MDRP

82E SE 032

PROPERTY FILE

001089

PROSPECTUS
GOLDEN CROWN PROJECT

Submitted by:

ATTWOOD GOLD CORP.
100 - 450 West Georgia Street
Vancouver, British Columbia
V6B 1Z3

Prepared by:

NORECOL ENVIRONMENTAL CONSULTANTS LTD.
Suite 700, 1090 West Pender Street
Vancouver, British Columbia
V6E 2N7

July 1989

File: 1-179-01.02

~~CONFIDENTIAL~~

PROPERTY FILE

TABLE OF CONTENTS

		Page
TABLE OF CONTENTS		ii
LIST OF TABLES		iv
LIST OF FIGURES		iv
LIST OF APPENDICES		iv
1.0	FACT SHEET	1-1
2.0	PROJECT DESCRIPTION	2-1
2.1	Introduction	2-1
2.2	Location and Access	2-1
2.3	Description of Claim Area	2-1
2.4	Existing Facilities	2-4
2.5	Project Schedule	2-4
3.0	GEOLOGY AND RESERVES	3-1
3.1	History and Exploration Summary	3-1
3.2	Property Geology	3-1
3.3	Regional Geology	3-2
3.5	Mineral Reserves	3-2
4.0	MINE OPERATION	4-1
4.1	Conceptual Mining Plan	4-1
4.2	Process Description	4-1
4.3	Tailings Disposal and Mill Site	4-1
4.4	Water Supply	4-2
5.0	ENVIRONMENTAL ASPECTS	5-1
5.1	Environmental Setting	5-1
5.1.1	Climate	5-1
5.1.2	Physiography	5-1
5.1.3	Drainages	5-1
5.1.4	Hydrology	5-3
5.1.5	Fisheries	5-3
5.1.6	Wildlife	5-3
5.1.7	Vegetation	5-3
5.1.8	Soils	5-4
5.1.9	Land Use	5-4
5.1.10	Water use	5-4

TABLE OF CONTENTS (concluded)

		Page
5.2	Potential Concerns	5-4
5.3	Ongoing and Proposed Studies	5-5
5.3.1	Climate	5-5
5.3.2	Hydrology	5-5
5.3.3	Groundwater	5-7
5.3.4	Water quality	5-7
5.3.5	Acid generation	5-9
5.3.6	Fisheries	5-11
5.3.7	Terrestrial	5-11
5.3.8	Wildlife	5-11
5.3.9	Land Use	5-11
5.3.10	Waste Management Plan	5-11
5.3.11	Water Management Plan	5-11
5.3.12	Reclamation Plan	5-12
6.0	SOCIO-ECONOMIC ASPECTS	6-1
6.1	Setting and Employment	6-1
6.2	Infrastructure and Services	6-1
6.3	Potential Issues	6-2
6.4	Proposed studies	6-2
REFERENCES		
APPENDICES		

LIST OF TABLES

Table		Page
1	Water Quality Parameters and Detection Limits	5-8

LIST OF FIGURES

Figure		Page
1	Location Map	2-2
2	Golden Crown Project: Critical Path Schedule 1989 to 1990	2-5
3	Project Area Drainages	5-2
4	Location of Sampling Sites	5-6
5	Sample Locations for Acid-Base Accounting	5-10

LIST OF APPENDICES

Appendix	
I	Analytical Results for Water Samples from Golden Crown Project
II	Acid-Base Accounting Results for Golden Crown Project

1.0 FACT SHEET

- All Estimates are subject to change pending further development of the ore body.

Mineral Reserves

Minerals	Gold - copper
Reserves	62,670 ~~oz gold~~ tons
Average grade of ore	0.445 oz/ton

Mining

Mine Operation	Underground
Production Rate	200 tons/day
Mill Process	Flotation
Milling Rate	200 tons/day
Mine Life	Unknown - based on current reserves about 2 years

Transportation

Road Access	From Grand Forks 22 km west on Highway 3 and then gravel road (Pheonix Road)

Work Force

Total Operational	20 - 30
Housing	N/A
On Site Accommodation	N/A
Construction Workforce	N/A Except to install mill would require 6 staff for about one month

Schedule

Pilot Plant (purchase or construction)	October 1989
Pilot Plant Test	November 1989 to February 1990
Site Construction	March 1990
Full Production	April 1990

2.0 PROJECT DESCRIPTION

2.1 Introduction

Attwood Gold Corp. is a Vancouver-based, publicly traded mining and exploration company, with holdings in a number of locations around the Grand Forks area of British Columbia. The company is presently proposing to develop the Golden Crown project as a gold-copper deposit with minor amounts of silver. Present metallurgical testwork indicates an economical concentration could be produced.

2.2 Location and Access

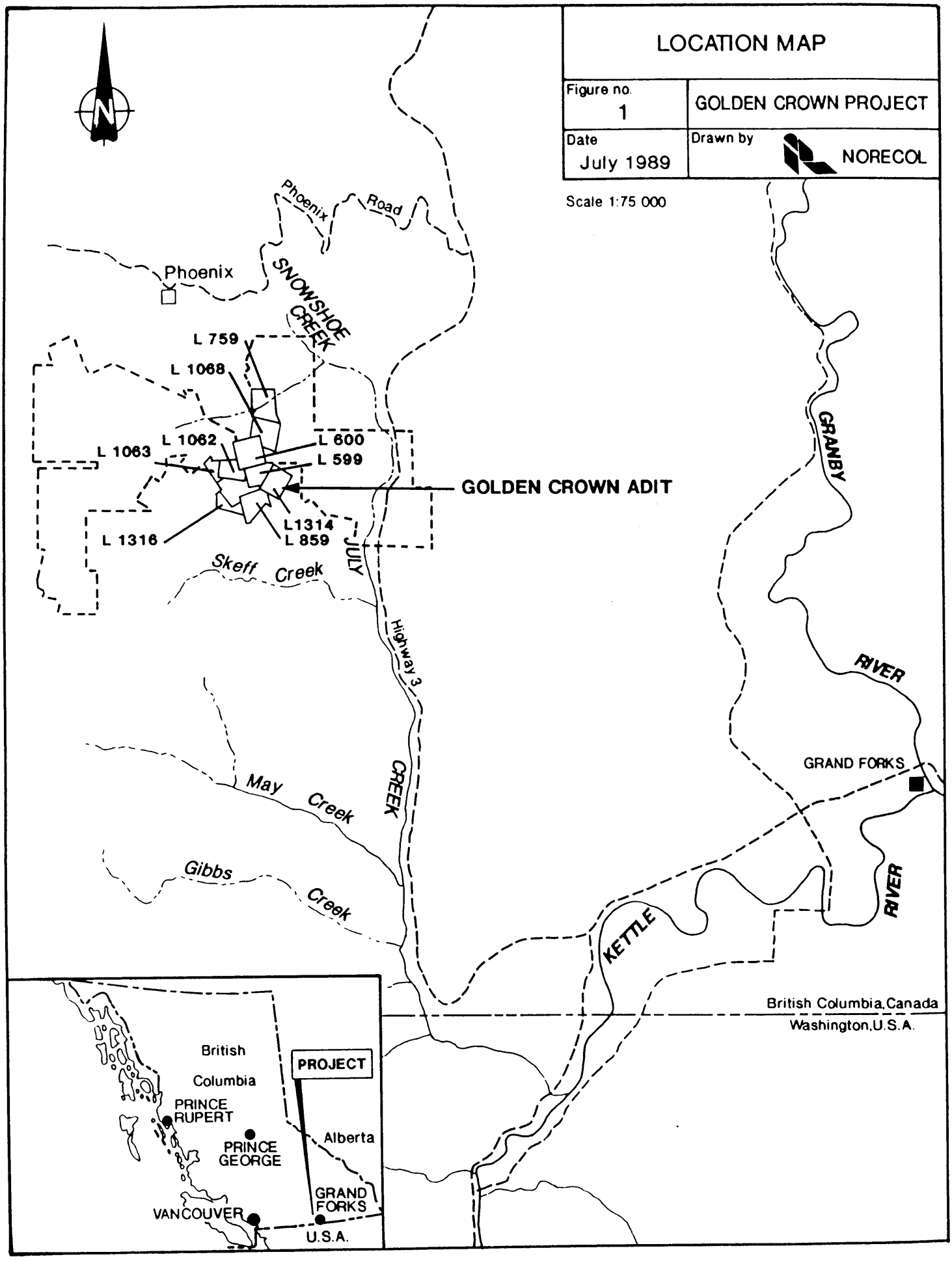
The Golden Crown project lies within the Greenwood Mining District in the West Kootenay Region of British Columbia approximately 12 km northwest of Grand Forks (Figure 1). The claims lie within the old Phoenix Mining camp and are situated at the 1250 m to 1350 m elevation.

Access to the property from Grand Forks is west along Highway 3 for 22 km and then by a gravel road called the Phoenix Road (Figure 1). A gravel branch road is then used to access the property from the Phoenix Road. Grand Forks can be accessed by air by charter airline. Penticton and Castlegar are serviced by scheduled airline and these cities are approximately two hours by road from the mine site.

2.3 Description of Claim Area

The total property consists of two Crown Claims, twelve reverted Crown Grants, and forty-nine located mineral claims. The following is a list of claims comprising the property. Location of the property which is the subject of this prospectus consists of two Crown Claims, seven reverted Crown Grants, and one located mineral claim and is shown on Figure 1 by a solid line. The additional property which is not currently the subject of this prospectus is outlined on Figure 1 by a dotted line.

Name	Lot No.	Record No.	Expiry Date
Crown Granted Mineral Claims			
Golden Crown	600	N/A	N/A
Winnipeg	599	N/A	N/A


LOCATION MAP
Figure no. 1
GOLDEN CROWN PROJECT
Date July 1989
Drawn by NORECOL
Scale 1:75 000
N
Phoenix Road
Phoenix
SNOWSHOE CREEK
L 759
L 1068
L 1062
L 1063
L 600
L 599
GOLDEN CROWN ADIT
L1314
L 859
L 1316
JULY
Skeff Creek
Highway 3
CREEK
May Creek
Gibbs Creek
GRANBY
RIVER
GRAND FORKS
KETTLE
RIVER
British Columbia,Canada
Washington,U.S.A.
British Columbia
PROJECT
PRINCE RUPERT
PRINCE GEORGE
Alberta
GRAND FORKS
VANCOUVER
U.S.A.

Name	Lot No.	Record No.	Expiry Date
Reverted Crown Granted Mineral Claims and Fractions			
Hecla	859	1772	December 12, 1994
War Cloud Fr.	1316	1773	December 12, 1994
Hard Cash	1062	1774	December 12, 1994
Nabob Fr.	1063	1774	December 12, 1994
Joe Joe	7595	1775	December 12, 1994
Sissy	1068	1776	December 12, 1994
Calumet	1314	1777	December 12, 1994
J & R	(L.1059)	1865	November 8, 1991
Silver Star	(L.1550)	1926	December 21, 1991
Hartford	(L.1057)	1927	December 21, 1990
Hartford Fr.	(L.1061)	1928	December 21, 1990
Nellie Cotton	(L.1460)	2173	May 13, 1994
Located Mineral Claims			
Win Fr.		1784	September 24, 1994
Attwood No. 1 Fraction		4243	June 23, 1996
Add No. 2		4615	June 23, 1995
Ike 1		1972	January 23, 1994
Ike 2		1973	January 23, 1994
Ike 3		1974	January 23, 1994
Ike 4		1975	January 23, 1994
Ike 5		1976	January 23, 1994
Ike 6		1977	January 23, 1994
Ike 7		1978	January 23, 1994
Ike 8		1979	January 23, 1994
Ike 9		2023	February 6, 1994
Ike 10		2024	February 6, 1994
Ike 11		2025	February 6, 1994
Ike 12		2026	February 6, 1994
Mineral Claims			
Crown 1		1986	January 28, 1993
Crown 2		1987	January 28, 1993
Crown 3		1988	January 28, 1993
Crown 4		1989	January 28, 1993
Crown 5		1990	January 28, 1993
Crown 6		1991	January 28, 1993
Crown 7		1992	January 28, 1993
Crown 8		1993	January 28, 1993
Crown 9		2015	February 6, 1993

Crown 10	2016	February 6, 1993
Crown 11	2017	February 6, 1993
Crown 12	2018	February 6, 1993
Crown 13	2019	February 6, 1993
Crown 14	2020	February 6, 1993
Crown 15	2021	February 6, 1993
Crown 16	2022	February 6, 1993
Crown 17	2202	May 28, 1993
Crown 18	2203	May 28, 1993
Crown 19	2204	May 28, 1993
Hip Fr.	2199	May 28, 1993
Golden Crown Fr.	2200	May 28, 1993
Star Fr.	2201	May 28, 1993
Crown Fr.	2027	February 6, 1993
Mikro	4426	November 1, 1990
Knob 1	4435	November 14, 1990
Knob 2	4436	November 14, 1990
Knob 3	4437	November 14, 1990
Knob 4	4438	November 14, 1990
Knob 5	4439	November 14, 1990
Knob 6	4440	November 14, 1990
Knob 7	4441	November 14, 1990
Knob 8	4442	November 14, 1990
Mikro 2	4536	March 12, 1993
Mikro 3	4537	March 12, 1993

2.4 Existing Facilities

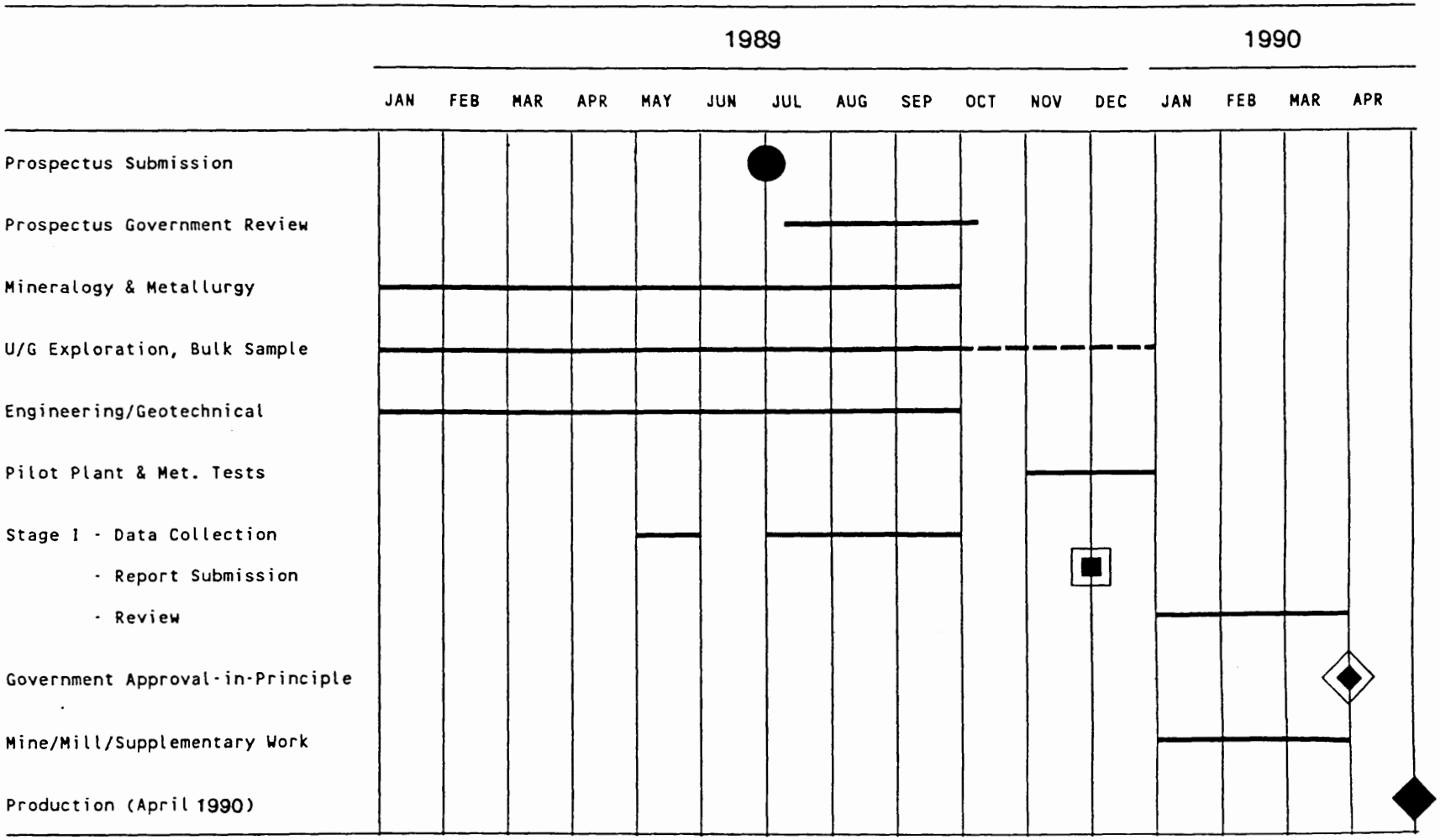
Existing facilities on the property consist of a work shed/drying room located on a landing at the portal located on the east side of Lot 1314 (Figure 1). Underground development has extended an adit 1000 m into the mountain side. The adit measures approximately 2.5 m x 2.5 m with 3 drill stations evenly spaced over the 1000 m. Two crosscuts and a raise have been completed connecting with the old Golden Crown workings.

2.5 Project Schedule

Pending the completion of the ongoing drilling program and a third set of metallurgical testing, an application for bulk sampling through a pilot mill will be made. Start up for the pilot plant is anticipated later in 1989.

Full mine production is planned for April 1990 subject to Stage I review and obtaining the necessary permits. Figure 2 outlines the project schedule, including exploration, pilot plant operation, mine planning, government approvals and production target dates.

GOLDEN CROWN PROJECT: CRITICAL PATH SCHEDULE 1989-90



NORECOL

Figure 2

3.0 GEOLOGY AND RESERVES

3.1 History and Exploration Summary

The Golden Crown Group of claims were first discovered in 1891 with a total of 2 440 m (8 000 ft.) of shafting and drifting occurring between 1891 and 1905. Ore shipments were made on a continual basis between 1901 and 1902 and again from 1910 to 1912. It was reported that during those periods production from the claim blocks totalled:

	Tonnes	Au	Ag	Cu
Golden Crown	2,742	1,243 oz	2,248 oz	83,890 lbs
Winnipeg	58,772	11,675 oz	36,550 oz	190,617 lbs

The property lay dormant until 1965 when Sabina Mines and Scurry Rainbow initiated geophysical work followed by 1652 m of diamond drilling for a total of 16 drill holes. Even though massive sulphide veins were identified in every drill hole, very little importance was put on their findings as the mandate of that time was to identify nickel and chromium deposits. A small amount of drilling was undertaken in 1976 (317 m) by Golden Crown Syndicate, and in 1977 (769 m) by Con Am Resources. In 1979, Boundary Exploration Ltd., former name for Consolidated Boundary Exploration Ltd., drilled an additional 329 m on the property.

The present owners did not actively start developing the property until 1983. Since the drilling program of 1983, the existing companies have completed the following physical work on the property:

Phase I

Drifting, crosscutting and raising	680 m	(2,240 ft)
Surface diamond drilling	191 m	(627 ft)
Surface shafts drilling	180 m	(600 ft)
Underground diamond drilling	610 m	(2,000 ft)

Phase II

Drifting and crosscutting	350 m	(1,150 ft)
Surface diamond drilling "NQ"	573 m	(1,881 ft)
Underground diamond drilling	2,700 m	(8,850 ft)

3.2 Property Geology

The property is underlain by Permo-Carboniferous to Triassic aged metavolcanic rocks and intrusive rocks. The predominant rock types on the claims are green to dark green metavolcanic rocks. The metavolcanics in the area have been generally termed greenstone, which is known to be of andesitic to basltic composition and in places has been metamorphosed and recrystallized

into amphibolite and amphibolite schist. The greenstones include both flow and tuffaceous textures with subrounded to angular cherty fragments of various sizes.

3.3 Regional Geology

Geology for what is known as the Greenwood-Grand Forks map area has been well documented in publications on file with the B. C. Yukon Chamber of Mines, University of British Columbia, and the Canadian Mining Association. In general terms, the area includes metamorphic, sedimentary and intrusive and extrusive igneous rocks, ranging in age from Permo-Carboniferous to Tertiary, that reflect multiple episodes of deformation and igneous intrusion.

Mineral deposits in the Greenwood-Grand Forks area vary from contact metasomatic skarn with base metal occurrences to structurally controlled quartz veining and sulphide deposits carrying precious metal values.

3.5 Mineral Reserves

Reserves are presently being calculated in all categories. With present work done it is anticipated that reserves will exceed 100 000 tons in all categories, with a gold grade averaging better than 0.445 oz/ton.

4.0 MINE OPERATION

The scope of the Golden Crown project will be better defined subsequent to the on-going drilling program when proven, probable and possible reserves will be determined. Details of the mine plan, tailings disposal site, mill site, water supply, power supply and transportation will be provided in the Stage I report.

4.1 Conceptual Mining Plan

Mine development will be by conventional underground methods with the main access to the orebody by the existing adit entry located at the 1282 m level on southeast side of Lot 1314 (Figure 1). Mining of the ore could be a combination of open stoping, shrinkage stoping, and cut and fill stoping.

4.2 Process Description

Metallurgical testwork has been undertaken to date to identify the most efficient milling circuit for processing the ore. The three options proposed for the mill circuit for the Golden Crown property include:

- produce a copper concentrate, while maximizing the gold and silver recovery to receive credit for the gold and silver contained in the concentrate;
- produce a copper concentrate, with cyanidation of the rougher tailings for recovery of gold and silver and a pre-aeration stage prior to cyanidation;
- whole ore cyanidation preceded by a pre-aeration stage.

A pilot mill is scheduled to commence operation in October 1989 assuming a positive feasibility study based on on-going drilling and metallurgical testing. The pilot mill will be used to test and confirm mill processing. The milling circuit will be refined as required during Stage I studies to minimize potential environmental impacts.

4.3 Tailings Disposal and Mill Site

Preliminary alternatives for a tailings disposal and mill site have been investigated. The options include the area near the existing adit or sites within 2 km to the north and northwest of the existing adit. These sites are located between elevations 1250 m and 1370 m within the July Creek drainage area. The specific design and location of the tailings management system will be provided in the Stage I report.

4.4 Water Supply

Potable water will be required for domestic use, fire protection and the process plant. Some preliminary alternatives for water supply are being considered including construction of a small storage dam in the upper reaches of Snowshoe Creek (July Creek) or water filled pits in the old Phoenix Mine area. Potential water supply sources and rate of supply will be more precisely identified during Stage I studies.

5.0 ENVIRONMENTAL ASPECTS

5.1 Environmental Setting

5.1.1 Climate

The study area lies within the Columbia Mountains physiographic region. The climate of this region is dominated by onshore air movement from the Pacific Ocean. The valley lowlands experience dry, warm summers and cold winters with moderate precipitation rates.

The Golden Crown property lies at an elevation of approximately 1300 m within the Engelmann spruce - subalpine fir biogeoclimatic zone.

There are three climate stations which are reasonably representative of the study area; Grand Forks, Greenwood and Kettle Valley, although their elevations (532-759 m) are below that of the claims area. These stations show a total annual precipitation of less than 550 mm. Snow course data from stations at a similar elevation to the claims area give average snow depths from January to April between 50-60 cm. Snow covers the claims area between mid-November and April. Mean daily temperatures are expected to range from -7°C to 20°C. Temperatures are lowest in January with extreme lows of -42°C and highest in July with extreme highs of 43°C.

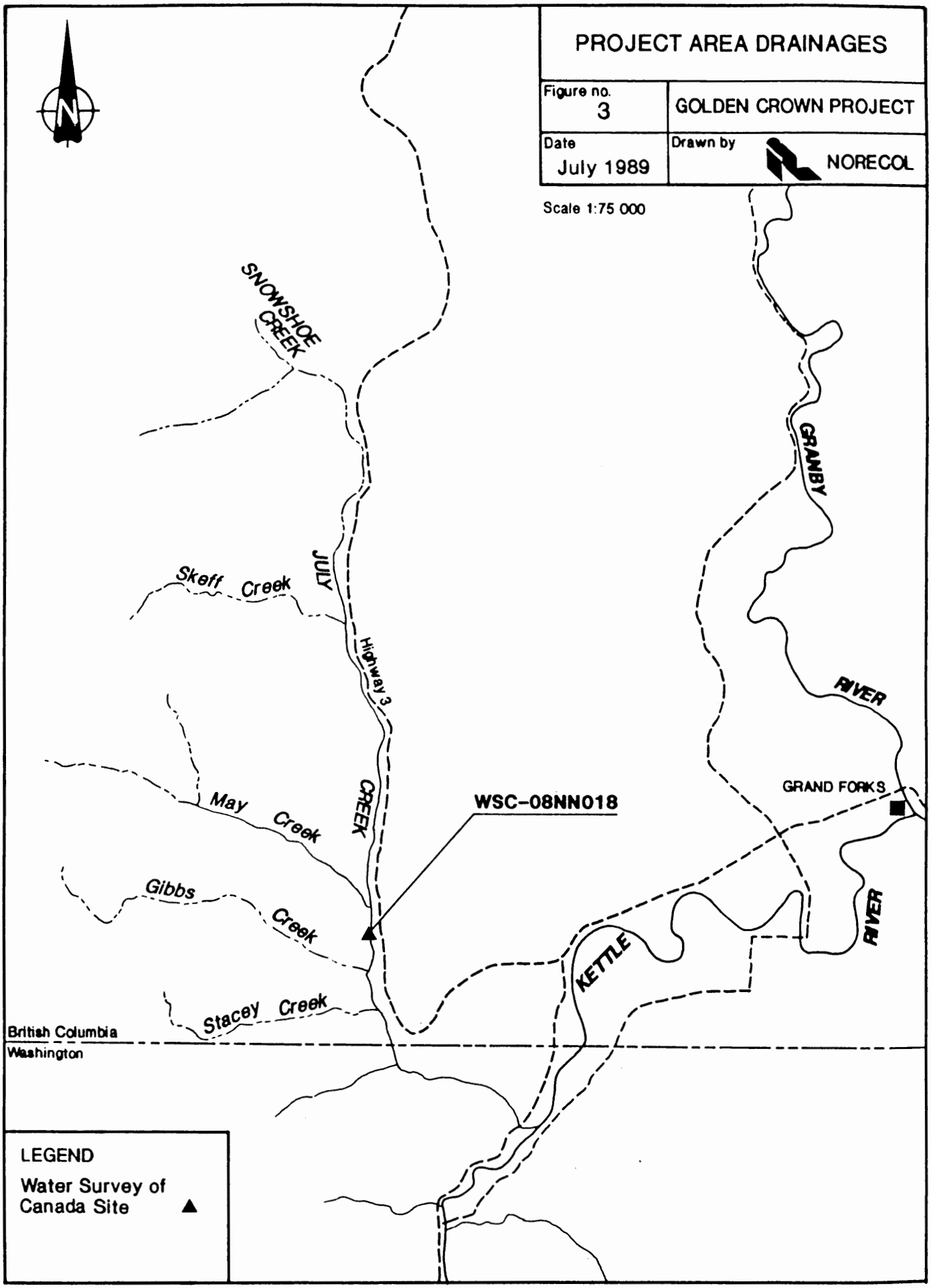
5.1.2 Physiography

The Golden Crown project lies in the Midway Range of the Monashee Mountains. This is a north-south trending mountain range bounded by the Kettle and Grandby rivers. The terrain in the project area is characterized by rounded, steeply sloping hills and mountains. The claims area lies on the west side of July Creek Valley at an elevation of about 1310 m. The valley floor of July Creek adjacent to the project area lies at an elevation of 880 m.

5.1.3 Drainages

The Golden Crown claims lie in the July Creek drainage area, but there are no surface drainages in the vicinity of the existing adit. An ephemeral tributary of Snowshoe Creek (tributary of July Creek) drains the north side of the claims area (Figure 3). July Creek flows south into the Kettle River and has a drainage area of 64 km^2 and a channel length of 14.2 km, of which 2.6 km lies in the United States. July Creek lies adjacent to the property in a V-shaped forested valley whereas in the lower reaches (below May Creek) the valley is broader and the stream is bounded by farmland.

The Kettle River is about 290 km long and has its source in the Monashee Mountains. It flows from Canada into the United States near Midway and re-enters Canada near Grand Forks. July Creek flows into the Kettle River 1.6 km upstream of the Canada-U.S. border at Danville. These streams are part of the Columbia River drainage.


PROJECT AREA DRAINAGES
Figure no. 3
GOLDEN CROWN PROJECT
Date July 1989
Drawn by NORECOL
Scale 1:75 000
N
SNOWSHOE CREEK
JULY CREEK
Highway 3
Skeff Creek
May Creek
Gibbs Creek
Stacey Creek
WSC-08NN018
GRANBY RIVER
GRAND FORKS
KETTLE RIVER
British Columbia
Washington
LEGEND
Water Survey of Canada Site ▲

5.1.4 Hydrology

Several hydrometric gauging stations are located in the vicinity of the study area which may have data relevant to the site. Of these stations, Kettle River near Laurier (Station 08NN012) and Christina Creek at the outlet of Christina Lake (Station 08NN014) are still active. Inactive stations include July Creek near Grand Forks (Station 08NN018 - Figure 3) and Boundary Creek at Greenwood (08NN001). The Kettle River near Laurier has continuous records since 1929. The stations located near the study area indicate a peak discharge in May and a minimum flow in January. Seasonal records (April to September) on July Creek, from 1965 to 1974, show a minimum daily discharge of 0.006 m^3/s (0.132 $L/s/km^2$) in September and a maximum daily discharge of 4.59 m^3/s (101 $L/s/km^2$) in late April (Environment Canada, 1987). July Creek is often dry below the Covert Irrigation intake south of May creek, presumably as a result of irrigation withdrawals.

5.1.5 Fisheries

There are no fish bearing streams in the Golden Crown claims area. Limited information exists for July Creek, but it is known to contain a resident population of rainbow trout (Harris, pers. comm.). The resident rainbow trout population in July Creek would be confined to the area upstream of May Creek, since downstream areas are dry for most of the year. Fish from the Kettle River may utilize lower July Creek during periods of higher flow, but this is unsubstantiated.

Fisheries information on the Kettle River is also limited and few studies have been conducted on this system near July Creek. Game fish species known to occur in the Kettle River include rainbow trout, brook trout, walleye, mountain whitefish, smallmouth bass and brown trout (Harris, pers. comm.; Vail, pers. comm.). Brown trout were planted in the U.S. portion in 1976 and have become established and occasionally occur in Canadian waters. The best rainbow trout habitat in the Kettle River occurs upstream of Rock Creek. The portion of the river below midway is known to become very warm in the summer and has relatively high densities of coarse fish species (Smith, pers. comm.).

5.1.6 Wildlife

White-tailed deer, mule deer, black bear, grouse and a variety of furbearers occur in the project area and vicinity. The general area supports low densities of moose. Elk occur in the general region, but not on the property. The property is moderate capability summer range for mule deer and white-tailed deer.

5.1.7 Vegetation

The lower elevations (below 1300 m) of this region lie within the Interior Douglas Fir biogeoclimatic zone, which typically has a Douglas fir/lodgepole pine overstory and a grass community understory. This grades at higher elevations (above 1300 m) into the Englemann Spruce Subalpine Fir zone where the Douglas fir/lodgepole pine overstory is replaced by Englemann spruce and subalpine fir and the understory becomes a shrub community.

5.1.8 Soils

Climate and surficial geology are two of the main differentiating determinants of soils in the region. Extensive glaciation has resulted in surficial deposits dominated by till, alluvial fans, and colluvium. On most of the sloping landforms parent materials are a thin veneer of coarse textured heterogeneous till or alluvial/colluvial deposits. Steeper areas are rocky. Valley bottoms consist mainly of alluvium. The climate of the area becomes wetter and colder with elevation resulting in a gradation from grassland soils (Chernozems with an organic enriched surface layer) associated with the Interior Douglas Fir zone at lower elevations to freely leached (podzols) soils associated with the higher precipitation and cooler Englemann Spruce Subalpine Fir zone at higher elevations.

5.1.9 Land Use

Mineral exploration and development is a historic land use in this area. Within the Golden Crown claims there is a right-of-way for West Kootenay Power Ltd. and B.C. Telephone Company. Grazing licences have been issued for some Golden Crown claims. The project area lies in the Granby Provincial Forest and the forest capability is moderate. Harvestable stands of lodgepole pine and Englemann spruce occur in the area.

Recreation capability of the immediate project area is moderately low, although there are some opportunities for hunting deer, black bear and upland game. July Creek is too small for angling, but downstream waters (i.e., Kettle River) are used for sport fishing. The Phoenix Ski Hill is located nearby and part of the access road to the ski hill is used to access the Golden Crown mine site.

5.1.10 Water use

July Creek is fully recorded with respect to water licences for irrigation and domestic use. Nine water licences have been issued for this stream all of which occur downstream of the project area. The Covert Irrigation District has two final water licences which allow the use of 680 and 150 acre-feet per annum for irrigation. The Sion Improvement District has two final water licences which allow the use of 450 and 100 acre-feet per annum for irrigation. Residents on lower July Creek hold three conditional water licences to use 12.125, 4.875 and 1.50 acre-feet per annum for irrigation and two conditional water licences to use up to 1000 gallons a day for domestic use and stock watering. Canada has no commitment to maintain minimum flows into the U.S. portion of July Creek.

5.2 Potential Concerns

This is a small scale project with minimal surface disturbance. The main environmental concern for the project is the potential effects on groundwater quality which could have indirect effects on the water users and the fisheries resources in July Creek. The potential effects on water quality for water users is of particular concern since water licences have been issued for irrigation or domestic use and there are several wells in the July Creek valley downstream of the project area.

Siting and design of facilities will require study to ensure proper containment and treatment of mine waste materials. Groundwater and surface water effected by the mine will meet government water quality standards at selected compliance points. Potential downstream effects resulting from mine construction and operation will be addressed in the Stage I report.

Direct effects on fish habitat is not a concern since there are no fish bearing streams in the claims area.

Since this project will be a relatively small scale operation, disruption of wildlife habitat and populations is not anticipated to be a major concern.

5.3 Ongoing and Proposed Studies

Norecol Environmental Consultants Ltd. conducted a preliminary environmental assessment of the Golden Crown project area in May 1988 and initiated collection of baseline water quality, hydrology and acid generation data in December 1988. A Stage I environmental program addressing specific concerns and providing input to engineering design will begin in early 1989. Terms of reference for a complete environmental program will be established following review of the project Prospectus by government agencies.

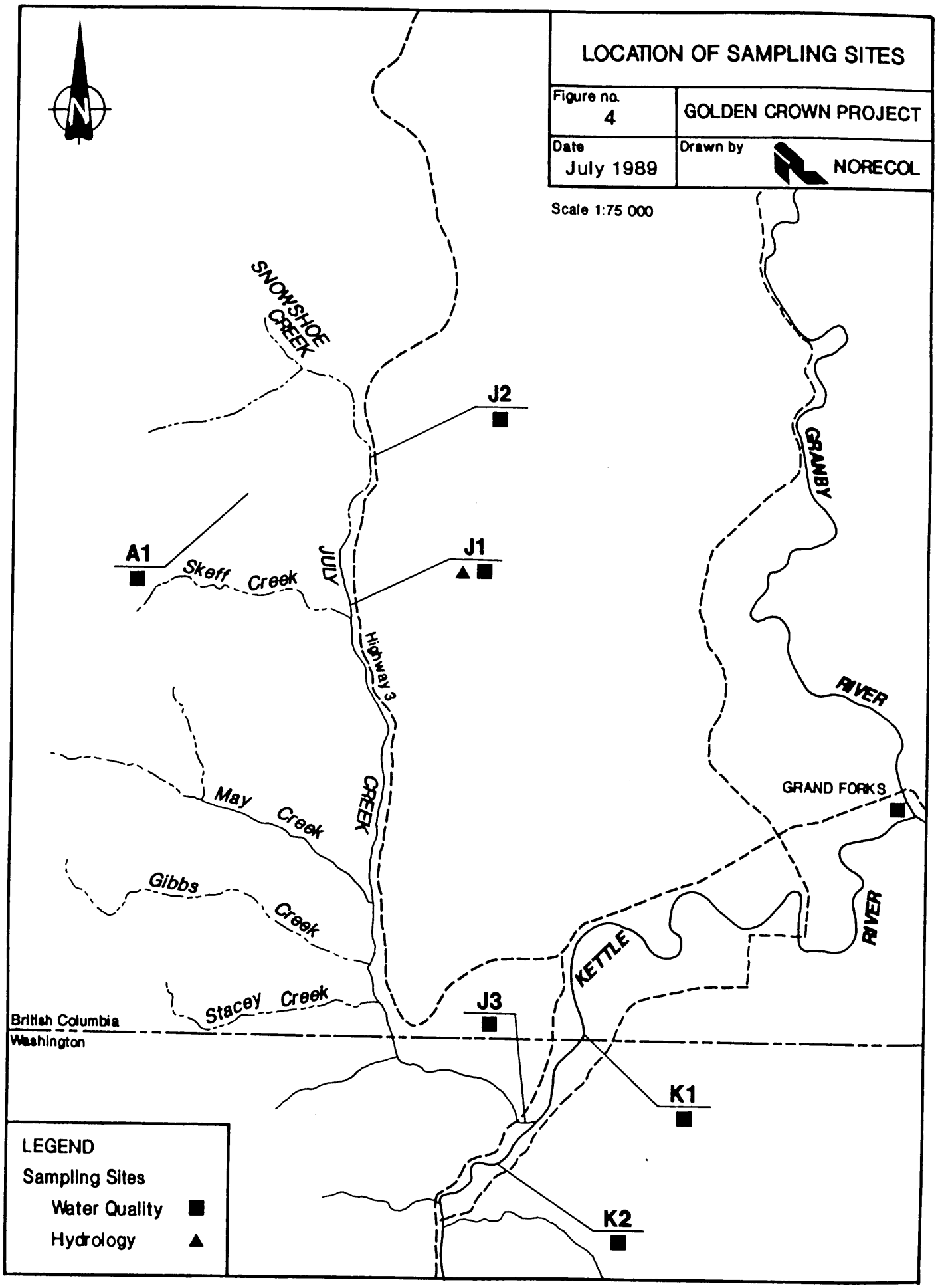
A brief summary of work conducted to date and proposed additional studies are outlined below.

5.3.1 Climate

Data from the regional climate stations are considered to be very representative of the climate of the study area (Section 5.1.1). Hence, no on-site climatological data collection program has been initiated and none is proposed. As part of the Stage I program, the regional data for precipitation (rain and snow), evaporation, temperature and wind will be compiled, reviewed and analyzed. The stage I report will describe the climate of the study area with particular emphasis on the parameters required for the engineering design of project facilities and the design of project water and waste management plans.

5.3.2 Hydrology

The hydrology monitoring program commenced December 15, 1988 with installation of a staff gauge and crest gauge on July Creek at Site J1 (Figure 4). Coincidental discharge measurements and staff gauge readings were made on two occasions. On December 15 a flow of .0037 m^3/s was measured at a gauge height of 0.385 m and on December 16 a flow of .0035 m^3/s was measured at a gauge height of 0.365 m. These coincidental stage and discharge measurements, along with similar measurements made in 1989, will be used to establish a stage-discharge relationship which can be used to estimate discharge from stage readings.


LOCATION OF SAMPLING SITES
Figure no. 4
GOLDEN CROWN PROJECT
Date July 1989
Drawn by NORECOL
Scale 1:75 000
N
SNOWSHOE CREEK
J2
A1
Skeff Creek
JULY CREEK
J1
Highway 3
GRANBY
RIVER
May Creek
GRAND FORKS
Gibbs Creek
KETTLE
RIVER
Stacey Creek
J3
British Columbia
Washington
K1
K2
LEGEND
Sampling Sites
Water Quality
Hydrology

Stage readings from the July Creek gauge will be collected on a regular basis to provide site specific discharge data. This site specific discharge data will be correlated with long term data from the regional hydrometric stations (Section 5.1.4) to give the average, low and high flow for July Creek required for the engineering design of project facilities. The Stage I report will summarize the hydrology of the study area with particular emphasis on the July Creek and Kettle River watersheds.

5.3.3 Groundwater

The initial hydrologic survey indicates there is only minor surface-water flow in and around the proposed minesite. As a result, local water movement and potential for aqueous contaminant migration during mining lie primarily in the groundwater system. An initial hydrogeological study will be carried out to begin the delineation of baseline conditions and to assess potential impacts of the mining operation on the groundwater system.

Baseline conditions will be evaluated through site observations, limited data collection from boreholes and wells, and selected water quality sampling in and around the minesite and below the site. Based on this information, an initial impact assessment of the mining operation on the groundwater system will be performed.

5.3.4 Water quality

A water quality monitoring program was initiated on December 15, 1988. A total of six stations were established at the following sites:

- July Creek downstream of mine area (J1)
- July Creek upstream of mine area (J2)
- July Creek at Danville (J3)
- Kettle River downstream of July Creek (K1)
- Kettle River upstream of July Creek (K2)
- Adit sample from Winnipeg Shaft (A1)

Water quality sampling sites are shown on Figure 4. Site K2 on the Kettle River and Site J3 on July Creek occur in the U.S. portion of these drainages. The sample from the Winnipeg Shaft (A1) was collected from standing water which had accumulated in old workings over several decades. The water quality at this site should not show any variability and will not be sampled in the future.

Water quality analyses have included a full range of physical parameters, plus nutrients and total and dissolved metals. The parameters and their respective detection limits appear in Table 1. Analysis results for samples collected on December 15, 1988 appear in Appendix 1. These results indicate the surface waters of July Creek to be very hard with high alkalinity, specific conductance

TABLE 1

Water Quality Parameters and Detection Limits

CHARACTERISTICS	DETECTION LIMITS
Temperature	field
pH	field + lab
Suspended Solids	1 mg/l
Turbidity	0.1 NTU
Specific Conductivity	1 umhos
Total Hardness	1 mg/l
Total Alkalinity	1 mg/l
Sulfate	1 mg/l
Phenols	1 mg/l
Nitrate	5 ug/l as N
Nitrite	2 ug/l as N
Ammonia	5 ug/l as N
Total phosphorus	3 ug/l as P
Total Cyanide	1 ug/l
Total Mercury	0.05 ug/l
Total and dissolved	
Aluminum	10 ug/l
Antimony	2 ug/l
Arsenic	1 ug/l
Barium	100 ug/l
Cadmium	0.2 ug/l
Cobalt	2 ug/l
Chromium	5 ug/l
Copper	0.5 ug/l
Iron	2 ug/l
Lead	1 ug/l
Manganese	0.5 ug/l
Molybdenum	5 ug/l
Nickel	2 ug/l
Selenium	1 ug/l
Silver	0.2 ug/l
Zinc	0.5 ug/l

and total solids. The Kettle River has moderately hard water with lower alkalinity, specific conductance, and total solids as compared to July Creek. The nutrient concentrations were slightly higher at the downstream site after the confluence with July Creek. Metal concentrations were generally low in July Creek and the Kettle River with none exceeding water quality criteria for British Columbia.

The standing water from the Winnipeg Shaft was very hard with high alkalinity, specific conductance and total solids. Elevated levels of sulphate, ammonia, nitrate and total phosphorus were indicated. Total cyanide was detected at a low concentration (0.005 mg/L). Metal concentrations, while generally low, were higher than those found in July Creek and exceeded the British Columbia water quality criteria for iron and nickel.

Additional water quality samplings for 1989 are scheduled for February (winter), May (high flow) and August (summer).

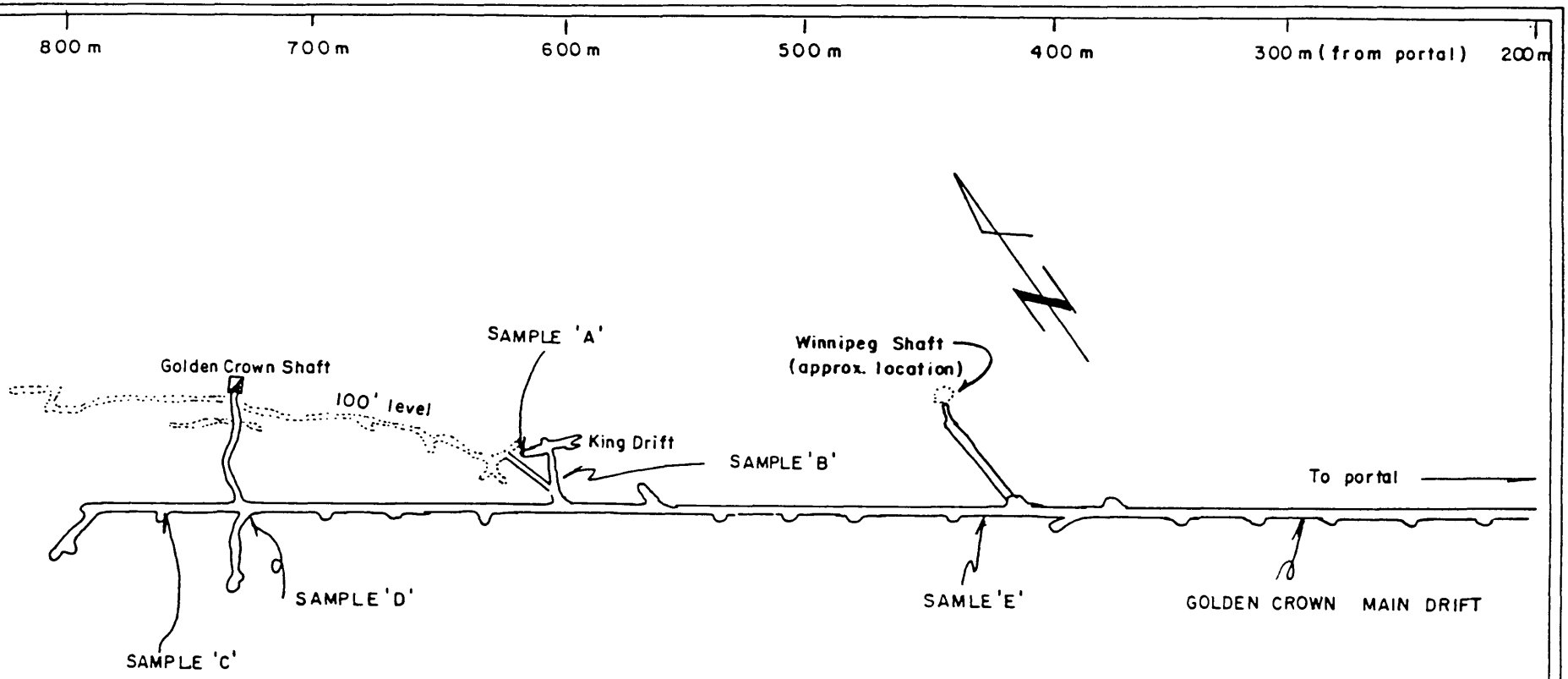
5.3.5 Acid generation

The preliminary acid generation study involved taking two ore and three waste rock samples from the adit and performing acid-base accounting tests. The samples were selected to represent each major type of ore and waste rock on the property. The locations of samples collected for acid-base accounting from the Golden Crown adit are shown on Figure 5.

The analysis results provided in Appendix II indicate that the ore consists mainly of pyrrhotite or quartz and chalcopyrite. The high sulphide content (10 and 15%) in the ore produced a high negative net neutralization potential (-434, -188 kg $CaCO_3$/t), even though the ore had significant neutralization potential (40, 126 kg $CaCO_3$/t). Due to the high sulphide content, the ore has a strong potential to generate acid.

The waste rock types are greenstone, diorite and serpentinite. All of the types had low sulphide content (0.01 to 0.03 %S) and moderate neutralization potential (25 to 28 kg $CaCO_3$/t) and, therefore, a positive net neutralization potential (+20 to + 29 kg $CaCO_3$/t). Consequently, the waste rock has a net acid consuming potential.

Additional testwork is planned for Stage I to characterize the ore and waste rock from an environmental perspective based on lithology, mineralogy and continuity of zone. Since the ore indicates acid generation potential, the type of mill process and the tailings will be evaluated to minimize the sulphide content in the tailings and to evaluate control options for acid generation if necessary.



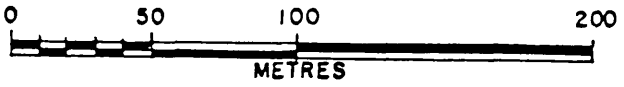


Figure 5

CONSOLIDATED BOUNDARY EXPLORATION LTD.

GRAND FORKS MINES LTD.

GOLDEN CROWN PROJECT

GREENWOOD M. D.

SAMPLE LOCATIONS FOR ACID-BASE ACCOUNTING

December 14, 1988

H. Kim, P.E., P.Geol.

5.3.6 Fisheries

Fisheries investigations will be conducted during summer 1989 to document fish species, population densities, distribution and fish habitat capability. The focus of the studies will be on July Creek. The Canadian portion of the Kettle River near the Canada-U.S. border will also be sampled to document species composition.

5.3.7 Terrestrial

The soils, terrain and vegetation of the area have been mapped by the B.C. Ministry of Environment (MOE) at 1:50,000. In addition, site specific information is available from the Ministry of Environment. A brief site inspection will occur during 1989 to describe and map terrain features and assess reclamation suitability. This will provide background environmental data and input into site location and design of mine facilities including the formulation of site reclamation plans.

5.3.8 Wildlife

Compilation of available information on wildlife from MOE and local sources has been initiated. A brief site visit is anticipated for 1989 to document wildlife habitat and vegetation types. Seasonal usage will not be detailed since the potential impacts of this project on wildlife are expected to be minimal.

5.3.9 Land use

Information on land tenure, present land use, mineral resources, agriculture, forestry, recreation, hunting, angling, and trapping will be compiled and assessed. Heritage resource potential of the area will be assessed if required.

5.3.10 Waste Management Plan

An essential part of the Stage I will be a comprehensive plan outlining the methods to be used for managing waste materials. The plan will focus on: acid generation potential, tailings effluent management, sewage, refuse disposal, dust control, surface runoff from the mine site and mill site, air emissions, and storage and handling of reagents, fuels and explosives. The plan will be developed with the project engineering team and will be designed to adequately resolve potential concerns.

5.3.11 Water Management Plan

A conceptual water management plan will be prepared for the mine site. This will include estimates of peak runoff from disturbed and undisturbed areas, conceptual layout of a surface drainage system, and preliminary design concepts for settling ponds and the tailings impoundment. The water management plan will be illustrated on a mine site plan at a scale of 1:5000 or larger.

5.3.12 Reclamation Plan

A conceptual reclamation plan for areas of disturbance will be developed for the Stage I report. The plan will be outlined as required under Section 7 of the Mines Act. Reclamation concepts will include end land uses, environmental protection during mine operation, and reclamation upon mine abandonment. This will include construction of final water management plans, revegetation species, requirements for topsoil and fertilization, and consideration of any potential for acid generation in the materials handling plans.

6.0 SOCIO-ECONOMIC ASPECTS

The following sections provide a brief overview of the socio-economic aspects of the project, with particular reference to existing infrastructure, communities, populations, employment and potential impacts.

6.1 Setting and Employment

The project area is located in the West Kootenay Region of British Columbia within the Kootenay-Boundary Regional District. The Boundary District has a long history of mining activity with the first claims being staked in 1884. During the First World War it was the most important copper producing area in the British Empire but by 1919 the mines and smelters were abandoned due to dwindling ore reserves and a labour strike (Sprout and Kelly 1964). The abandoned Pheonix mine near the Golden Crown property was a major copper producer in the region. The population of the Boundary District decreased upon the closing of the mines and smelters, but has gradually increased again due to industries such as manufacturing, agriculture and tourism.

The major industry in the area is manufacturing of forest products. The largest single employer being Pope and Talbot Ltd., which operates forest product mills at Grand Forks and Midway. The Grand Forks mill employs some 185 people. Can Par Industries operates one of the largest particleboard plants in the world employing about 120 people.

Agriculture has been an important industry in the Boundary District since the early 1900's but the industry relies heavily on irrigation. Today this area is famous for its crops of potatoes, onions, cabbage and asparagus. Strawberries, raspberries and orchard crops are also important.

Tourism is increasing in importance in the Grand Forks area as thousands of tourists visit Christina Lake, the warmest lake in Canada, during the summer months. The heritage buildings in Grand Forks, built by the Doukhabors who emigrated from Russia at the end of the 19th century, and the Doukhabor Museum are also popular tourist attractions.

6.2 Infrastructure and Services

The closest major community to the project area is Grand Forks, located 12 km to the southeast. Grand Forks has bus service, truck and rail freight facilities and is located along Highway No. 3. The community is fully serviced and incorporated as a city and has a population of 3187 within the city limits (Central Statistics Bureau 1988) and about 4500 in the surrounding areas. It has a good transportation infrastructure and a wide variety of private and government services. Employment in the community in order of importance are manufacturing, retail trade, accommodation and food, health and social services, and agriculture. Available services include a full service hospital, two elementary schools and one secondary school, a satellite campus of Selkirk College, R.C.M.P., library, motels, restaurants and art gallery. Grand Forks appears the most likely community for mine employees to reside. Access to the property is along Highway No. 3 and then via gravel logging roads to the site.

Greenwood is a small community located 7 km west of the project area. Greenwood is incorporated and has a population of 719 (Central Statistics Bureau 1988). The main industries are mining and forestry. The community is of interest to tourists due to its museum and restored turn-of-the-century buildings. The community has a city hall, bank, elementary school, library, restaurants and motels. The high school and R.C.M.P. detachment servicing the town are located in Midway 12 km to the southwest.

6.3 Potential Issues

Potential issues relate primarily to opportunities for services, housing and employment for regional communities. Grand Forks has services and housing to accommodate incoming workers' families. The present unemployment level in the area make a variety of skills and trades available to the project. The small settlements near the project area may have minimal capacity to absorb additional families.

Due to the small workforce required for this project, the socio-economic impacts of the project are expected to be minimal.

6.4 Proposed studies

A Stage I level socio-economic assessment will be conducted for the project, as required under the Mine Development Review Process. This will include an assessment of regional communities, employment, available services, skills, housing, and ability to respond to project development. However, the level of detail required for this assessment is not expected to be significant given the small size of the project.

REFERENCES

Central Statistics Bureau. 1988. Community Statistical Profile. Ministry of Economic Development. Victoria, B.C.

Environment Canada. 1987. Historical Streamflow Summary to 1986, British Columbia. Inland Waters Directorate, Water Survey of Canada. Ottawa:

Harris, B. 1988. Personal Communication. Ministry of Environment, Fish and Wildlife, Penticton, B.C.

Smith, D. 1989. Personal Communication. Ministry of Environment, Fish and Wildlife, Penticton, B.C.

Sprout, P.N., and C.C. Kelley. 1964. Soil Survey of the Kettle River Valley in Boundary District of British Columbia. Report No. 9. B.C. Department of Agriculture and Canada Department of Agriculture.

Vail, C. 1989. Personal Communication. District Fish Biologist. Washington Department of Game. Kettle Falls, Washington.

APPENDIX I

ANALYTICAL RESULTS FOR WATER SAMPLES FROM GOLDEN CROWN PROJECT

ANALYTICAL PARAMETER	SITE A1	SITE J1	SITE J2	SITE J3	SITE K1	SITE K2
pH	7.3	7.4	6.8	7.8	7.4	7.5
Alkalinity (mg $CaCO_3$/L)	144	193	169	250	73	75
Turbidity (NTU)	9	1.0	0.6	1.3	0.4	0.4
Conductance (µmhos/cm)	566	434	410	474	130	129
Total Solids (mg/L)	518	362	334	373	96	97
Suspended Solids (mg/L)	21	3	<1	3	<1	<1
EDTA-Hardness (mg $CaCO_3$/L)	358	266	244	308	72	71
Sulfate (mg/L)	221	61	74	53	10	10
Ammonia (mg N/L)	1.74	0.051	0.083	0.049	<0.005	0.005
Nitrate (mg N/L)	1.70	0.094	0.038	0.710	0.022	0.031
Nitrite (mg N/L)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Phosphorus (mg P/L)	0.053	0.023	0.012	0.032	0.008	0.016
Total Cyanide (mg/L)	0.005	<0.001	<0.001	<0.001	<0.001	<0.001
TOTAL METALS: (mg/L)						
Ag	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Al	0.17	0.02	0.01	0.03	0.01	0.01
As	0.046	<0.001	<0.001	<0.001	<0.001	<0.001
Ba	0.017	0.05	0.06	0.08	0.028	0.022
Cd	0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Co	0.010	<0.001	<0.001	<0.001	<0.001	<0.001
Cr	0.001	<0.001	<0.001	0.002	<0.001	<0.001
Cu	0.0005	0.0008	0.0017	0.0007	<0.0005	<0.0005
Fe	0.81	0.06	0.08	0.05	0.020	0.025
Hg (µg/L)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mn	0.15	0.04	0.11	0.0022	0.0024	0.0040
Mo	0.006	<0.005	<0.005	0.007	<0.005	<0.005
Ni	0.20	<0.002	<0.002	<0.002	<0.002	<0.002
Pb	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sb	0.003	<0.002	<0.002	<0.002	<0.002	<0.002
Se	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
DISSOLVED METALS: (mg/L)						
Ag	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Al	0.01	0.01	<0.01	<0.01	0.01	0.01
As	0.004	<0.001	<0.001	<0.001	<0.001	<0.001
Ba	0.017	0.05	0.06	0.07	0.026	0.021
Cd	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Co	0.009	<0.001	<0.001	<0.001	<0.001	<0.001
Cr	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Cu	<0.0005	0.0006	<0.0005	0.0006	<0.0005	<0.0005
Fe	0.22	0.026	0.030	<0.005	0.009	0.011
Mn	0.14	0.04	0.07	<0.001	0.0021	0.0033
Mo	0.006	<0.005	<0.005	0.007	<0.005	<0.005
Ni	0.20	<0.002	<0.002	<0.002	<0.002	<0.002
Pb	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sb	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Se	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

APPENDIX II

ACID-BASE ACCOUNTING RESULTS FOR GOLDEN CROWN PROJECT

TYPE OF MATERIAL	DESCRIPTION	SAMPLE No.	PASTE pH	TOTAL S (%S)	SULPHIDE (%S)	SULPHATE (%S)	kg $CaCO_3$/t MAXIMUM POTENTIAL ACIDITY[a]	kg $CaCO_3$/t NEUTRALIZATION POTENTIAL	kg $CaCO_3$/t NET NEUTRALIZATION POTENTIAL
ORE	mainly pyrrhotite, minor chalcopyrite and quartz	A	6.9	23.3	15.16	0.030	474	40	-434
ORE	mainly quartz and chalcopyrite minor pyrrhotite	C	7.9	12.2	10.04	0.027	314	126	-188
WASTE	Greenstone (meta-andesite)	B	8.2	0.568	0.27	0.013	8.4	28	+ 20
WASTE	Diorite (finely grained)	D	8.9	0.172	0.01	0.013	0	29	+129
WASTE	Serpentinite	E	9.2	0.017	0.01	0.007	0	25	+ 25

[a] Maximum potential acidity calculated using sulphide content.