.75	$25.50
	2		30 EL.ICP	$12.00	$24.00
	2		GERMANIUM	$17.00	$34.00
	2		GALLIUM	$10.00	$20.00
	2		GOLD	$8.40	$16.80
			SUB-TOTAL		$267.10
			GST(7%)		$18.69
			Total		$285.79

1301 Fewster Dr., Mississauga, Ont. L4W 1A2 Tel (416) 602-8236 Fax (416) 602-8239

INVOICE

LAKEFIELD RESEARCH
A DIVISION OF FALCONBRIDGE LIMITED
Postal Bag 4300, 185 Concession St., Lakefield, Ontario K0L 2H0
Phone: (705) 652-3341 Telex No. 06 962842
Fax No. (705) 652-6365

No.: C 09803 (C9803)

DATE July 19, 1994

TO: Scott, Brian (540)
Box 66
Tagish, Yukon Y0B 1T0

Attn : ---

Ref. : ---

G.S.T. NUMBER R 101733426

Project : LR9446352
LR. Ref : JUN9099.C94

Qty	Description	$ unit	$ total
4	Pulverized	3.25	13.00
4	[4] Ga by GFAA - sol	26.00	104.00
4	[1] Co by XRF	13.50	54.00
	SUB TOTAL $		171.00

Analysis	171.00	171.00
GST 7 %	11.97	182.97
- Advance Payment	169.06	13.91
	TOTAL $	13.91

Samples WC-OP1,4,5,6

PLEASE PAY BY INVOICE — Terms: Net 30 days. 2% service charge per month on overdue accounts.

DENISON MINES LIMITED

RECOVERY OF MAGNETITE FROM WHITEHORSE COPPER TAILINGS

SUMMARY REPORT

NOVEMBER 1984

PREPARED BY:

KILBORN LIMITED
2200 Lake Shore Blvd. West
Toronto, Ontario
M8V 1A4

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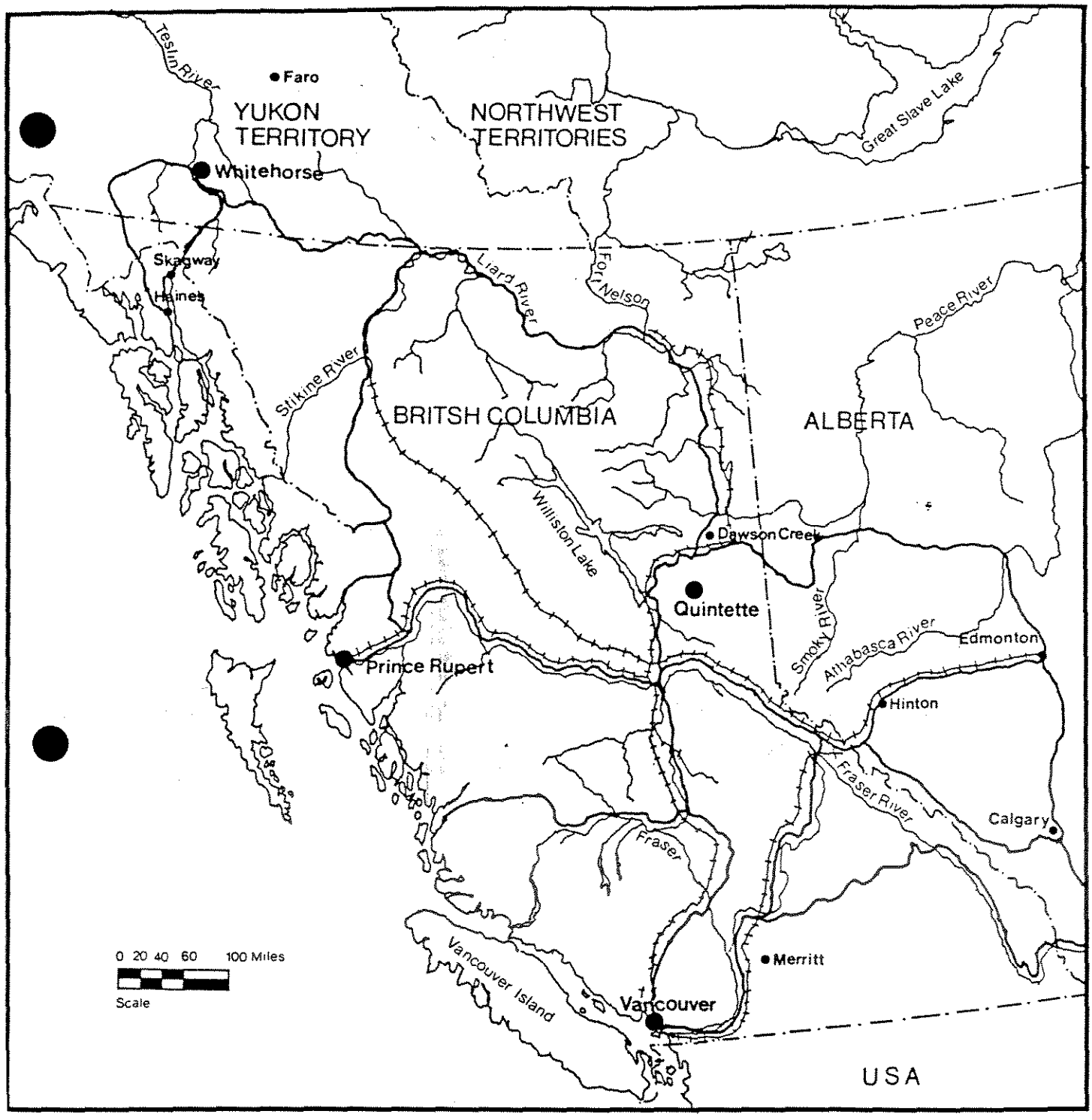

Denison Mines Limited

Magnetite Project
Location Map

1.0 INTRODUCTION

Magnetite is used in the heavy media circuit of many coal cleaning plants. The consumption of magnetite is largely related to the quantity of material processed by the heavy media plant. Quintette Coal Limited is presently consuming about 10 000 tonnes per year, Luscar Ltd., near Hinton, Alberta consume about 17 000 tonnes per year.

At the present time there is no producer of magnetite in Western Canada. All the magnetite consumed in B.C. and Alberta comes from a stockpile owned by Craigmont Mines Limited of Merritt, B.C. The stockpiled material is of inferior quality and is being consumed quite rapidly. Accurate data is not available but at present sales rates the stockpile should be exhausted by 1990.

For the foregoing reasons Denison Mines Limited have a continuing interest in securing an alternative supply of magnetite. It has been noted by Mr. V.V. Jutronich that the tailings which were produced by Whitehorse Copper Mines Ltd. in the Yukon Territory contained significant quantities of magnetite. A preliminary investigation including sampling, metallurgical testwork, capital and operating cost estimates was completed in October 1984 with encouraging results. Work has continued since the initial report was issued and has resulted in refinements to the capital and operating cost estimates. This report summarizes the October study as modified by more recent findings.

TABLE 2-2
OPERATING COST SUMMARY

Item	C$ 1984/a
Administration	$ 142 000
Reclamation	104 000
Processing	365 000
Packaging	88 000
Transportation	2 800 000
Totals	$ 3 499 000
	$ 87.48/t product

3.3 MAGNETITE RECOVERY PLANT

The design criteria which follow are based on a projected market demand, an operating strategy which recognizes climatic conditions in the Yukon, preliminary metallurgical tests and background data from other relevant operations.

TABLE 3-2
PROJECT DESIGN CRITERIA

Production Criteria		
Annual Magnetite Production	t/a	40 000
Operating Time - Process Plant	h/a	1 600
	h/day	11
	d/week	5
	weeks/a	29
Production Rate	t/h	25.0
Product Grade	% magnetite	92.0
Plant Feed Grade	% magnetite	20.0
Overall Recovery	%	92.0
Plant Feed Rate	t/h	125.0
Annual Tailings Reclaim Rate	t/a	200 000
Tailings Reclaim		
Method		Wheel Loader and Reslurry
In-Situ Density	t/m^3	1.9
In-Situ Average Moisture	%	10.0
Reclaim Reslurry Solids	%	50
Reslurry Surge Time	m	10

Conditioning and Primary Separation

Equipment for Conditioning		Existing Rod Mill
Primary Separator Type		Single Drum, Concurrent
Primary Separator Feed Solids	%	33.33
Primary Separator Drum Diameter	mm	1 220
Primary Separator Feed Rate	m^3/slurry/h/m	105
Primary Separator Magnetics Recovery	%	92
Primary Concentrate Percentage Solids	%	66.67
Primary Concentrate Magnetite Content	%	65.0

Regrinding and Secondary Separation

Coarse Feed Size Analysis	% -400 mesh	32
	80% past microns	100
Finished Product Size Analysis	% - 325 mesh	93
	% - 400 mesh	82
	80% past microns	35
Work Index (metric)	kWh/t	32
Secondary Separator Type		Double Drum, Countercurrent
Secondary Separator Feed Solids	%	20.0
Secondary Separator Drum Diameter	mm	1 220
Secondary Separator Feed Rate	m^3 slurry/h/m	175
Secondary Separator Magnetics Recovery	%	96
Secondary Concentrate Percentage Solids	%	66.67
Secondary Concentrate Magnetite Content	%	92.0

Product Filtration and Packaging

Feed Rate	t/h	25
Filtration Rate	$t/h/m^2$	0.3
Filter Aid Dose	kg/t product	0.1
Filter Cake Moisture	%	8.0
Product Package		Bag
Bag Capacity - Rating	kg	2 000
Bag Capacity - Dry Mass Packed	kg	1 750

4.0 SUMMARY OF CAPITAL DETAILS

4.1 SUMMARY

Pre-production capital costs are summarized in Table 4-1 and discussed overleaf.

TABLE 4-1
CAPITAL COST ESTIMATE

Area	Cost C$ New	Other	Total
General Mill Building			
Structural, New or Modified	-	-	81 000
Building Services Modification	-	-	5 000
New Process Piping Material			10 000
New Electrical Material			10 000
New Instrumentation			5 000
Sub Total - General Mill Building			111 000
Process Equipment			
Tailings Reclaim	164 000	7 000	171 000
Condition and Primary Sep.	69 000	2 000	71 000
Regrind and Secondary Sep.	144 000	7 000	151 000
Filter and Packaging	73 000	5 000	78 000
Tailings Disposal	-	6 000	6 000
Bags (5 000 x 2 t)	175 000	-	175 000
Sub Total - Process Equipment	625 000	27 000	652 000
Additional Sampling, Testwork and Data			20 000
Engineering Services			70 000
Indirect Construction Costs			90 000
Pre-Startup Operating Cost			137 000
Working Capital			559 000
Contingency (25% of $588 000)			147 000
Grand Total			$1 786 000

Notes:
1. Costs are given in last quarter 1984 Canadian dollars.
2. Aquisition costs are excluded.

4.2 GENERAL MILL BUILDING

Structural costs mainly comprise costs for providing a new timber and concrete truck loading ramp adjacent to the mill building. The other items included in the general cost category are largely self explanatory.

Costs reflect the availability of materials in the Whitehorse Copper Mines warehouse. Most of the work considered here is to be performed by the five plant operating personnel prior to startup. Labour costs are included with the pre-startup operating cost category.

4.3 PROCESS EQUIPMENT

The 'New' costs noted in this area include for the purchase and installation of new equipment. Major items of equipment, cost sources and costs are as follows:

Cyclone Cluster	Technequip Limited	$ 52 000
Magnetic Separators	Eriez of Canada Limited	$155 000
Bags and Bagging Equipment	Bonar and Bemis Ltd.	$210 000
Reclaim Hopper/Conveyor/Screen	Rexnord	$ 78 000
Fork Lift	Wajax Industries Limited	$ 20 000

4.4 ADDITIONAL SAMPLING, TESTWORK AND DATA

The required program of sampling, testwork and data aquisition is expected to cost a total of $20 000. This sum covers the cost to obtain and distribute samples for further analysis, equipment sizing testwork, and costs for travel to Whitehorse to confirm engineering and other data.

4.5 ENGINEERING SERVICES

A budget allowance of $70 000 is proposed to cover engineering costs. It is envisioned that much of the normal engineering costs can be avoided by field routing pipelines and electrical cables and by locating equipment in the field. Some engineering assistance will be required in particular regarding pipe line selection, structural steel and concrete design, mechanical design, purchasing assistance and start-up help.

4.6 INDIRECT CONSTRUCTION COSTS

This cost allowance includes for construction equipment rental, power and fuel consumed during the construction period and other indirect costs.

4.7 PRE-STARTUP OPERATING COST

This cost covers payroll and administration department operating costs from the date of aquisition (assumed to be January 1, 1985) to plant startup, July 1, 1985.

4.8 WORKING CAPITAL

Working capital is made up as follows:

Payroll and administration costs for two months - $46 000.

Process costs less bag costs for two months operation (11 000 t) - $93 000.

Transportation costs for one month (6 000 t) - $420 000.

4.9 CONTINGENCY

A contingency allowance is made equal to 25% of the general mill building and process equipment costs (excluding the bags). This allowance is intended to cover the costs of items which have not been specifically itemized in the capital cost estimate.

5.0 SUMMARY OF OPERATING COSTS

5.1 SUMMARY

Project operating costs are summarized below in Table 5-1. Explanatory notes are provided overleaf.

TABLE 5-1
OPERATING COST SUMMARY

Cost Area	Annual Cost - $1000/a						Production Cost
	Labour	Supplies	Power	Fuel	Other	Total	$/t Product
Administration	58	5	-	2	77	142	3.55
Reclamation	33	45	6	20	-	104	2.60
Processing	99	133	130	3	-	365	9.13
Packaging	-	88	-	-	-	88	2.20
Transportation	-	-	-	-	2800	2800	70.00
Totals	190	271	136	25	2877	3499	87.48

NOTES:
1. Production cost based on 40 000 tonnes of dry product per year.
2. Labour cost includes 30% payroll burden.
3. Maintenance supply costs included under supplies.
4. All costs are given in last quarter, 1984 Canadian dollars.

5.2 ADMINISTRATION OPERATING COSTS

The proposed project will employ a single project manager/ administrator who will also control payroll and accounting. Annual administration payroll costs are calculated to be $58 000 comprising $45 000 direct remuneration and $13 000 payroll burden (30%).

Administration supplies are expected to be minimal and an allowance of $5 000 only is proposed.

It is assumed that the administrator is provided with a rental vehicle and fuel. Fuel costs are taken as $2 000 per annum. The rental vehicle will also serve as the site service vehicle.

The following miscellaneous cost allowances are also made:

TABLE 5-2
MISCELLANEOUS ADMINISTRATION COSTS

Item	Cost $/Year
Vehicle Rental	4 000
Communications (telephone, telex, courier, etc.)	5 000
Insurance	10 000
Travel	5 000
Consultants and Custom Analyses	5 000
Legal and Audit Costs	10 000
Municipal Taxes	38 000
TOTAL	$ 77 000

5.3 RECLAMATION

Mining or reclamation of the tailings will employ the existing Caterpillar 966D wheel loader followed by reslurrying of the tailings and pumping to the mill.

Estimates indicate that the existing wheel loader with a 4 cubic yard bucket will be able to recover the desired 125 t/h at travel distances up to 200 m (700 ft).

A single reclaim operator will comfortably handle the required work load. It is assumed that he will receive remuneration of $25 000/year and that payroll burdens amount to $8 000 for a total labour cost of $33 000/year.

Supply and fuel costs for the wheel loader are generated in Table 5-3.

The cost of supplies for maintaining the reslurry and pumping system is taken as $6 000/a or 5% of the cost of maintainable equipment.

The power required to reslurry the tailings and pump the slurry to the mill from the upper tailings areas is estimated to be 75 HP or 56 kW. Annual costs at an incremental rate of $0.063/kWh are $6 000/a.

TABLE 5-3
WHEEL LOADER FUEL AND SUPPLY COSTS

Item	Units	Data
Operating Hours	h/a	1 600
Number of Units		1
Fuel		
Fuel Consumption	L/h/unit	32
Annual Fuel Consumption	L/a	51 200
Fuel Cost	$/L	0.40
Annual Fuel Cost	$/a	20 480
Supplies		
Oil, Lube and Filters	% fuel cost	30
Oil, etc. Cost	$/h/unit	3.84
Base Price of Unit	$	193 600
Maintenance Cost Factor		0.8
Maintenance Base Hours	h	10 000
Maintenance Parts Costs	$/h/unit	15.49
Tyre Costs	$/tyre	1 600
Number of Tyres	tyres/unit	4
Average Tyre Life	h	1 400
Tyre Cost Factor		1.15
Tyre Costs	$/h/unit	5.26
Total Supply Costs	$/h/unit	24.59
	$/year	39 344

5.4 PROCESSING COSTS

Reclaimed tailings are conditioned in the existing rod mill. Magnetite is then separated, reground, cleaned and filtered. Moist filter cake is then packed in 2 t bags at a production rate of 25 t/h.

Two men are required to operate and maintain the processing plant. A third man is required to attend to the packaging of product and the movement of loaded bags to the immediate storage area. Labour costs are taken to be $25 000 per man plus payroll burden of $8 000 per man for costs of $33 000 per man or $99 000/year.

Processing supplies are estimated for a production rate of 40 000 t/a as follows:

TABLE 5-4
PROCESSING CONSUMABLE SUPPLY COSTS

Item	Unit	Consumption		Unit Cost	Annual Cost
		per unit	per year	$	$/a
Grinding Balls	kg	0.44/t feed	88 000	0.900	79 200
Filter Cloths	cloth	0.005/t product	200	20	4 000
Filter Aid	kg	0.1/t product	4 000	2.400	9 600
Totals	-	-	-	-	$92 800

Notes:
1. Unit costs are delivered.
2. Ball consumption based on 0.07 kg/kWh, 22 kWh/t rougher concentrate and 0.3 t conc/t feed.

Maintenance parts cost, including screen cloth, cyclone liners, pump parts and the like are expected to cost an additional $40 000/a for a total of $132 800/a.

Installed and operating electrical power data are summarized below in Table 5-5.

TABLE 5-5
PROCESS POWER CONSUMPTION

Item		Inst. HP	Draw HP
Rod Mill		450	100
Primary Separator Feed Pump		20	10
Primary Separator Drive	(48" x 120")	7.5	5
Demag Coil		1	1
Mill Pumps (2 inst. 1 op)		50	36
Ball Mill		900	900
Tailings Pump		100	92
Reclaim Pump		100	25
Denver Conditioner		7.5	5
Conc. Transfer Pump		5	2.5
Secondary Separator Feed		15	10
Secondary Separator Drive	(48" x 72")	5	3
Dorrco Agitator		5	3
Vacuum Pump	(CL2002)	100	70
Filtrate Pump		2	0.5
Disc Drive		5	3
No. 13 Conveyor	20' long x 0' lift	5	2
Drier Drive		7.5	5
Bagger Feed Conveyor		2	1
Bagger System		1	1
Water Pumps		100	25
Compressor	2-one running 375 cfm	100	60
Lights/Sump Pumps/Cranes etc.		50	10
Totals		2039	1370

The average operating horsepower equates to an average demand of 1022 kW or 8.2 kWh/tonne feed (40.9 kWh/tonne product). The Yukon Electrical Company Limited rate schedule Y-31 calls for a demand charge of $26 700/year and an energy charge of $0.063/kWh. Applying these data yield an annual power cost of $129 700.

Fuel will be consumed in the processing plant during operation of the product handling forklift. An overall annual allowance of $3 000 is proposed.

Since the plant is operated during the warmer 7 months of the year fuel is not required for comfort or process heating.

5.5 PACKAGING

Product is moved to market in re-fillable 2000 kg capacity bulk bags containing 1750 kg of dry product. For this study it is assumed that an average of 9.1 trips are possible before bags are discarded. On this basis one bag will move 16 t of product to market. Since a single bag costs $35, annual costs are $87 500 or $2.20 per ton.

5.6 TRANSPORTATION

As discussed elsewhere there are several ways in which product might be moved to market. A preliminary proposal has been received from Yukon Freight Lines of $57.50/s.ton ($63.25/tonne) delivered to Northern B.C./Alberta. The product will be shipped with approximately 8% moisture. The freight rate on a dry tonnage basis therefore becomes $68.75/dry tonne product or $2 750 000/a.

Empty bags must be returned to Whitehorse for refilling. Approximately 1600 bags can be loaded into a standard van for a return cost of $2.20/bag or $1.25/t dry product. Total transportation cost therefore becomes $70/dry tonne of product or $2 800 000/a.

6.0 PROJECT DESCRIPTION

6.1 SUMMARY

Approximately 10 000 000 tonnes of Whitehorse Copper tailings are stored in five adjacent areas. A preliminary survey has shown that the magnetite content of the different areas varies somewhat but averages about 19% magnetite. The tailings represent reserves of approximately 1 800 000 tonnes magnetite.

The firm and dry nature of the tailings will permit primary reclamation using a front-end-loader. A 6.7 month operating strategy is proposed in order to eliminate cold weather operating problems.

Testwork at Lakefield Research on tailings samples has shown that a simple, two-stage magnetic separation process will yield a premium grade heavy media magnetite product at a high level of recovery. The process will predominantly employ existing equipment in the Whitehorse Copper mill. Magnetite will be filtered and packed in 2 tonne capacity bags.

Transportation of magnetite from the Yukon to users in British Columbia and Alberta will be performed at back-haul cost using the vans used to convey food and beverages to the Yukon.

The new tailings produced by the plant will be pumped into an abandoned open pit located close to the mill building. Water released by the tailings will be re-used and an effluent requiring discharge will not be produced.

PRESENT TAILINGS DAMS

As shown on the drawing overleaf, tailings are located in two general areas viz adjacent to the mill (Areas 1-4) and in valleys North of the mill (A and B valleys). Areas 1-4 were used until 1975 and the North valleys thereafter.

In the absence of detailed records or surveys the mass distribution of tailings between the areas alongside the mill and the valleys has been estimated from historical data. Detailed distribution within the two general areas has been calculated on the basis of surface areas.

The magnetite content of each dam has been evaluated on the basis of preliminary samples taken in early October 1984. Further information concerning the sampling and subsequent analyses are recorded in the preliminary Kilborn report and the Lakefield report.

The inventory of magnetite in the tailings is recorded in Table 6-1 below. Tailings moisture levels in early October ranged from 3 to 20% in the tailings areas adjacent to the mill and from 6 to 27% in the valley dams. Size analyses show that the Area 1 tailings are about 54% -200 mesh. The other tailings areas are somewhat finer in size.

TABLE 6-1
APPROXIMATE MAGNETITE RESERVES, WHITEHORSE COPPER TAILINGS

Area Designation	Estimated Tailings-tonnes	Magnetite Content % Range	Magnetite Content % Average	Magnetite Reserve-tonnes
1	1 670 000	15 - 34	23	384 000
3	1 160 000	15 - 27	20	232 000
4	1 480 000	16 - 28	20	296 000
A	3 340 000	8 - 26	17	568 000
B	2 050 000	15 - 21	18	369 000
Totals	9 700 000	8 - 34	19	1 849 000

When examined in October, all tailings areas were found to be competent and could be worked by machines without difficulty. A possible exception is the decant area of dam A which presently contains a small pond of water. However, this is of little concern since the A area would not be reclaimed for many years at which time the pond, if present, could be drained.

Access to all tailings areas is by way of gravel roads which are presently in good condition.

3 TAILINGS RECLAMATION SYSTEMS

Several reclamation schemes have been studied including:

- Hydraulic monitoring and pumping to the process plant.
- Reclamation with an elevating scraper and dumping into a new hopper or a pile and bulldozing into the existing hopper.
- Reclamation by front-end loader and rear-dump truck transport to existing truck dump hopper.
- Front-end loader reclaim into a re-slurry tank located on the tailings and pumping to the process plant.

The latter alternative was selected for the following reason:

- A Caterpillar 966 wheel loader is on site and would be aquired with the property.
- The selected technique offers low operating and capital costs and allows use of existing materials.

In the proposed system the wheel loader digs tailings and transport them to a reslurry plant. The reslurry plant incorporates a hopper with belt feeder, an elevating conveyor, a trash removal screen, an agitated reslurry tank and a return pump. During operation the system meters tailings over the screen and into the reslurry tank. Water is added to the screen and tank at a rate sufficient to give a 50% solids slurry.

As reclamation proceeds the travel distance for the loader increases and costs will rise. When the distance is about 200 m, the reslurry system and associated power and pipe lines must be relocated to a point closer to the reclaim face. This movement would be required perhaps once or twice per operating season.

6.4 MAGNETITE RECOVERY

Reclaimed tailings pumped from the dam area are delivered to the existing rod mill. This unit is operated with a low load of rods to condition the plant feed.

Slurry from the rod mill is pumped to a new 48 in. x 120 in. magnetic separator located on a new, high-level floor in the grinding area of the mill. Primary separator tailings are sampled and then gravitated to the tailings pump box. The latter is the original pump box relocated into the grinding bay.

The tailings pump discharges into a 10 in. diameter line which conducts tailings to the old Little Chief open pit mine. Tailings slurry settles in the pit and clear water is reclaimed by a submersible pump/syphon system for re-use in the process.

The primary magnetic concentrate is reground to 93% -325 mesh in the existing ball mill. A new cyclone cluster, comprising ten 6 in. diameter cyclones and ancillary launders, is used to effect the required classification.

The ground concentrate is run through existing pipes into the existing Denver conditioner tank which is used to provide surge capacity ahead of the secondary magnetic separator.

The secondary separator is a double drum, Steffenson type cleaner with internal, intermediate repulping. Tailings from this unit are returned to the primary separator feed tank to ensure recovery of any misplaced magnetite.

The cleaner concentrate is filtered with the use of a dewatering aid to a cake moisture level of about 8%. It is then transferred through the existing dryer to new conveying and semi-automatic bagging equipment. It can be noted that the drier could be used to further reduce moisture levels if required.

The final product is packed in bulk bags holding 1 750 kg of product (dry basis). Bags are provided with a top filling spout and a bottom dump spout equipped with a draw string closure. Loops are provided to permit fork-lift movement of loaded bags.

The proposed bags are re-useable and an average of 9 trips before retirement is anticipated. Other methods of transportation and storage are possible and are discussed in the following section.

The only reagent used in the process is the dewatering aid. The proposed material is non-toxic and bio-degradable. At the anticipated circuit operating pH level of about 8, the decomposition time is 6 days. Since the new tailings pit will provide a far longer residence time, problems are not anticipated.

6.5 TRANSPORTATION TO MARKET AND STORAGE

The 40 000 dry tonnes of product require transportation from the Yukon to markets in Northern British Columbia and Alberta. A number of alternatives have been investigated including:

1. Road or rail to Skagway or Haines, Alaska, barging to Ridley Island (Prince Rupert) and road/rail transport inland.

2. As above but landing at Vancouver and inland transportation by road/rail.

3. Road transportation on the Alaskan Highway to Dawson Creek and thence by provincial highways into B.C. and Alberta.

Recent correspondence with Yukon Freight Lines Ltd. produced an estimate of $57.50 per short ton for back-haul trucking of material. This equates to $68.75/dry tonne of product. Occasionally a van will be required to transport empty bags back to the plant. This will increase costs to $70/t product.

In the proposed back-haul transportation system, empty food and beverage vans will stop at the plant site and be loaded with 20 to 30 t of product prior to returning to B.C. At the present time Yukon Freight Lines Ltd. have approximately 1200 trucks per year return empty from the Yukon.

Loading of vans is achieved using a new timber ramp equipped with a dock leveller. A heavy duty fork-lift truck is used for loading operation. Offloading operations at customers plants will similarly require the use of a dock and fork-lift truck.

Magnetite is only produced during the summer but is consumed by customers throughout the year. Magnetite consumers generally have bulk storage facilities equal to three months of consumption. At the end of a production season, the supply/storage situation will be as noted overleaf in Table 6-2.

TABLE 6-2
MAGNETITE DISPOSITION AT END OF SEASON

Item		Tonnes Dry Product
Magnetite produced over season		40 000
Magnetite consumed by users		22 500
Magnetite in storage	- total	17 500
	- users	10 000
	- project	7 500

In order to match the available back-haul rate, the magnetite stored by the project will have to be kept on the property at Whitehorse. The quantity to be stored is most conveniently held in shipping bags since covered bulk storage space on the property is limited and bagged product may be kept outside.

The area adjacent to the bagging equipment can accommodate about 500 tonnes of dry product in bags. The remaining 7 000 t of storage would be located outside in the general area of the new loading ramp and in the shops. The storage factor is 3 t/m^2 therefore about 2 300 m^2 (25 000 ft^2 or 160 x 160 ft) is required at site. The average reclaim rate during the winter season will be 70 tonnes or about 40 bags per week day and require the full time attention of one day-shift operator.

WASTE AND EFFLUENT DISPOSAL

The Little Chief open pit produced in excess of 1 100 000 tonnes of ore and at least 1 300 000 tonnes of waste. With an in-situ density of 2.8 tonnes/m^3 the pit volume is about 850 000 m^3. Assuming a deposited tailings density of 1.62 dry tonnes/m^3 (101 lb/ft^3) the pit can store 1 400 000 t of tailings corresponding to approximately 9 years of production.

A number of options are available for storing new tailings after the Little Chief open pit is full. These include:

- Use of the underground workings, from which 2 600 000 tonnes of ore alone were removed - enough volume for at least 9 years magnetite recovery operation.

- Use of Area 1 tailings dam which will be empty after about 8 years of operation.

- Use of other open pits in the area, e.g. the War Eagle (899 000 t ore), Arctic Chief (202 000 t ore) and Black Cub South (167 000 t ore). Cumulatively these three pits would be adequate for about 10 years operation if strip ratios were similar to that at Little Chief.

As noted previously the process only employs a bio-degradable dewatering aid and no other reagent. Furthermore, the project will be a net consumer of water; a discharge stream will not be produced by the process. The actual rate of fresh water consumption is minor, amounting to about 17.3 m^3/h (76 USGPM) or 0.14 m^3 water/t tailings handled (33 US gallons/ton of tailings). This water could be obtained from the Yukon river using the original water pumps. Alternatively fresh water could be obtained from Copper Lake or from one of the un-named lakes on the ridge which is South of the plant site.

7.0 ABANDONMENT REQUIREMENTS

The Yukon Territory Water Board has reviewed an abandonment plan submitted to the Board by Whitehorse Copper Mines Ltd. Kilborn have not yet reviewed Whitehorse Copper's plan but have received a copy of the Board's response to the plan. Denison and Kilborn representatives have met with officials of the Board.

The Board's main concern appears to be the migration of ground water to the Yukon river and resulting bank-slides. It is not clear if the Whitehorse Copper tailings actually contribute to slides or whether there is simply a local perception of the connection between the tailings and the slides. The Board felt that diversion of ground water flow would be necessary if the tailings remain in their present location. When the Board was told of the possible relocation of the tailings they expressed confidence that the perceived problem would be solved.

Other concerns or interests expressed by the Board include:

- The effect of pits and waste dumps on water quality.
- Proposals regarding revegetation of tailings.
- Quality of water leaving tailings areas.
- Hydrology of proposed spillways etc.
- The long term maintenance of spillways, dams, etc.

In discussing the proposed development with the Board it was apparent that the proposal would receive their endorsement for the following reasons:

1. The board would have an operating, locally based company with which to deal.
2. The development would fill at least the Little Chief pit and possibly others and thereby reduce concerns.
3. The Board perceived that the project would remove tailings from present areas and relocate them in more suitable, controlled areas.

8.0 PROJECT SCHEDULE

A preliminary project summary schedule is provided overleaf. The schedule assumes the use of Sala magnetic separators for which a six month delivery has been promised. Eriez have offered better delivery times for separators but this selection would not necessarily improve the start-up date.

The attached schedule shows a start-up in late July 1985 provided that the property is expeditiously aquired and magnetic separators are ordered early in December 1984. All other equipment would require ordering by the end of December 1984.

Production during 1985 should equate to about 20 000 dry tonnes of product.

9.0 MANPOWER

CONSTRUCTION

Approximately 4 000 manhours of non-contracted installation labour are required spread over 6 months. This equates to a construction crew of 4 men. The operating crew comprises a working manager and 4 men. Because of the nature of the construction tasks it is proposed that construction be executed by the plant operators supplemented by specialized or general contractors as required to complete the job.

Three employees of Hudson Bay Mining and Smelting are presently performing clean-up, maintenance and security duties at Whitehorse Copper. It is proposed that these men be retained for their local knowledge and relevant skills.

All construction will be executed by local personnel living at home in Whitehorse or the immediate area. Construction camps, travel allowance, subsistence allowance and most other factors which contribute to high construction overhead (indirect) costs will be avoided.

OPERATING

The proposed project must operate with the minimum of staff. Specialists cannot be supported; all personnel must be versatile and capable of operating, performing maintenance and carrying out repair work.

A project manager is required to liaise with local government agencies, control payroll and accounting, report to head office and otherwise superintend the operation.

The processing plant requires three operators. Any one man must be able to execute any one of the several general tasks covered by processing. These include process operator, maintenance man and bagger operator. The latter job is virtually full time; 160 bags per day have to be placed into the bagger, removed by fork-lift and placed into vans. It is likely that the job of bagging will be done in short spells by each of the operators.

The task of reclaiming the tailings with the wheel loader is performed by a single operator working a 12 hour shift during the production season. Reclamation operating will be alternated with process operating by the employees.

During the operating season of 29 weeks each of the 5 project employees works 12 hours per day, five days a week for a total of 1 740 h/man. During the remaining 23 weeks of the year the only tasks are as follows:

- Security control
- Maintenance
- Loading into vans of 7 500 tonnes (4 300 bags) of magnetite on site at end of production season. This task involves the loading of about 300 vans or about 3 vans every week day.

The forementioned tasks will be performed over the 23 week (115 working days) non-production season by the five project employees, each of whom will work 25 eight hour days to give an annual time of 1940 hours.

TABLE 9-1
OPERATING MANPOWER

Job Title	Number	Annual Costs $/year		
		Salary per man	Payroll Burden per man	Total Cost
Project Manager	1	45 000	13 000	58 000
Process Operator	3	25 000	8 000	99 000
Reclaim Operator	1	25 000	8 000	33 000
TOTALS	5	$145 000	$45 000	$190 000

10.0 ADDITIONAL DATA REQUIREMENTS

The following data should be obtained or confirmed prior to a final commitment to the project.

Additional Sampling

Areas 1, 3 and 4 should be re-sampled to greater depths.

Additional Testwork

Additional composite samples have been made up and shipped to Sala and Eriez for confirmatory test work. The work should be completed by mid-December and should refine or confirm present estimates of rougher recovery and grade, cleaner recovery and grade, rougher concentrate grinding work index and magnetic separator requirements.

Product Evaluation

The test program will produce several kilograms of typical product which should then be made available to potential customers.

Product Transportation

The transportation alternatives should be further examined and best attainable shipping rates negotiated and confirmed.

Process Plant Equipment

The condition of all equipment necessary for the proposed plant must be carefully ascertained through field studies. The availability of spares in the warehouse should also be verified.

Engineering Data

As-built drawings or original drawings and field confirmation sketches are required in the areas of interest.

Tailings Storage/Environmental

The capacity and suitability of the Little Chief open pit should be confirmed. Discussions with relevant environmental agencies should clarify the present and future requirements.

Utilities

Discussions regarding low cost, interruptable power rates should be initiated with the Yukon Electric Company Limited. The source of fresh water should be defined.