noranda

Noranda Exploration Co.

GOLDSTREAM PROJECT

Information Prospectus

Jan. 19, 1977

NORANDA EXPLORATION COMPANY

GOLDSTREAM PROJECT

TABLE OF CONTENTS

TABLES

DRAWINGS

NORANDA EXPLORATION COMPANY

GOLDSTREAM PROJECT

1. SUMMARY

Noranda Exploration Co. have confirmed the presence of a viable copper-zinc-silver orebody in the Big Bend area, north of Revelstoke, British Columbia.

The deposit has been estimated to contain the following diluted tons of ore: -

3,940,600 metric tons grading 3.69% copper, 2.67% zinc, 0.56 oz. per ton of silver.

A pre-production program, launched in April, 1977 would see first commercial production by May, 1979. (See Table 1.) The proposed plant would be capable of mining and concentrating 1360 metric tons per calendar day. The known ore reserves would maintain an operation for eight years. Recovery of reserves would exceed 95%.

Manpower requirements would peak at 250 men during the pre-production and construction program, and stabilize at 185 employees during operations. (See Table 2.)

Approximately 10% of the reserves would be extracted by means of a small open pit, and the remainder by a highly mechanized underground operation utilizing deslimed mill tailings to backfill openings and optimize recovery of reserves.

A concentrator will be established on site to treat the ore and produce two concentrates. The zinc concentrate

will probably be trucked to Trail for smelting, and a copper concentrate trucked to Revelstoke, loaded on C.P.R. to Vancouver and shipped to Japan for smelting.

Additional major site construction would consist of a service building and single status camp. Administration and loadout facilities would be established in Revelstoke. A small number of employees will establish themselves in Revelstoke initially, with additional people settling there as the construction boom for the Revelstoke dam subsides in three year's time.

Testwork to determine quality of process water effluents is well underway, and a suitable disposal area located.

The Revelstoke Hydro Dam construction program, which commences this year, will severely strain the resources of the City of Revelstoke. Our comparative effect on the City will be minimal initially and will have a beneficial effect as the Hydro program draws rapidly to a close in 1983.

2. PROPERTY LOCATION

2.1 General

The deposit is located approximately 58 road miles north of Revelstoke, B.C., on the Goldstream River, a tributary of the Columbia River.

The Goldstream River flows generally from east to west, with its headwaters forming in the centre of the Selkirk Mountain Range.

Placer mining activities were carried out on the river as early as the 1860's, and formed the centre of the Columbia River Gold Rush. Intermittent mining is carried on to this date.

2.2 Discovery Area

With the exception of a thin strip of land along the Columbia River, the entire area is held under Tree Farm License by Canadian Cellulose, who are conducting harvesting operations in various locations along the Goldstream. Major portions of the valley over the deposit and proposed plant site have already been cleared.

The deposit outcrops at about the 900 metre elevations, on a south slope of the valley. It dips north underneath the Goldstream River which crosses the deposit at about an elevation of 645 metres.

The valley slope is covered with glacial till, averaging 3 to 5 metres in depth. Overburden in the valley bottom is significantly deeper, running as deep as 30 metres.

2.3 Road Access, Transportation

Highway 23, a paved highway, runs north from Revelstoke along the east bank of the Columbia River, a distance of 88 miles to Mica Creek. Mica Creek is the location of the latest Hydro dam to come on stream as part of the Columbia River development.

From mileage 50 on Highway 23, access to our deposit is via Forestry road, a distance of 7.4 miles. This access road must be upgraded to accept expanded traffic of both Can Cel and Noranda. In addition, Forestry officials are insisting that the primary access road must be relocated from its present location at valley bottom, to a higher elevation, for environmental reasons.

It is expected that the cost of this road will be shared by Can Cel, Noranda and the Forestry Service.

2.4 Power

M. A. Thomas, Electrical Consultants of Vancouver, conducted studies into most probable or economical source of electrical power.

After extensive investigation of local hydro possibilities, they have concluded that the most viable source of power must be from B.C. Hydro's Mica Dam by transmission line to Goldstream River, a distance of 45 miles.

It is imperative that B.C. Hydro make a committment to supply us power by the spring of 1970.

2.5 Water

Process water will be reclaimed from the concentrator tailings pond. All mine water, including backfill water will be reclaimed and re-used for backfilling.

Fresh water for domestic and makeup use will be obtained by gravity from Brewster Creek.

2.6 Revelstoke

The City of Revelstoke was established as a divisional point on the C.P.R. It has a population of about 8,000, including several unincorporated municipalities on its borders. Major employers for City residents are the C.P.R., Forest and tourism industries.

Medical, educational, security, recreational, water and sewer services are above average for this size of community.

Accommodation is in very tight supply. This has been brought about by a combination of speculation on the Revelstoke Dam and a limited supply of available land for development. Cost of housing is very high, running 20 to 30 percent higher than surrounding communities.

2.7 Revelstoke Dam

B.C. Hydro have just received permission to proceed with construction of another Hydro dam, about 3 miles north of Revelstoke on the Columbia River. This dam will take 5 years to construct and will flood the last 80 miles of the Columbia River.

Manpower requirements for the dam will peak in 1980 when 350 men will be at work. Construction will start in early 1977, and first major demand for manpower will occur in 1979, when 1500 men will be on site.

The effect of this work force on the well ordered life of Revelstoke will be severe. B.C. Hydro will contribute significantly to expand services to accommodate 50% increase of population for a short period.

The majority of these workers will live in bunkhouses built by Hydro, however, anywhere from 400 to 1,000 men are expected to bring their families to Revelstoke.

The direct employment of Revelstoke natives on the dam will probably be low. This is because of Union agreements with B.C. Hydro, which permit only Union members employment on these jobs. In these days of high unemployment it is unlikely that many Revelstoke residents will be given the opportunity to work on the project because of Union committments to members.

2.8 Accommodation

The most acceptable type of accommodation for operating personnel would be family housing units located in Revelstoke. However, because of the Revelstoke Dam, it is unlikely that this can be accomplished in the near term.

In addition it is quite likely that we will attract employees who will prefer to leave their families as far away as the Okanagan, and will require single status accommodation at the property.

Generally, we should take a flexible approach to housing and accommodation along the following lines. Provide temporary single status accommodation at the Mine Site or Mica Creek for the excess construction crews during the pre-production period. Provide permanent top quality single status accommodation at the Mine Site. Purchase 6 to 10 housing units in Revelstoke for senior staff members, and provide assistance to any employee seeking to purchase housing in Revelstoke, after the demand by dam employees begins to slacken.

2.9 Communications

Okanagan Telephone are investigating possibilities for improving telephone reception at Goldstream, and confidently predict that they can provide a sufficient number of private lines to the property, capable of data transmission if necessary.

3. GEOLOGY

3.1 Geometry

The Goldstream deposit lies within a sequence of metamorphosed and deformed sedimentary and volcanic rocks. In the area of the deposit the rocks strike N 65^{o} - 75^{o} W and dip 35^{o} - 45^{o} NE.

The shape of the deposit is that of a "flattened rod" or "ruler" and although it occurs concordantly with the surrounding rock units and as a particular stratigraphic horizon, it rakes across the dip of the other units.

The long, or plunge, axis of the deposit strikes N 60^{o} E and dips 20^{o} - 25^{o} in that direction.

Thickness varies from 2 metres to 8 metres, strike width from 150 metres to 350 metres, and the down plunge length has been followed for 1500 metres by drilling.

3.2 Rock Sequence

The general sequence of rocks encountered from hangingwall to footwall are as follows: -

1. Dark Banded Phyllite
2. Garnet Zone
3. Grey Green Phyllite
4. Massive Sulphides
5. Grey Green Phyllite
6. Limestone

The "Dark Banded Phyllite" occurs as a wide thickness with the bottom of the formation occuring 15 to 20 metres above the ore zone.

This rock is generally competent, calcareous, with occasional narrow graphitic fractured zones dipping with the formation.

The "Garnet Zone" occurs as a bed conforming with the bottom of the above bed. As viewed in this years workings it is usually sheared on the hangingwall contact, contains graphite garnets, and has an average thickness of 12 metres.

The "Grey Green Phyllite", is an altered (sericitic) phyllite, occuring immediately in the hangingwall of the ore zone, with varying degrees of calcareous or siliceous alteration. This bed averages 5 1/2 to 6 metres in thickness, and is occasionally mineralized.

The "Massive Sulphide" bed occurs as a continuous and consistent sheet of mineralization ranging from 1/2 metre to 8 metres in thickness, averaging about 3 metres. A few minor cross-faults cut the ore zone with offsets of about one metre.

The "Grey Green Phyllite", which occurs in the footwall of the massive bed is similar to the hangingwall sequence, with an additional graphite band within one metre of the footwall of the ore.

A "Limestone" bed, 16 metres in thickness, occurs in the footwall of the zone, (within 4 - 8 metres). This bed appears to be regular and competent.

3.3 Mineralogy of Ore Zone

The core of the ore zone is a massive sulphide lens consisting of chalcopyrite, pyrrhotite, sphalerite and lesser amounts of pyrite. Adjoining the massive zones on some occasions, are narrow bands of disseminated mineralization containing chalcopyrite and pyrrhotite, usually occuring in siliceous sericite schist.

3.4 Mineral Inventory

The final calculation of the Mineral Inventory following the surface drilling program was as follows: -

3,177,903 metric tons grading 4.49% Copper, 3.24% Zinc, 0.68 opt. Silver.

An assessment of the proposed mining system suggests that a dilution of 24% should be used in the study. This assumes a hangingwall dilution of 15% and a footwall dilution of 8% in the underground section. Open pit dilution has been estimated at 28%, for an average of 23.5% for the entire orebody. (Use 24%).

Grade of this dilution has been estimated at .36% Copper, .28% Zinc, .08 opt. Silver.

SUMMARY - MINERAL INVENTORY

	Metric Tons	% Copper	% Zinc	opt. Silver
Drill Indicated Ore	3,177,903	4.49	3.24	.68
Dilution (24%)	762,697	.36	.28	.08
Total Inventory	3,940,600	3.69	2.67	.56

4. PRODUCTION RATE

A production rate of 1360 metric tons per calendar day was selected as the maximum amount which could be mined on two shifts per day, 5 days per week, without committing major pre-production development funds.

The mill equipment has been sized to handle this throughput, (1360 metric tons), on a 365 day per year basis.

5. DESCRIPTION OF OPERATION

Ore will be mined by open pit and underground methods and hauled to a coarse ore bin excavated in rock below the 700 portal.

The coarse ore will be crushed to minus 6" in a Jaw Crusher, also situated in rock below the coarse ore bin. It will then proceed by conveyor out of the mine to the secondary crushing and screening plant on surface where it is reduced to all passing - 5/8" in size.

The ore is transferred by conveyor to a fine ore stockpile, reclaimed and run through a grinding stage which reduces it once again to 80% minus 200 mesh in size.

Appropriate chemicals and reagents are then added to the material and two concentrates are produced by flotation methods. The copper concentrate will grade about 25% in copper content while the zinc will grade about 50%.

These concentrates are filtered and finally dried to about 6 - 7% moisture.

These concentrates are then loaded by front end loader into trucks and hauled to Revelstoke for transshipping into rail cars, or in the case of the zinc concentrate probably trucked directly to Trail, B.C.

After all concentrates have been extracted from the ore, the fine material will be removed by cyclones to produce a backfill which can be placed hydraulically in mined out openings to prevent subsidence and permit more

complete recovery of the ore.

The fine tailings material is then pumped 3 miles to a tailings disposal area west of Brewster Creek for impoundment.

The following illustrates where the material from 1 day's mine production (1360 metric tons) eventually ends up.

1.	Copper Concentrate	-	187 tons to Japan
2.	Zinc Concentrate	-	29 tons to Trail, B.C.
3.	Backfill	-	544 tons to mine openings
4.	Tailings	-	600 tons to tailings pond.

6. TAILINGS DISPOSAL

Our tailings impoundment area would be comprised of a dammed off valley west of Brewster Creek.

The disposal method would be to discharge the tailings at the east end of the Valley in a single point discharge permitting the tailings solids to form a long flat slope towards the impermeable dam. A settling pond would form at the west end and the settled effluents reclaimed and pumped back to the concentrator.

In addition a seepage dam would be built downstream of the main dam. Water from this dam would be either pumped into the main dam, or released to the natural water course. If water treatment becomes necessary it would be treated at this point.

Diversion ditches along the south edge of the disposal area would intercept run-off and divert it around the dam.

7. MINE OPERATION

7.1 Open Pit

A small open pit will be developed to mine the top 50 metres of the deposit, where it slices through to surface at an acute angle. This pit is required to permit recovery of this section and to provide first ore for the concentrator.

A total of 450,000 metric tons of ore will be trucked to the concentrator, and 1,150,000 metric tons of waste will be disposed of either in the tailings disposal area, plant roads, or disposal dumps.

7.2 Underground

The bulk of the ore reserve will be mined by underground methods. That part of the deposit which lies above the River Valley will be developed by adits at the 845 metre, 770 metre, 700 metre and 659 metre elevations.

The ore reserve below the Valley bottom will be serviced by a combination of decline for men and material and a vertical shaft for muck removal.

The proposed mining method is a fully mechanized approach which mines sections or panels by open benching, followed by panel fillings using deslimed tailings and underground waste rock as backfill.

The total material to be removed will be 3,350,000 metric tons of ore to the concentrator, and 600,000 metric tons of waste.

7.3 Buildings

The following buildings will be constructed at the plant site: -

Concentrator	-	25,000 sq. ft.
Crushing Plant	-	3,000 sq. ft.
Screening Plant	-	400 sq. ft.
Main Service Building	-	10,000 sq. ft.
Carpenter Shop Garage	-	1,500 sq. ft.
Cold Storage	-	4,000 sq. ft.
Oil House	-	500 sq. ft.
Powder Magazine	-	1,000 sq. ft.
Fuse, Cap house	-	200 sq. ft.
Ventilation, Heating	-	600 sq. ft.
Camp Accommodation	-	25,000 sq. ft.

7.4 Roads, Yards, Services

The primary access road will run along the 725 metre elevation from about mileage 3 to the concentrator. This road will be a public road and will be used by Can Cel as well as Noranda.

A series of plant roads will connect the main plant area at elevation 650 to 700 metres with the open pit operation at elevation 915 metres, with

access to the intermediate portals from the same road system.

A pipeline trench along the primary access road will contain the following lines between the plant site and tailings disposal area.

a) 10" tailings line
b) 10" reclaim water line
c) 4" fresh water line (From Brewster Creek)

Power will be supplied by a B.C. Hydro line (67,000 volts), running along the main access road from Highway 23.

Two major yard areas would be established, at elevation 700 metres, and at 650 metres.

7.5 Land Disturbances, Waste Disposal

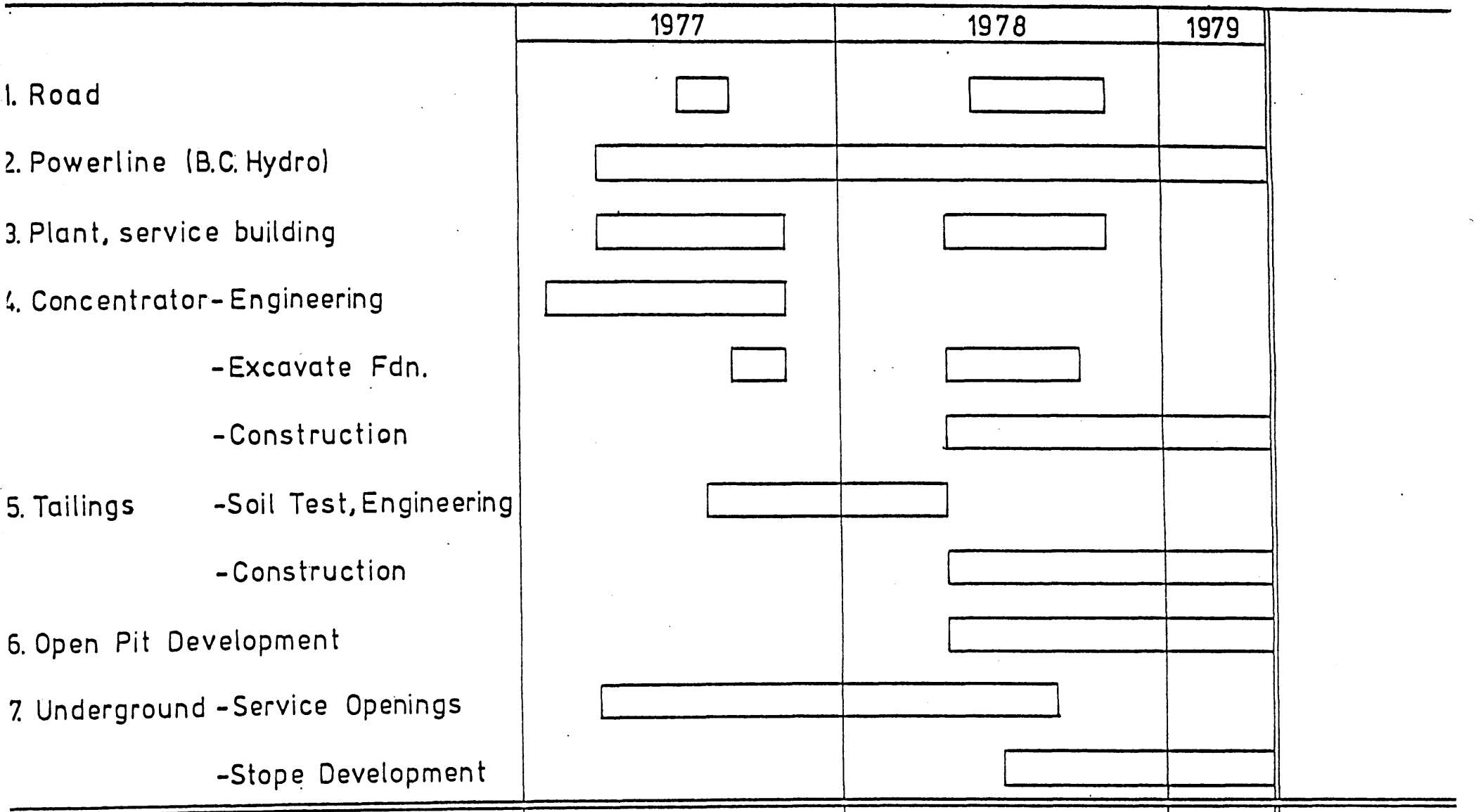
Generally speaking, well over 50% of the land required is already cleared of trees. In those areas not cleared, cut blocks can be planned to coincide with our requirements.

The primary access road will be built whether we proceed or not. In fact, the primary access road will be on improvement on an existing road.

Therefore, exclusive of clearing of trees and the primary access road we will cause the following land disturbances: -

1.	Plant Roads, Yards	- 30 acres
2.	Open Pit -	
	a) Mining	- 15 acres
	b) Waste Disposal	- 20 acres
	c) Roads	- 20 acres
3.	Camp	- 20 acres
4.	Tailings Disposal	- 90 acres
	TOTAL	195 acres

TABLE I - SCHEDULE of EVENTS and EXPENDITURES



	1977	1978	1979	TOTALS
1. Capital Expenditures	3,500	20,000	2,790	26,290
2. Mine Development	1,500	4,500	873	6,873
3. Working Capital, Inventory			4,510	4,510
	5,000	24,500	8,173	37,673

TABLE 2

DISTRIBUTION OF MANPOWER

	Hourly Rate	Staff	Total
Mine Department	82	13	95
Mill Department, Assay	29	7	36
Maintenance & Plant	26	3	29
Administration	-	12	12
Caterers, Janitorial	-	13	13
	137	51	185

TO KAMLOOPS

1

REVELSTOKE

23

PROPOSED HYDRO DAM

TO CALGARY

N

NORANDA EXPLORATION PROJECT
CLAIM GROUP

COLUMBIA RIVER

DOWNIE CREEK

GOLDSTREAM RIVER

MICA DAM

CANOE REACH

McNAUGHTON LAKE

MILES
FROM REVELSTOKE TO

GOLDSTREAM	56
MICA DAM	85
KAMLOOPS	130
CALGARY	240

inches
0 1 2
0 1 2 3 4 5
centimetres

BRITISH COLUMBIA GEOLOGICAL SURVEY

This reference scale bar has been added to the original image. It will scale at the same rate as the image, therefore it can be used as a reference for the original size.

App'd By

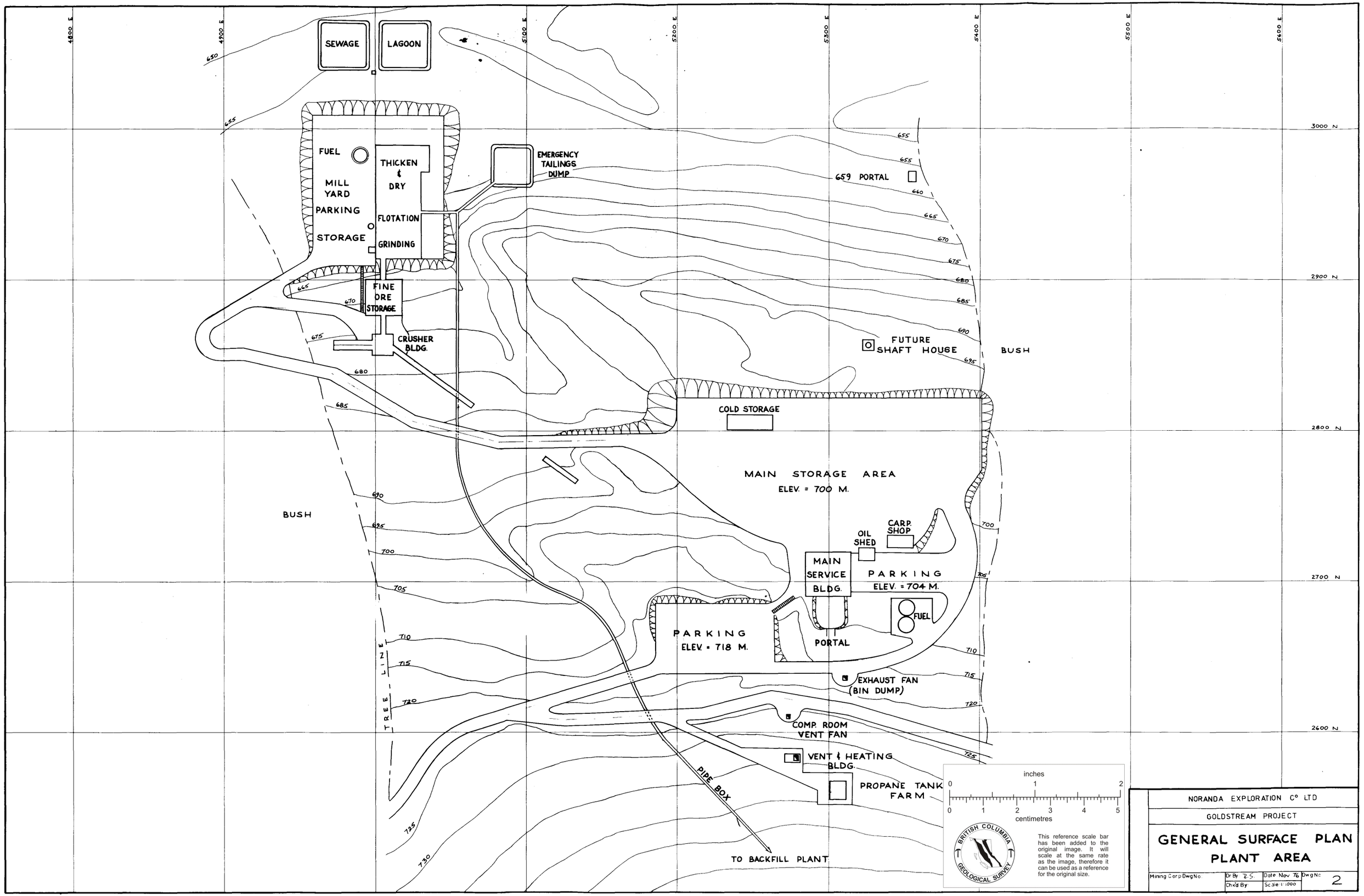
NORANDA EXPLORATION C° LTD

Project: GOLDSTREAM PROJECT

Title:

LOCATION PLAN

Mining Corp Dwg No:	Dr'n: R.S.	Scale:	Dwg No:
	Ch'k'd By:	Date: Dec. 76	1



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NORANDA EXPLORATION Co LTD

GOLDSTREAM PROJECT

GENERAL SURFACE PLAN PLANT AREA

Mining Corp Dwg No.	Dr By R.S.	Date Nov 76	Dwg No. 2
	Ch'd By	Scale 1:1000	

2000 N

2500 N

3000 N

1100 M

900 M.

700 M

500 M

300 M

OFF SECTION

845 PORTAL

BACKFILL BINS

770 PORTAL

INTERNAL ORE PASS SYSTEM

VENT. & SERVICE RAISE

MAIN VENT. RAISE

700 PORTAL

TO CRUSHER

700 HAULAGE

VENT. & SERVICE RAISE

659 PORTAL

ORE BINS

638 CRUSHER STA.

645 HAULAGE

BLOCK

1 OPEN PIT

2 OPEN FLOOD FILL

3 PANEL FILL

4 PANEL FILL

inches

0 1 2

0 1 2 3 4 5

centimetres

BRITISH COLUMBIA GEOLOGICAL SURVEY

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NORANDA EXPLORATION C° LTD

Project: GOLDSTREAM PROJECT

Title: PROPOSED DEVELOPMENT PROGRAM
PROJECTION TO VERTICAL PLANE - LOOKING WEST

Mining Corp Dwg No	Dr By: R.S.	Date: Dec. 76	Dwg No 3
	Chkd By:	Scale:	

715 E DRIFT

715 W DRIFT

700 X-CUT

STOPE I

STOPE J

STOPE K

STOPE F

STOPE G

STOPE H

STOPE E

1ST LIFT STARTED

STOPE D (1ST LIFT STARTED)

STOPE C (BEING MINED)

STOPE B (MINED OUT)

STOPE A (FILLED)

MINING FACE

SUB DRIFT

RAMP

ORE PASS

#5 DUMP

#4 DUMP

#3 DUMP

#2 DUMP

#1 DUMP

DECLINE

FOOTWALL DECLINE

ORE WASTE

645

RIB PILLAR 3

RIB PILLAR 4

FENCED

CULVERT

SILL PILLAR 1

SILL PILLAR 2

645 ORE DRIFT

TO DRAW PT.5

TO 645 RAMP

inches
0 1 2
0 1 2 3 4 5
centimetres

BRITISH COLUMBIA GEOLOGICAL SURVEY

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Appd By

NORANDA EXPLORATION Co LTD

Project GOLDSTREAM PROJECT

Title PROPOSED MINING METHOD TYPICAL STOPING BLOCK STEP-ROOM AND FILL

Mining Corp Dwg No	Dr By T.S.	Date Dec 76	Dwg No 8
	Chkd By	Scale	

DWG. NO. 765-306-00-00

UNDERGROUND ← → SURFACE

ORE PASS

R.O.M.

① 36" x 48" JAW CRUSHER

-6" ORE

36" CONVEYOR

UNDERGROUND BIN 1800 TONS

36" CONVEYOR

② 50" x 8' ROD GRIZZLY

③ 4¼' STANDARD CRUSHER

④ 5½' SHORTHEAD CRUSHER

36" CONVEYOR

36" CONVEYOR

O/S

⑤ 6' x 16' SCREEN

200 T.P.H SCREEN U/S -⅝" ORE

36" CONVEYOR

24" CONVEYOR

3600 TON FINE ORE STORAGE

36" SLOT FEEDER

24" CONVEYOR TO ROD MILL

65 T.P.H -⅝" ORE

ROD MILL

⑥ 8' x 12' ROD MILL – 400 HP

⑦ HARDINGE BALL MILL – 600 HP

⑧ 4+1 15" CYCLONES

COPPER ROUGHING AND SCAVENGING

⑮

COPPER CLEANING

⑰ ⑯

COPPER CONCENTRATE

⑭

⑨ 8' x 8' Cu REGRIND BALL MILL – 200 HP

⑩ 3+1 10" CYCLONES

⑪ 5' x 8' Zn REGRIND BALL MILL – 75 HP

⑫ 1+1 10" CYCLONE

ZINC ROUGHING AND SCAVENGING

⑬ ⑯

ZINC CONCENTRATE

ZINC CLEANING

⑱ ⑰

⑲ 50' DIA COPPER CONCENTRATE THICKENER

U/F

O/F

⑳ ㉒

COPPER CONCENTRATE TO LOADOUT BIN (750 T. STORAGE)

FLOTATION TAILINGS

⑲ 30' DIA ZINC CONCENTRATE THICKENER

U/F

O/F

㉑ ㉓

ZINC CONCENTRATE TO LOADOUT BIN (150 T. STORAGE)

BACKFILL PLANT

㉔ ㉕

BACKFILL PUMPED TO UNDERGROUND STORAGE BIN AT ELEV. 800 M.

TAILINGS PUMPED TO DISPOSAL SITE

MAJOR EQUIPMENT

1. 36" x 48" JAW CRUSHER
2. 50" x 8' ROD GRIZZLY
3. 4¼' STANDARD CRUSHER
4. 5½' SHORTHEAD CRUSHER
5. 6' x 16' SCREEN
6. 8' x 12' ROD MILL – 400 HP
7. HARDINGE BALL MILL – 600 HP
8. 4+1 15" CYCLONES
9. 8' x 8' Cu REGRIND BALL MILL – 200 HP
10. 3+1 10" CYCLONES
11. 5' x 8' Zn REGRIND BALL MILL – 75 HP
12. 1+1 10" CYCLONE
13. 10' x 10' CONDITIONER/MAXWELL CELL
14. 8' x 8' CONDITIONER/MAXWELL CELL
15. NUMBER 30 DENVER "DR" FLOTATION CELLS
16. NUMBER 30 DENVER "SUB" "A" CELLS
17. NUMBER 24 DENVER "SUB" "A" CELLS
18. NUMBER 18 DENVER FLOTATION CELLS
19. 14' x 14' FILTER FEED AGITATED STOCK TANK
20. 8'-6" – 7 DISC FILTER
21. 6'-0" – 4 DISC FILTER
22. 5' x 30' COPPER CONCENTRATE DRYER
23. 4' x 35' ZINC CONCENTRATE DRYER
24. 4+1 10" CYCLONES
25. 2+1 10" CYCLONES

inches 0 1 2

0 1 2 3 4 5 centimetres

BRITISH COLUMBIA GEOLOGICAL SURVEY

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NO.	DATE	REVISION	LOC.	BY	APP.	APP.
1	20 DEC 1976	TAILINGS THICKENER REMOVED				

REFERENCES ; DRAWINGS — NUMBER

CODE — BY — DATE — ISSUED ONLY FOR

CONSTRUCTION APPROVAL

HEATHWOOD ENGINEERING ASSOCIATES LIMITED CONSULTING ENGINEERS KIRKLAND LAKE ONTARIO CANADA

CLIENT		SCALE —	DATE
CLIENT		DRAWN BY	18 NOV 1976
H.E. PROJ. SUPV.		DES. BY	
H.E. PROJ. ENG.		CHKD. BY	
H.E. PRINC.		CO-ORD. BY	

MINING CORPORATION OF CANADA (1964) LTD
GOLDSTREAM PROJECT

PROCESS FLOW SHEET

PROJ. NO. 5306 — DWG. NO. 765-306-00-00 — 0