HOPE BAY JOINT VENTURE

2CH005.02

HOPE BAY PROJECT
PRELIMINARY ASSESSMENT
DORIS NORTH TRIAL OPERATION
NUNAVUT, CANADA

SRK Consulting

Engineers and Scientists

2CH005.02

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PRELIMINARY ASSESSMENT
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NUNAVUT, CANADA

Prepared for:

HOPE BAY JOINT VENTURE
A 50:50 Joint Venture Between
Miramar Hope Bay Ltd. And Hope Bay Gold Corporation
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EXECUTIVE SUMMARY

The Hope Bay Project is located in Nunavut Territory and comprises in excess of 1,000 km^2 of mineral rights that encompass almost all of an Archean greenstone belt. The property is owned by Miramar Hope Bay Ltd. and Hope Bay Gold Corp as to 50% each. The property has been the subject of extensive exploration since 1992 and, to date, three mineralized deposits have been discovered on the belt: Boston, Doris and Madrid.

In October 2001, the Hope Bay Joint Venture commissioned a Preliminary Assessment, or scoping study, (the "Study") to benchmark the current project status and to evaluate options for the development of a commercial operation at Hope Bay. As the Study progressed, it became apparent that the stand alone development of the high grade, near surface Doris Hinge Zone could provide a compelling alternative for a lower capital cost, rapid payback operation that could generate significant cash flow to continue the development of the full potential of the Hope Bay belt. Independent consultants, SRK Consulting and Bateman Engineering, in conjunction with Nuna Logistics, completed the Study. Since the Study incorporates inferred resources in addition to those defined as measured and indicated, the Study will be characterized as a Preliminary Assessment under National Instrument 43-101. National Instrument 43-101 requires that the following disclaimer accompany disclosure of a Study that includes an economic evaluation that uses inferred mineral resources: ***This Study is preliminary in nature. It includes inferred mineral resources that are considered too speculative geologically to have economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the results of the Study will be realized***.

As contemplated in the Study, the development of the Doris Hinge Zone will commence with a small open pit followed by ramp access and underground mining of the majority of the

Hinge Zone resources. In addition, approximately 9,000 tonnes of higher grade material stockpiled at Boston will be hauled to the mill for processing. To minimize capital costs, mining and ore haulage is proposed to be undertaken by a contractor and the Boston camp will be moved to Doris and the site cleaned up to reduce the current level of bonding. Due to the relatively large dimensions of the Hinge Zone, mining will be by lower cost bulk mining techniques such as room and pillar or bench and fill. Ore will be delivered to a crusher that will feed a modular mill pre-constructed off site and located adjacent to the portal. Due to the modularized nature of the mill, it requires no foundations but would be set on compacted fill and covered with a sprung structure similar to those used at a number of other arctic locations. The ore will undergo conventional crushing and grinding with an integral gravity gold recovery circuit followed by flotation and cyanidation, with gold dore produced on site.

Waste rock would largely be used for civil construction projects such as an access road to a barge unloading facility on the coast 3.7 km to the north, an airstrip, and for tailings dam construction. Tailings are proposed to be deposited in a tailings impoundment east of the Doris Hinge area, utilizing a small lake for deposition.

As contemplated in the Study, all equipment, bulk supplies and materials are proposed to be moved to site by barge from Hay River. Other supplies and personnel will be transported to and from site by aircraft. Up to 100 personnel are anticipated to be employed on site on a fly in, fly out basis, with hiring anticipated from the local communities in the Kitikmeot region and from Yellowknife.

The principal parameters related to the development of the Doris Hinge Zone are as set out in the table below.

Summary of Preliminary Assessment on Doris Hinge Zone, Hope Bay Project

Assumptions	
Gold price (US$/oz)	$280
Exchange Rate (C$/US$)	1.57
Gold Price (C$/oz)	$440
Production	
Ore Milled (tonnes)	471,600
Daily Throughput (tonnes/day)	600
Operating Life (years)	2.1
Diluted Grade (g/t gold)	18.5
Recovery (%)	97%
Total Gold Recovered (oz)	271,724
Cash Operating Cost (US$/oz)	***$114***
Total Cost (US$/oz)	***$177***
Capital Costs (C$000's)	(26,685)
NET CASH FLOW (C$000's)	**44,786**
Rate of Return on Investment	83.4%
NPV @ 5% Discount Rate (C$000's)	$38,365
Payback (months)	13

1. INTRODUCTION AND TERMS OF REFERENCE

In October, 2001 the Hope Bay Joint Venture (HBJV) requested proposals for engineering services to complete an Engineering Study for a "Doris North Trial Operation" at its Hope Bay Project located approximately 160 km southwest of Cambridge Bay in the Kitikmeot region of Nunavut in northern Canada. The Hope Bay Project is a joint venture between Miramar Hope Bay Ltd., a wholly subsidiary of Miramar Mining Corporation and Hope Bay Gold Corporation

This Preliminary Assessment Report has been prepared in response to the RFP from Hope Bay Joint Venture requesting the following:

- An Engineering Study: the purpose of this study is to develop a project description of suitable definition to support the creation of a "Preliminary Plan of Operation" for submission to the Nunavut Impact Review Board.
- The study must use the existing mineral resources including those currently categorized as inferred, as such the contents of this document could be used to prepare a "Preliminary Assessment" as defined by National Policy 43-101.
- The study must develop sufficiently detailed capital and operating costs for mining, milling, site infrastructure, and administration to provide an indicative economic evaluation of the project.

National Policy 43-101 allows an issuer to disclose a preliminary assessment that includes an economic evaluation which uses inferred mineral resources, provided certain conditions are satisfied, including (but not limited to) the following:

- a proximate statement that the preliminary assessment is preliminary in nature, that it includes inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves, and there is no certainty that the preliminary assessment will be realized, and
- the basis for the preliminary assessment and any qualifications and assumptions made by the qualified person

In this report, the term "study resources" is used instead of reserves. "Study resources" are the Doris North mineral (gold) resources of all classifications proposed to be extracted with estimated dilution and mining recovery factors applied. The sources of information for this preliminary assessment are:

- Existing reports prepared for, or by HBJV describing the mineral property, the geology, mineralization, exploration and existing infrastructure. Refer to the list of references included with this report.
- Estimates of mineral resources prepared by HBJV, including 3D Gemcom block models of mineralized solids with tonnes and grades.
- Estimates of mining manpower, mining costs, and production schedules prepared by contractors Nuna Logistics.
- Estimates for process capital and operating costs prepared by Bateman Engineering.
- Estimates for general and administrative costs developed by the Hope Bay Joint Venture.
- In-house data and estimates prepared by SRK Consulting concerning planned mine development, production, infrastructure and waste management.

"Certificate and Consent" forms for the qualified persons responsible for this preliminary assessment are included in Appendix H. HBJV qualified persons are responsible for geology, mineralization and resources, and they have had extensive field involvement. Qualified persons of SRK Consulting and Bateman Engineering have not visited the project site.

This report considers the economics of extracting the Hope Bay, Doris North resources that comprise of three deposits, including Doris Hinge, Central Vein and Lakeshore Vein.

2. PROPERTY DESCRIPTION AND LOCATION

2.1 Location

The Hope Bay Project is situated approximately 685 km northeast of Yellowknife and 160 km southwest of Cambridge Bay within the Territory of Nunavut (see Figure 2.1). The centre of the project is approximately 160 km north of the Arctic Circle at latitude 67^0 30' N and longitude 107^0 W. The nearest communities are Umingmaktok, located 65 km to the west and Kingauk (Bathurst Inlet), located 110 km southwest.

2.2 Area of Property

The entire land package at Hope Bay was maintained in good standing throughout 2001. A summary of the current land status at Hope Bay is shown in Table 2.2 and a detailed claim status report, as of December 31, 2001 is tabulated in Appendix F. The Hope Bay Property comprises an area of 1,078 km^2 and forms one large contiguous block that is approximately 70 km by 30 km in size.

Four new claims were staked in the Hope Bay belt during 2001: three claims to secure the south-eastern extension of the greenstone belt (BOSTON 18, 19 and 20 claims), and one claim (HEKU 5) area to cover a greenstone outlier at the southwest end of the Hope Bay belt. These claims were submitted to the Mining Recorder in August were approved by the Mining Recorder in mid-December 31. These new claims cover approximately 4,800 acres and assessment work totalling $19,200 must be completed before August 2003.

TABLE 2.2
Summary of Current Land Status

Tenure Type	No. Title	Area (ha)	Area (acres)
Federal Mineral Claims	54	35,701	88,215
Federal Mining Leases and Leases Pending	19	16,150	39,906
Inuit Exploration Agreements	7	55,976	138,317
Total	80	107,827	266,438

3. ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

3.1 Topography, Elevation and Vegetation

This information is covered in other sections of this report.

3.1 Property Access

The primary access route to the property for fuel, equipment and supplies will be via sea barges from Hay River during the summer month of August when the ice conditions allow for passage. The barges will land at the southernmost tip of Roberts Bay where off-loading will be done (see Figure 3.2(a)). Details on the ice-conditions for the shipping route as well as bathymetric surveys of Roberts Bay are reported in the "Boston Gold Project Scoping Study" (BHP World Minerals, 1995 and in the EBA Engineering Consultants Ltd report dated October 1997.

After the initial off-loading, all equipment will remain on the shoreline until such time as a winter road can be constructed to the mine site. Upon completion of the winter road, mining of the Open Pit will commence and the permanent all-weather access road between the Mill and Roberts Bay will be constructed starting at the Mill location.

From the barge landing site a 750 m all-weather access road will join up with the 1,800 m Class 3D airstrip. Beyond the southern end of the airstrip, a 2,050 m all-weather access road will be constructed to the Mill site. This combination road/airstrip will be the primary access route for fuel, supplies and equipment to the site. Personnel and additional supplies will be flown in using up to a Hercules size aircraft in reasonable weather conditions. During the winter larger planes can be landed on a prepared airstrip on Doris Lake. All the mine access, haul, and service roads as well as the permanent airstrip locations are marked on Figure 3.2(a). The sections below describe each road type and the airstrip in greater detail.

3.1.1 All-Weather Roads

The all-weather roads will be constructed with a minimum fill thickness of the pad required to cover micro-relief and protect permafrost. The soil type and ground ice conditions should dictate the thickness required for protection. For planning purposes constant thicknesses of all roadways have been assumed as indicated in Figure 3.1.1.1, however further site specific investigation will be required to confirm the suitability of these thicknesses. Some additional guidelines are provided in EBA Engineering Consultants Ltd, October 1993. If possible all roadways will be constructed in the winter to ensure the integrity of the permafrost, however should summer construction be necessary appropriate geotextiles will be used in the construction. All roadway fill will be from the overburden waste rock in the Open Pit. Prior to using this material appropriate testing will be conducted to ensure that it is geochemically stable. Fill will be crushed to the required size fraction on site, using a 30” x 48” Jaw crusher and a 4.25’ Cone Plant.

3.1.1.1 Access/Haul Roads

There will be two sections of roadway that will serve as primary site access road. Furthermore, there will be one section of road that will primarily serve as a haul road. The details of these road segments are described below, and are illustrated in Figure 3.2(a).

Access road #1: 750 m long road starting at the southernmost tip of Roberts Bay at the barge landing site. This road will follow in a south-easterly direction towards the northern tip of the airstrip.

Access road #2: 2,050 m long road starting at the southern tip of the airstrip. This roadway will continue in a southerly direction for approximately 1,000 m before turning south-east towards the Mill site location.

Haul road #1: 650 m long road between the Mill site location and the Waste Rock Disposal area via the Open Pit. This road follows a north-easterly route parallel to the Doris Lake shoreline.

A typical cross section through these roadways is illustrated in Figure 3.1.1.1. The road surface will be 10 m wide with 50% (26.6^{o}) side slopes. Roadway drainage will be via 1.5% surface grading in both directions from the centerline of the roadway. The pad will consist of a minimum of 200 mm thick surfacing grade layer overlying a 300 mm thick select grade layer overlying a 600 mm thick subgrade layer. There will be no surface preparation for winter construction. For summer construction a heavy grade woven geotextile will be placed directly on top of the surface prior to placing the pad.

3.1.1.2 Service Road

Tailings deposition will be in Tails Lake (see Figure 3.2(a)) and a 4,600 m long service road will be constructed to maintain and inspect the tailings facility. The road will start at the Waste Rock Disposal site and follow a north-easterly direction towards the northern end of Doris Lake (250 m). At this location a bridge will be constructed to cross a small seasonal stream. The road will then turn south-east and will hug the shore of Tails Lake towards a junction where the tailings dam embankment will be constructed (1,250 m) (see Figure 3.2(a)). A short 300 m road section will extend in a south-west direction to allow access to the tailings dam wall. The road will then continue 2,800 m in a southern direction along the Tails Lake shoreline to the southernmost tip of the lake.

This roadway will only be wide enough for single lane traffic of light trucks for service and maintenance purposes of the tailings facility. Turn-out sections that will allow for vehicles to pass or turn around will be provided at approximately 1,500 m intervals (10 m wide x 25 m long).

A typical cross section through this roadway is illustrated in Figure 3.1.1.2. The road surface will be 5 m wide with 50% (26.6o) side slopes. Roadway drainage will be via 1.0% surface grading across the road surface. The pad will consist of a minimum of 200 mm thick surfacing grade layer overlying a 600 mm thick select layer. There will be no surface preparation for winter construction. For summer construction a heavy grade woven geotextile will be placed directly on top of the surface prior to placing the pad.

3.1.2 Airstrip

The airstrip design is based on the type of aircrafts anticipated to use the facility. The primary aircraft that will be used for the project is expected to be Lockheed C-130 Hercules, and Boeing 737 along with a variety of smaller turbo-prop aircraft. Further, the airstrip is assumed to have a non-instrument approach. The proposed runway design for this project is according to the Transport Canada class 3D runway requirements. A detailed description of these requirements is provided in EBA Engineering Consultants Ltd., December 1997.

The 1,680 m long x 45 m wide runway (1,800 m long overall length with 60 m approach strip at either end) lies in a predominantly north-south direction as illustrated in Figure 3.2(a). A 200 m x 150 m apron for turning airplanes is located east of the runway, 200 m north of the southern end of the runway.

A typical cross section through the airstrip is illustrated in Figure 3.1.2(a). The airstrip will be 45 m wide with 40% (21.8^{o}) side slopes. Airstrip drainage will be via 1.5% surface grading either side of the airstrip centre line. The pad will consist of a minimum of 200 mm thick surfacing grade layer overlying a 300 mm thick select layer, overlying a 600 mm thick subgrade layer. There will be no surface preparation for winter construction. For summer construction a heavy grade woven geotextile will be placed directly on top of the surface prior to placing the pad.

The typical cross-section through the apron is illustrated in Figure 3.1.2(b). The pad construction and side slope configuration will be identical to that for the airstrip. Apron drainage will be via 0.5% surface grading.

3.1.3 Construction Quantities for Roads/Airstrip

An estimate of the required construction quantities for all the access, haul, and service roads as well as the airstrip are listed in Table 3.1.3. These quantities are based on the simple cross-sections presented in Figures 3.1.1.1, 3.1.1.2, 3.1.2(a) & (b). The volumes are based on a rock density of 2,900 kg/m3 and a bulking factor of 1.5.

TABLE 3.1.3
Construction Quantities For The All-Weather Roads And Airstrip

Material	Geotextile	Sub grade (1000 mm max.)	Select Grade (200 mm max.)	Surfacing grade (38 mm max.)
Access road #1 (750 m)	10,800 m^2	5,940 m^3	2,906 m^3	1,500 m^3
Access road #2 (2,050 m)	29,520 m^2	16,236 m^3	7,944 m^3	4,100 m^3
Haul road #1 (650 m)	9,360 m^2	5,148 m^3	2,519 m^3	1,300 m^3
Service road #1 (4,600 m)	37,720 m^2	-	23,966 m^3	4,600 m^3
Airstrip (1,800 m)	90,900 m^2	52,920 m^3	39,094 m^3	16,200 m^3
Apron (150 m x 200 m)	30,413 m^2	18,585 m^3	24,891 m^3	6,000 m^3
Sub-totals	208,713 m^2	98,829 m^3	101,319 m^3	33,700 m^3
Total fill required	233,848 m^3 (452,106 tonnes)			

3.2 The proximity of the Property to a Population Centre, and the Nature of Transport

The Hope Bay Project is situated approximately 685 km northeast of Yellowknife and 165 km southwest of Cambridge Bay within the Territory of Nunavut. The centre of the project is approximately 160 km north of the Arctic Circle at latitude 67^0 30' N and longitude 107^0 W. The nearest communities are Umingmaktok, located 65km to the west and Kingauk (Bathurst Inlet), located 110 km southwest. There are no permanent transportation routes connecting the site to these communities. The only transportation from these locations to the project is by air or, in winter, by skidoo or cat train.

3.3 The climate and the length of the operating season

The region experiences long cold winters and brief cool summers. Temperatures in January are often below –30^{o}C while the mean annual precipitation is less than 150 mm. Snow accumulation and freeze-up of lakes begin in mid to late September and remain into June. Prevailing winds are strong and steady from the northwest. Due to its location above the Arctic Circle, the property experiences 24-hour sunlight in midsummer and 24-hour darkness in midwinter. It is an area of Arctic tundra with continuous permafrost. BHP's work at Boston shows that permafrost persists to depths of as much as 500 m. Exploration activities take place primarily in two seasons: between late February and June when lakes are frozen, and July through October when lakes are clear of ice. Break-up and freeze-up periods are preferably avoided. However, a permanent airstrip will allow year round access and operation.

3.4 Surface Mining Rights and Permitting

The Territory of Nunavut was created on April 1, 1999, with the sitting of its first Legislative Assembly. Four resource management boards have operated since July 1996; the Nunavut Water Board ("NWB"), the Nunavut Impact Review Board ("NIRB"), the Nunavut Wildlife Management Board ("NWMB") and the Nunavut Planning Commission ("NPC").

Receiving overall project approval and operating permits will be dependent upon an environmental assessment process coupled with community consultation and, in the case of major developments, the successful negotiation of an acceptable Inuit Impact and Benefit Agreement made under the Nunavut Land Claims Agreement. It is expected that between 18 and 24 months may be required to obtain approvals and licenses for construction and operation of a mine. To date, there has been no precedent case to assess the time or efficiency of the process in Nunavut. One issue is the method in which cumulative impacts of mineral development are assessed.

Any use of Inuit surface land requires a land use permit, licence or lease. Such permits are issued and administered by the Kitikmeot Inuit Association ("KIA"). The KIA, NIRB and local communities, any one of which can attach specific conditions to the permit, review applications. Land-use licenses are valid for up to three years. Amendments describing proposed work must be submitted on an annual basis and are subject to local community review.

Any water use on Inuit lands requires permitting. The NWB issues all water licenses and permits within Nunavut subject to a review by NIRB, which provides recommendations to the Nunavut Water Board respecting permit issuances.

3.5 Availability and Sources of power

3.5.1 Electrical Load

The total annual property power consumption is estimated at 12.5 GWH. Of this approximately 70% is required in the process area. The remainder is evenly divided between the mine and surface camp. Peak demand is projected at 2.6 MW with a constant load of 1.4 MW.

3.5.2 Power Plant

A package made up of four generators complete with a synchronized load distribution center, will provide between 2.4 and 3.3 MW of electric power to the Mill, shop, camp, underground mining operation, and all other areas. These generators will be complete with jacket water heat recovery systems. Only two of the generators will be required on site prior to the start of Mill operations.

3.5.3 Waste Heat Recovery

Waste heat will be recovered from the generators using a glycol heat exchange system. Waste heat will be used primarily in the mill enclosures.

3.6 Availability and Sources of Water

3.6.1 Fresh Water Supply

The source of fresh water to the project will be Doris Lake (see intake location on Figure 3.2(a)). Fresh water will be used only for potable requirements and mill gland water.

3.6.2 Return Water

All mill process water will be recycled from Tails Lake, the repository for mill tailings (see tailings and return water lines on Figure 3.2(a)).

3.6.3 Water Storage and Distribution

Separate storage and distribution systems will be provided for fresh/fire water, potable water and return water.

3.6.4 Fresh/Fire Water

The 76 m^3 fresh water tank at the Mill receives water from Doris Lake for distribution throughout the project site. Potable water will be provided from this supply by chlorination and storage in a potable water storage tank of 24 m^3. Potable water will be distributed for domestic use in the accommodations, mill area and service buildings.

The fire water reservoir will be contained in the lower 60% of the fresh water tank. The fire water system will be sized to provide in excess of two hours emergency supply. The system will include a fire water pump station comprising two electric pumps, one emergency diesel pump, plus a jockey pump. An internal ring main will supply the buildings complex, with wall hydrants at access doors and a fire alarm system. The power house will be protected by wheeled dry chemical extinguishers and inert gas portable fire extinguishers. Portable fire extinguishers will be located at all electrical rooms and at strategic locations throughout the surface facilities.

Automatic sprinkler systems will be provided in the accommodations and service building.

3.6.5 Emergency Overflow Sump

An emergency overflow sump will be constructed adjacent to the mill with a holding capacity of 2000 m^3. The sump will be excavated into the ground and lined with a 1.5 mm thick HDPE liner (see Figure 3.6.5 for a typical cross section). The estimated volume of excavation is 1,300 m^3 and the required fill volume is 1,180 m^3. The estimated area of liner required is 1,840 m^2.

3.7 Availability and sources of mining personnel

It is estimated that at peak operation, a total of 100 employees will be required to perform all operating duties. As part of the permitting process in Nunavut an Inuit Impact and Benefits agreement must be concluded. A key element of this agreement will be local job creation and training opportunities. Mining activities are completed using a mining contractor and as such personnel will primarily be drawn from the contractor's existing labour pool. This will be supplemented where practical with local hiring. Surface operations, including the process plant will offer the greatest local employment opportunities with potential employees being drawn from various communities within the Kitikmeot region of Nunavut.

In addition Miramar Hope Bay Limited has access to a well trained workforce at operations within Yellowknife to provide key staff positions, mine and process personnel.

3.8 Tailings Storage Area

600 tonnes/day of ore will be processed in the Mill. All tailings will be mixed to a 35% solids ratio and will be pumped to Tails Lake for deposition. The pumping distance is 5,250 m with a maximum head of 10 m.

Tailings will be deposited into the southern end of Tails Lake via an insulated and trace heated pipeline. The pipeline will follow the Tails Lake access road route (see Figure 3.2(a)) and will be placed on surface. Deposition will be via end-pipe discharge and a beach will be allowed to form. The discharge will be periodically relocated to allow a gradual beach that moves north towards the dam wall. Return water will be pumped from immediately upstream of the dam wall via a heated and insulated pipeline with a barge pump. Discharge from Tails Lake will be via a controlled siphon

outlet, and discharge will be into the river downstream of Doris Lake. No discharge will be into Doris Lake at any time.
The tailings deposited into Tails Lake will be contained by constructing a dam across the northern end of the Lake. Since deposition will be in the southern Lake end, the tailings will settle in the lake and clarified water will be allowed to decant to the downstream receiving environment. Decant to the receiving environment will mainly occur during storm flow events and the annual snowmelt season. For the remainder of the time the Mill water balance will require that the Tails Lake water balance be negative. This would ensure that maximum control is maintained over the containment of the deposited Tailings.

A typical cross-section through the tailings impoundment wall is illustrated in Figure 3.8. The dam core is rockfill that is dumped systematically from the east shore and as the fill daylights and becomes a trafficable surface construction towards the opposite bank commences. Upon completion of placing the rockfill core the substrata will be densified in-situ. A slurry trench will then be constructed through the dam centerline through the substrata to a founding rock layer. If necessary grouting into the fractured rock foundation will be done to ensure a good seal of the dam.

The freeboard height of the slurry wall will be 1 m, with an additional 1.2 m freeboard distance to the final crest level. The core sideslopes will be 33.3% (10.4^{o}). The final crest width of the dam will be 6 m wide with a 1.5% surface drainage slope.

3.9 Waste Disposal Areas

A total of 375,000 tons of waste rock will be produced from the Open Pit, and 7,500 tons from the underground mining operations. Driving the access ramp into the Open Pit will produce an additional 125,000 tons of waste rock, for an overall total of 507,500 tons. The waste rock will be used as construction material for the roads, airstrip, apron, foundation pads etc., provided geochemical testing confirms its suitability.

Any excess waste rock and/or temporary storage will be in a demarcated area north of the Open Pit. The haul distance from the Open Pit to the dump area is 200 m. The waste rock will be end dumped in rows over demarcated areas. Upon completion of a single dumping zone a grader will be used to level the surface and a subsequent lift of end dumping will commence. No compaction of the waste rock other than self compaction by vehicle traffic will be performed. Final dump side slopes will be at angle of repose.

3.10 Processing Plant Site

The processing plant will be founded on a rock foundation. The plant will be sited south-west of the open pit (see Figures 3.2(a) and (b)), in close proximity to all the other surface facilities.

3.11 Administration and Service Complex

3.11.1 Mine Equipment Maintenance & Machine Shop

A 12 m x 24 m fold-away machine and maintenance shop will be erected on site. The shop will be supplied with all tools and equipment required for service and maintenance of both the Open Pit and underground contractors fleets. The shop will be heated.

3.11.2 Offices

A single office trailer will be supplied on site for use by the mining contractors as well as the Hope Bay Joint Venture personnel. This office will be fully equipped with electrical and communication outlets.

3.11.3 Change Rooms

A portable dry facility will be provided on site that would accommodate the 60 man camp.

3.12 Accommodation

The 60 man camp is a combination of 12 x 54 ft trailers, which will arrive on site intact. The individual trailers currently exist at the Boston project site and will be relocated to the Doris site.

3.13 Sewage Treatment

Sewage treatment will be via a package biological treatment plant that will be brought to site fully assembled within a skid mounted container. The treatment plant will have a treatment capacity of 23 m^3/day, which is sufficient capacity for a fully manned 74 man camp. The camp wastewater is collected in a grinder pump lift station and discharged to the solids settling tank within the skid mounted container. Clarified raw sewage overflows to the equalizing tanks that feed the extended aeration bioreactors. Each bioreactor consists of an aerated primary side and a clarifier cone. Wastewater enters the primary aerated side and is mixed with the existing water by means of an extremely efficient fine bubble aeration system.

The clarification zone separates developed solids from the treated wastewater, allowing solids to settle back into the aerated side of the tank. This action reduces the value of total solids and improves treatment.

Treated effluent is collected in a discharge/recycle tank for delivery to the disposal field or the recycle line. Discharge is to a surface field using perforated pipes to disperse treated effluent. The discharge pipes are covered with wood chips and loose fill to encourage horizontal dispersion and soil infiltration, even in winter.

Prior to discharge the treated sewage will have achieved the required operating environmental standards.

3.14 Fuel Storage

3.14.1 Barge Landing Site

A 6 million liter capacity fuel tank farm will be established at the barge landing site on the southern shore of Roberts Bay (see Figure 3.2(a)). The tank farm will be in an engineered containment area consisting of a lined and bounded facility. The tank farm will be located a minimum distance of 150 m from the maximum annual high water level on the shoreline. Fuel off-loading will be via floating fuel line from the barges during the summer shipping season.

3.14.2 Mill Site

A 21 day fuel storage supply will be maintained at the Mill location. This fuel will be stored in 6 x 70 m3 and 2 x 50 m3 Enviro-Tanks. Fuel will be transported between the barge landing site and the Mill and any areas of use with a Fuel truck.

3.15 Communications Systems

Off-site communications (2 voice & 1 data line) will be via satellite channels. Short-wave radios will be used for on-site communications.

4. HISTORY

In 1962 the Geological Survey of Canada geologists carried out the first geological reconnaissance of the Hope Bay Belt as part of “Operation Bathurst”. Exploration for gold and base metal deposits in the Hope Bay Greenstone Belt was started in 1965 by Roberts Mining Company and by 1973, the company was operating two small silver mines on the Arctic Coast. During the late 1970s and early 1980s, Noranda Exploration Company (“Noranda”) explored the area for volcanogenic massive sulphide (“VMS”) deposits. In 1987, Abermin Corporation staked claims in the vicinity of Spyder Lake and Doris Lake and completed some reconnaissance exploration.

In 1991, BHP Minerals Canada Ltd. (“BHP”) acquired a contiguous block of claims covering approximately 1,016 km^2 and carried out systematic exploration airborne and ground geophysical surveys, geological mapping and prospecting, overburden drilling and over 177,000 m of diamond drilling. In 1996 and 1997 BHP also carried out 2,300m of underground development, underground exploration and a 27,000 tonne bulk sampling of the Boston deposit. From 1991 to 1998, BHP spent approximately $85 million in exploring the entire Hope Bay Greenstone Belt and initiating preliminary metallurgical and scoping studies and environmental baseline studies.

In December 1999 the Hope Bay Project was purchased from BHP by the HBJV. The HBJV spent an additional $17 million in exploration and supplies at Hope Bay in the 2000 program. The 2000 program included 309 surface and underground drillholes for 43,70 m and surface mapping and geochemical programs. In 2001, the HBJV completed a 40,000 m surface drilling and 6,000 m of reverse circulation (RC) drilling with an approved budget of $16.4 million. This drill program consisted of infill drilling at Boston South and Doris Connector with the objective of upgrading a portion of the current defined resource to indicated category and peripheral drilling to expand the resource. Significant drilling occurred at recent discoveries Naartok, Suluk and South Patch and new resource estimates were released in January 2002.

5. GEOLOGICAL SETTING

The Slave Structural Province is a geological sub-province of the Canadian Shield and comprises an Archean-aged granite-greenstone terrane. The late Archean Hope Bay Greenstone Belt lies entirely within the fault-bounded Bathurst Block that forms the northeast portion of the Slave Structural Province. Hope Bay is a typical Archean greenstone belt comparable to the Yellowknife, Kirkland Lake and other such belts; it extends over 80 km in a north-south direction and is between 7 and 20 km wide. The belt comprises mafic meta-volcanic (mainly meta-basalts) and meta-sedimentary rocks that are bound by Archean granite intrusives and gneisses. The greenstone package has been deformed during multiple events and is transected by major north-south trending shear zones that appear to exert a significant control on the occurrence of mineralization, particularly where major flexures are apparent and coincident with antiforms. Similar features are the locus for major gold deposits in other Archean greenstone gold camps (e.g. Kirkland Lake).

6. DEPOSIT TYPES

The Doris deposit is typical of the "Archean lode" or "greenstone-hosted" deposit style. It consists of a steeply dipping, over 3 km long quartz vein system in folded and metamorphosed pillow basalts and is situated on an inferred inflexion in the regional Hope Bay Break. At the north end, the veins are folded over to create a high-grade anticlinal hinge zone lying close to surface (Doris North). As part of the same vein system, 1.2 km to the south, an intersection of two structures creates a high-grade zone (Doris Central). The (Doris Connector) zone spans approximately 500 m in strike extent, between the Doris Central and Doris North resource areas. Alteration is defined by iron-carbonate, paragonite, pyrite and sericite. Gold is found at quartz vein and wall rock contacts and is associated with dark-coloured tourmaline-pyrite septa or ribbons.

7. MINERALIZATION

The Doris vein system is characterized by a series of north-south striking, sub-vertical, gold- bearing, ductile-brittle structures, that commonly host wide, stylolitic, ribboned bull quartz-veins. Host rocks are variably carbonate (dolomite) altered and deformed basalts with lesser gabbro. Gold-bearing structures have been traced by diamond drilling for over 2,300 m, and from surface to a depth of 400 m. Within the vein, gold is commonly associated with narrow tourmaline-chlorite septa oriented parallel to and along the vein margins. Gold is also associated with disseminated sulphides at the margins of the quartz veins, or with sulphide clusters within the vein. Occasionally, gold is present within brecciated zones adjacent to the quartz veins. Sulphide mineralization consists of trace to 2% pyrite, trace chalcopyrite, rare sphalerite and pyrrhotite.

The deposit comprises three veins, the folded Doris Vein with its Central (east) and Lakeshore (west) limbs, the Island Vein and the West Valley Wall Vein. The Doris vein system has also been subdivided into the Doris North and Doris Central resource areas, which are separated by the Connector Zone (Figure 7). At least four sub-parallel structures have been identified within the Doris vein system. From west to east, these include: the West Valley Wall (WVW) set, C2/Stringer structure, Central (CV), Lakeshore (LV), and Island Veins (IV).

7.1 Lakeshore Vein

The Lakeshore Vein is the most continuous and robust structure in the Doris system, with variable gold mineralization, locally within shoots. With local exceptions, the vein occurs along the sub-vertical eastern contact between the Fe and Mg rich tholeiites, and extends for over 2,300 m along strike and has been traced over 500 m down-dip. The Lakeshore Vein varies from over 20 m to less than 1 m in true thickness, and averages between four and five metres wide.

At Doris Central, the Lakeshore Vein is variable in both thickness and gold content. The thickest and highest-grade section (greater than 100 gram-metres) appears to have a sub-vertical plunge with a strike extent of 40 m and a down-dip extent of 180 m. Gold is distributed throughout the Lakeshore Vein, but is usually concentrated near the footwall (eastern) side of the vein, where visible gold is relatively common.

7.2 Central Vein

The Central and/or C2 Vein extend for about 1,800 m , and occur along the western contact between the Fe and Mg rich tholeiites, dipping west between 50º and 75º. The Central Vein is four or five metres wide at the hinge, pinches down to cm scale veins and swells to 40 m down-dip. Below this point, the shear zone that hosts the vein continues, but the vein itself has either attenuated or is pinched out completely. The C2 and Stringer Zones may possibly be the same structure, whereby the C2 Vein in the Doris North area grades into the Stringer Zone at Doris Central. The Stringer and C2 Zones both lie west of the main Lakeshore Vein.

7.3 Doris Hinge

The Central and Lakeshore Veins are the most important of the veins, and possibly represent the limbs of a shallow northerly plunging anticline. The strongest gold grades occur within the Central Vein and Hinge Zone at the crest of the anticline. The Hinge has been eroded south of the surface exposure, and has been tested to the north by diamond drilling over a strike extent of 325 m. Quartz veins hosted in the closure vary in thickness from one or two metres at the north to 12 m true width to the south, near surface. The quartz veins in the hinge area are dismembered into a series of wedges by axial planar shears and crosscutting brittle faults.

8. EXPLORATION

8.1 BHP Exploration

In 1991 BHP began a reconnaissance sampling program over available properties in the Hope Bay belt. Mapping and sampling continued in 1992 on the Boston claims and Madrid claims and the first surface mineralization at Madrid was discovered. The first drill holes were completed at Boston and additional claims were staked at Boston to protect the Fe-carbonate shear.

In 1993, BHP staked all available Crown mineral title in the belt. At this time about 60% of the belt was closed to staking by the Tunngavik Federation of Nunavut (TFN) during the final stage of their land claims settlement. Successful drill programs continued at Boston and the exploration focus shifted to locating another deposit elsewhere in the belt. The first drill holes at Doris and Madrid were completed the following spring in 1995 and fieldwork continued at evaluate other areas throughout the belt until 1998. Underground development and drilling occurred at Boston in 1996-1997. In 1998, BHP suspended their activities and put the Hope Bay project on care and maintenance.

Between 1992 and 1998, BHP conducted an aggressive gold exploration program in the Hope Bay Belt. To the end of 1998, the following activities had been completed:

- 177,350 m of core drilling;
- 2,341 m of underground development at Boston (1996-1997);
- 16,761 tonnes of bulk samples at Boston (1996-1997);
- 17,183 km of airborne geophysics;
- 1,500 km of ground geophysics;
- 1:10,000 scale geological mapping over the entire belt;
- 23,872 surface samples including regional till samples;
- 6,127 m of overburden drilling;
- Comprehensive environmental baseline studies;
- Detailed studies addressing access, infrastructure, metallurgy and engineering.

In total, BHP spent of the order of C$85 million defining gold mineralization in the Hope Bay Belt.

8.2 Geophysics and Landsat Imagery

The majority of the outcrop in the belt has been mapped and sampled. The greatest potential for new discovery lies under cover within the shallow overburden filled valleys. Numerous breaks, flexures, faults and folds have been interpreted from the magnetics images. The following is a brief summary of geophysical activities completed in the Hope Bay Volcanic Belt (HBVB) to date. Complete lists of geophysical surveys are contained in Tables 8.2(a) and 8.2(b).

BHP has also purchased LandSat TM, RadarSat, and Shadowed Topography images for delineation of belt scale features. The Shadowed Topography image comprises summer and winter LandSat data to delineate EW features, and improve depth perception. The HBJV recently purchased updated Landsat images for the belt.

TABLE 8.2(a)
Ground Geophysical Surveys in the Hope Bay Volcanic Belt

Year	Claim/NTI Group	Anomaly/Grid	Survey
2000-01	Tok 3	Madrid	Magnetics/IP
1998	PJ	GM	HLEM
1997	Boston	South Boston	HLEM/Magnetics
1997	Tok	Doris Corridor	Magnetics/VLF
1997	Tok, Boston	Doris Lake, Spyder Lake	Marine Seismic
1997	Tok/Amarok	Corridor Seismic	Refraction Seismic
1997	Boston NTI	Boston W.	Magnetics
1996	Akungani	Kamik	Magnetics
1996	Tok	Wizard	Magnetics
1996	Madrid	N. Patch	Magnetics
1996	Amarok	Amarok	Magnetics/VLF
1996	Tok	Wolverine	Magnetics/VLF
1995	Koig	Discovery Bay	Magnetics/IP
1995	Koig	Engine	Magnetics
1995	Boston	Boston 18/19	Magnetics/VLF
1995	Tok	Patch Lake	HLEM/Magnetics/VLF
1995	Koig	Dupras	Magnetics
1995	Tok	Doris	Magnetics
1994	Koig	Discovery	Magnetics/VLF
1994	Tok	Doris	Magnetics
1994	Tok	Jeffe	Magnetics
1994	Madrid	Madrid	Magnetics/VLF/IP
1994	Amarok	Kamik	Magnetics/VLF
1993	Boston	Wally/Redback/Huntsman /Fickle-duck	Magnetics/VLF
1993	Madrid	Madrid	Magnetics/VLF/IP

TABLE 8.2(b)
Airborne Surveys in the Hope Bay Volcanic Belt and Elu Inlet Volcanic Belt

Year	Company	Surveys	Extent
1993	Dighem	Magnetics/EM	3,129 line-km
1994	Dighem	Magnetics/EM	2,924 line km
1995	Dighem	Magnetics/EM	4,673 line km
1998	High Sense	Magnetics, Magnetics/EM	6,750 line-km

9. DRILLING

9.1 BHP Drilling

BHP Minerals Canada Ltd began diamond core drilling in the Hope Bay during the summer of 1992. A lightweight, thin-wall BQ core drill rig (Hydracore-28), operated by Shearcroft Mining Exploration Services Ltd was the first drill mobilized into the belt. A BBS-25A NQ core drill operated by Conners Drilling Ltd was brought in later in the 1992 season.

In 1993, JT Thomas Diamond Drilling Ltd was awarded the drilling contract and utilized in two Longyear-38 drill rigs drilling NQ sized core. JT Thomas continued as drill contractor through the 1998 season operating two rigs in 1994, three in 1995-96, five in 1997, and seven diamond drill rigs in the 1998 winter/spring season. Drilling of HQ size core was introduced in 1994 to aid in delineation at the Boston deposit (larger core provides a more representative Au concentration) and was subsequently used at the Doris and Madrid deposits. A Longyear-44 was commissioned in 1996 for deep drilling at the Doris deposit. A gopher diamond drill rig (ABDGM size core) supplied by Shearcroft Mining Exploration Services Ltd was utilized during the 1996-98 season for reconnaissance.

In total there have been 691 surface diamond drill holes (excluding 10 abandoned holes that drilled less than 10 metres) drilling 482 NQ-sized core, 144 HQ-sized core, 44 ABDGM-sized core, and 21 BQ-sized core holes.

9.2 2000 HBJV Winter Surface Drill Program

The 2000 winter drill program consisted of drilling in three different areas: Doris North, Doris Central and South Patch. A total of 23,114m were drilled in 141 holes with NQ2 drill rods. The program was completed with four drills, although for a short period of time five drills were operating. The program started with three Longyear 38's and one Longyear 44. Later in the program two Major 2000's were mobilized and the Longyear 44 was demobilized from the Hope Bay Belt. Table 9.2 lists the number of holes and metres drilled for each area.

TABLE 9.2
2000 HBJV Winter Drill Program Summary

Area	Metres Drilled	Holes
Doris North	12,053	91
Doris Central	6,430	27
Doris Central – Phase 2	3,626	17
South Patch	1,005	6
Total	**23,114**	**141**

9.2.1 Doris North (Hinge and Connector)

The Doris North area was the primary target for the 2000 winter drill program. The goal of the drill program was to increase the density of drill data in order to upgrade the Inferred Resource to a higher confidence Indicated Resource. The largest Inferred Resource at Doris North was identified by BHP in the Hinge Zone. The planned drill hole locations were designed to provide 25 by 15 m intercepts through the Hinge Zone. Drilling confirmed the interpretation of the Hinge Zone and confirmed its continuity over at least 300 m. The strike of the Hinge Zone may extend up to 550 m, although this must be confirmed with more drilling. Many of the best intersections were from the Central Vein in the Hinge Zone. While high-grade intersections were obtained from the Lakeshore Vein, the distribution was erratic and these intersections were less common. Visible gold in the quartz veins was quite common in the Central Vein and Hinge Zone, slightly less so in the Lakeshore Vein.

The proposed program was also designed to test the west dipping Central Vein and the sub-vertical Lakeshore Vein. A number of vertical holes were planned to test for sub-horizontal splays that may have been associated with the Lakeshore Vein. The drilling succeeded in delineating the Hinge Zone on a minimum of 25 m spaced pierce points along the majority of its strike length. Prior to 2000, the Connector Zone was not well drilled; a few widely spaced holes returned some good intersections. The goal of the 2000 drill program in this area was to expand the Inferred Resource in the Doris Underground and Connector Zones.

9.2.2 Doris Central

Doris Central drilling was designed to test the Lakeshore Vein on a 50 by 50 m pattern, with the goal of expanding the Inferred Resource. After the Stringer Zone was discovered during the Phase 1 drill program, a second phase of drilling was initiated. The purpose of the Phase 2 program was to improve the drill hole spacing to 50 by 25 m and to better define the Stringer Zone. Drilling during 2000 was generally on 25 m centres along strike, and 25 to 50 m centres down dip, with decreasing drill density away from the core, high-grade zone at Doris Central.

The Stringer Zone was discovered at Doris Central. Although, Stringer Zone mineralization was encountered in 1997 drill holes, the intersections were narrow and located in close proximity to the Lakeshore Vein. In some holes the Stringer style mineralization was incorrectly identified as the Lakeshore Vein. The dilational zone is a zone centred where the Stringer Zone intersects the Lakeshore Vein.

9.3 2000 HBJV Fall Drill Program

A much smaller-scale program was implemented in early fall 2000 to test two areas not investigated during the winter program: Madrid and Doris North Extension. Thirteen holes and 2,625 m were drilled using NQ2 drill rods. A Major 2000 drill tested conceptual/geological targets defined by the summer surface exploration program in the Madrid area. A Longyear 38 tested similar conceptual targets at Doris North Extension.

The goal of this program was to identify new gold mineralization that could significantly increase the total ounces in the northern half of the Hope Bay belt. Drilling at Doris North Extension targeted the underground projection of a vein network identified in the summer mapping program. This program had also identified high-grade gold values in sulphidic argillites. Results from this drilling failed to identify any significant mineralization and suggests that the Doris vein system either exists at depths exceeding those of the latest drilling or that the Doris vein system occurs further east from the last occurrence found on section 15800N.

10. SAMPLING METHOD AND APPROACH

10.1 Core Handling

The drilling contractor placed drill core in labeled boxes with marking blocks showing depth down the hole. The core boxes were delivered to the geology core logging areas at the Boston and Windy camps for geotechnical logging, geologic logging, core photography and sampling. The following procedure is rigorously complied with:

- Geotechnical technicians check that all footage blocks are in the proper order. (We work in metric, but the drillers work in feet).
- Geotechnical technicians fit the ends of the broken core back together without changing the "up-hole" direction.
- Geotechnical technicians convert the blocks to metres (drillers work in feet), and write the depths in metres on each block
- Geotechnical technicians measure the length of core (without gaps left by pushing the pieces together) between each set of blocks.

10.2 Geotechnical Logging

Core was laid out on a table in the boxes and measured to ensure blocking had been done properly. Downhole depths were indicated in feet on the core blocks, technicians converted depths to metric and marked the depth on the other side of the core blocks.

Geotechnical technicians record RQD (Rock Quality Designation) over the entire hole. RQD is a measure of the strength of each rock type, based on the density of natural fractures within it and is expressed as a percentage of the actual core lengths. In specific areas geotechnical logging was completed according to the Laubscher method of rock mass rating. This application was maintained to stay as consistent as possible with previous work completed by BHP. Cameron Clayton, a rock mechanics engineer with Golder and Associates Ltd., visited early in the program to observe the geotechnical logging procedures and provide technical assistance to HBJV geologic technicians.

Initially, all holes at Boston had geotechnical logging through mineralized zones plus 20 m uphole and downhole from the boundaries of the mineralization. As a result of the visit by Cameron Clayton, the amount of geotechnical logging was further reduced. The deposit was divided into 10 m thick vertical east-west slices, consistent with the mine geology cross sections, and detailed geotechnical logging was only done on holes drilled within every second 10 m thick slice. RQD and recovery were recorded for drill holes that did not require detailed geotechnical core logging.

At Windy, most of the holes were geotechnically logged for the entire length of the hole. Following Cameron Clayton's visit, certain holes were selected for geotechnical logging based on the distribution of holes that had already been logged. Also, only the mineralized and altered zones were logged plus 20 m intervals above and below the zones.

10.3 Core Photography

Digital photos were taken of all drill core and a camera mount has been constructed above each core logging table to ensure uniformity of photo. Procedures for photography are described below:

- Align the core boxes with marks on the table.
- Place a bar documenting the hole #, box numbers (from and to) and drill interval in metres (from and to) where it will appear at the top of the photo. This bar has a colour card attached to it.
- Make sure the colour card is clean.
- Wet the core before taking the photograph.
- All core photos are to be taken using the highest resolution possible with the digital camera.

10.4 Core Logging

Once the core has been geoteched it is ready to be logged. Logging will focus on the collection of geological and mineralogical parameters, which have a demonstrated relationship to gold mineralization. Log sheet and sample form templates are located in an Excel file named "2001_LOG_TEMPLATE.XLS". Each project (Doris, Boston, Madrid) has an individual log sheet within this file. The geotech and sample forms are the same for all projects. A drill hole summary template is located in Word document 2001_SUMMARY_TEMPLATE. Changes made to the templates on site must be approved by the Project Manager and then relayed to the Database Manager.

The geologist will fill in the log sheet using standard codes for lithology, alteration, veins and mineralization. The Project Manager must approve any new codes before they can be used, and this information conveyed to the Database Manager. For numerical values, ranges are not permitted. If required, a range may be indicated in a note. Notes may be written across all columns in the log, since there is no specific column dedicated to notes.

The Drill Hole Header Sheet should be filled out with collar coordinates, hole azimuth, dip, etc. For holes with acid tests, the information should be entered in the appropriate place. For holes that are surveyed by Maxibor, an indication that Maxibor was used should be included on the Header Sheet, and the Maxibor file should be e-mailed to Vancouver (data@skycomip.com).

Core logging and sampling methods were very similar to those previously employed by BHP except that logging by HBJV geologists was more quantitative than qualitative. For example, HBJV geologists made estimates of the percentages of quartz and pyrite, where previously BHP geologists had used terms such as “Strong”, “Medium” and “Weak”.

10.5 Core Sampling

Sampling was done using minimum sample lengths of 30 cm and maximum sample length of 1.0 m. Where possible, samples were defined by geological boundaries or characteristics such as sulphide abundance, alteration or vein intensity. All sampled core was sawn, and one half placed in labelled plastic sample bags. The other half of the core was returned to the core box and is kept at site.

10.6 Core Storage

At Boston, core boxes were placed on pallets, one drill hole per pallet, with the boxes in order, first box on the bottom and last box on top. The pallets were bound with steel strapping and stored on the muck pad. Initially the pallets were stacked rows, so that any hole from the 2000 program could be accessed quickly by fork-lift. Later the pallets were moved off the muck pad to provide additional room. Re-organization of the pallets will be required before the drill holes will be readily accessible again.

Core storage will be an ongoing problem at Boston, due to the limited space available on the muck pad and the high cost of building and maintaining core racks. Once the crusher and sampling tower are removed it might be possible to store core in the building that housed them, although this space is also valuable for storing other materials.

At Windy drill core was previously stored in "Coreland" located north of the Windy Camp. The area was filled with core from drill programs dating from 1994 though 1998. It was necessary to start a new Coreland for the 2000 drill core. The area chosen was located on the ridge above the camp. Initially, core was moved to the new Coreland with snowmobiles and skimmers, but this was an extremely time consuming process requiring up two or three snowmobiles and six to eight people. After the snow was melted, the core was bundled and flown by the helicopter to the new Coreland.

11. SAMPLE PREPARATION AND SECURITY

11.1 Sample Assays

Drill core from Hope Bay Project was analyzed at TSL Laboratories in Saskatoon, Saskatchewan. TSL is a recognized Canadian Laboratory that uses standard fire assay techniques. HBJV and Roscoe Postle personnel made a series of visits to TSL and reviewed analytical procedures.

The sample preparation used was to crush the entire sample to 70% passing 2 mm. From this a 1,000 g split was pulverized with a ring and puck mill to 95% passing 106 microns. The routine gold assay method was on a 29.2 g sample using fire assay with a gravimetric finish. Although BHP used an atomic absorption finish the upper limit of accuracy is only 10 g Au/t. Use of the gravimetric finish was found to give a much better comparison against the metallic screened results.

Samples observed to contain visible gold were sent directly for screened metallics assay. Initially samples that contained greater than 5 g Au/t on an initial fire assay were automatically re-assayed with a screened metallics assay. As more analysis became available the comparison between gravimetric and screen metallic indicated that metallic assays replicated screen metallics at values in excess of 20 g Au/t. In 2001 the threshold at which assays were submitted for screened metallics was increased to 10 g Au/t.

Assay results were received from TSL, first as digital Microsoft Excel files via e-mail, followed, several days later, by a signed hard-copy certificate via regular mail. These digital files were compiled into a Microsoft Access database. Separate tables within the database were maintained for fire assays and for metallics assays. The "final value" used in various reports and calculations, was the metallics assay when available, otherwise the value was an average of the fire assays.

When the signed certificates arrived, they were checked against the Access database tables. A second data integrity check, performed by another person, in which one out of five certificates, chosen randomly, was used to verify the digital data. No errors were detected. The only difference between the hard-copy certificates and the database is the substitution of a value of –0.03 to represent below-detection-limit assays, reported on paper as <0.03 g/t Au. This substitution is made to allow the assay fields within the database to remain as numerical values, rather than text

12. DATA CORROBORATION

Drill logs were written out by hand in the field. The hand-written sheets were faxed to the HBJV Vancouver office where a data-entry clerk keyed each drill log into an Access database. Separate database files were maintained for each drill hole, these were compiled into a master Access database after an initial round of verification. The data entry system implemented pick lists and validation rules in order to limit entries to codes that had been approved by the project managers. The Database Manager checked all sample numbers and sample intervals against the faxed copies of the hand-written sample sheets. The data tables from each drill log were exported into an Excel file. The Excel file was e-mailed to camp, proofread and corrected digitally by the logging geologist, and the corrected file e-mailed back to the HBJV Vancouver office. The verified data was imported back into the drill-hole-specific Access database and from there compiled into the master Access database.

Approximately once per week, the compilation of corrected drill-hole data was exported into an Excel file, e-mailed to camp and imported into Gemcom. Gemcom validations were run in order to detect further errors in the data such as overlapping or missing intervals. Corrections were made to the hole-specific Access databases and then the corrected data re-imported into the compiled Access database. This process was repeated until no errors were detected.

Several geologists experimented with logging directly onto laptop computers using Microsoft Excel. For these logs, the data was manipulated to maintain consistency with the Access database. Data was separated into tables on separate worksheets, codes added to link sub-tables such as alteration and veins to the appropriate lithological unit, notes shifted so that they were associated with the appropriate interval, and blank intervals deleted. Once manipulated, the data was imported into the Access database, and subjected to the validation procedure outlined above.

12.1 Quality Control/Quality Assurance of Assays

For every 20 samples submitted for assay, one blank and one standard were inserted into the sample stream. Blanks were either pieces of diabase dyke or samples of carbonate dyke rock. Pulverized standards were obtained from ALS Chemex and IME Laboratories. Table 12.1 identifies the estimated grade and one standard deviation for each of these standards.

TABLE 12.1
List of Standard used at Windy and Boston, 2001

Standard	Expected Value	Standard Deviation
IME00L	3.06	0.18
IME00H	7.83	0.38
IME01QX	3.21	0.34
IME01RX	7.56	0.39
IME01ZX	11.69	0.49
CH01SIN	1.97	0.21
CH01COS	5.85	0.37
CH01TAN	13.25	0.67

If the assayed value of a standard was greater than two standard deviations from the mean expected result for that particular standard, the HBJV requested the complete re-assay of an entire batch of samples.

These results are reported under an extensive quality control program supervised by Dean McDonald, P.Geo. Ph.D., Exploration Manager with Miramar Mining Corporation, who is an appropriately qualified person as defined by National Instrument 43-101. To further ensure the integrity of exploration results, the HBJV had Roscoe Postle & Associates independently audit quality control and quality assurance ("QA/QC") programs in place at the Hope Bay project. See News Release 00-06 dated April 11, 2000 for details on the program. This QA/QC program includes on site control of core samples and a program of duplicate, check, and blank assaying, including check assaying at a separate laboratory. Roscoe Postle found that the quality of these QA/QC programs exceeded industry standards. Dr. McDonald has corroborated the data, including sampling, analytical and test data, on which the above information is based.

13. ADJACENT PROPERTIES

The Hope Bay belt includes a number of other mineral deposits that are not addressed in this report: the balance of the Doris deposit (including Doris Connector and Doris Central, and all of the Madrid and Boston deposits.

Mineralization contained in these deposits is detailed in the mineral resource estimates discussed below and the geologic setting is outlined above. However, these deposits do not affect the results of thus Study as the development of the Doris Hinge Zone is addressed on a stand alone basis, and these adjacent deposits are therefore not material to the results of this Study.

14. MINERAL PROCESSING AND METALLURGICAL TESTING

14.1 Summary Of Metallurgical Testing

Laboratory studies were performed on a number of mineral samples obtained from the Doris Deposit, at the Hope Bay Gold Project. The samples were obtained from three areas, consisting of the Doris Central - Stringer Zone (CSZ), Doris Central – Lakeshore Vein (CLV), and Doris North.

The use of gravity recovery followed by cyanidation of gravity tailing or cyanidation of flotation concentrate provided for a promising treatment procedure;

- The gravity concentrate typically recovered 25% to 50% of the gold present, depending on the composite sample tested and grind conditions used.
- The primary grind can be relatively coarse (80% passing 149 microns), which will impact the size of the mill as well as the power required. Gold recovery improved at finer grind sizes and this may be justified pending economic evaluation.
- Overall gold recoveries using gravity and cyanidation ranged from 89% to 98.5% depending on the composite sample tested and conditions used.

- The gold recovery to the flotation rougher concentrate is good and only this concentrate needs to be reground prior to cyanidation, rather than the whole ore.
- The overall recovery of the gold by gravity and cyanidation of reground flotation concentrate ranged from 93% to 98%.

The test program indicates that the Doris material responds well to conventional gravity, flotation and cyanidation procedures for recovery of gold. For further details see Appendix E – Metallurgical Test Program by PRA.

14.2 Summary Process Description

The gold extraction process concentrates the incoming ore using gravity and sulphide flotation techniques. Only the concentrate is then intensively leached using cyanide. The gold in solution is electrically plated out from the cyanide solution and the resulting cathodes are then smelted to form gold dore bar. The cyanide in the treated concentrate and effluents is destroyed prior to discharge of the tailings to the tailings pond. The details of the process are as follows:

- Run of mine (ROM) ore is crushed in a two stage crushing circuit to a final product size of –13 mm. Crushed ore is stored on a stockpile and fed continuously to the processing plant by front-end loader.
- Crushed ore is ground in a closed circuit wet ball mill, with the entire mill discharge being fed to a continuous in-line pressure jig for recovery of free coarse and medium sized gold particles. By treating the entire mill discharge, recovery of nuggetty or flaky gold is maximised since it is recovered before it is broken up into finer particles or trapped in the circulating load. Mass of jig concentrate will be approximately 5% of the mass of new feed to the plant, and gold recovery is expected to be 60% of new feed. This concentrate is fed to an in-line leach reactor (ILR).

Jig tailings are classified in a cyclone cluster. Cyclone underflow is treated in a single flash flotation cell for recovery of remaining coarse gold, free fine gold and fast floating sulphides, principally pyrite. Mass of flash flotation concentrate will be approximately 4% of the mass of new feed to the plant, and gold recovery is expected to be 22% of new feed. This concentrate discharges to a concentrate regrind circuit. Flash flotation tailings are recycled to the ball mill.

Cyclone overflow at a size of 80%, -125 microns is treated in a scavenger flotation circuit consisting of four tank cells in series. Each cell is fitted with froth crowder rings to maximise recovery of lower grade froth expected in this part of the circuit. Mass of scavenger flotation concentrate will be approximately 2% of the mass of new feed to the plant, and gold recovery is expected to be approximately 15% of new feed. This concentrate discharges to a concentrate regrind circuit. Scavenger tailings gravity flow to the final tailings sump.

The concentrate regrind circuit treats 1.6 t/h of concentrate from the flash and scavenger flotation circuits. It consists of a vertical grinding mill in closed circuit with a classifying cyclone. Concentrate is ground to an 80% passing size of 45 microns. The purpose of this process step is to liberate more of the fine gold prior to leaching in the ILR.

Slurry from the regrind circuit cyclone overflow is combined with concentrate from the in-line pressure jig in the ILR feed cone, where it is dewatered to 75% solids w/w before gravity feeding into the ILR. In the ILR, gold is leached with spent electrolyte from electrowinning, supplemented by sodium cyanide solution. Sodium hydroxide is added in this step to control the pulp to a pH of 12. Gold recovery to solution is approximately 98%.

Slurry leaving the ILR is thickened in a settling cone. Clear overflow solution from the settling cone proceeds to gold electrowinning. Settling cone underflow at 60% solids content is filtered on a belt filter to reduce the moisture content to 15%. A three stage counter current wash ensures high recovery of cyanide soluble gold and free cyanide to the filtrate, with a washing efficiency in excess of 99%. Filtrate is pumped to electrowinning for recovery of gold.

Electrowinning is performed in two cells in series to maximise maximises gold recovery. Gold recovery over electrowinning is approximately 98%. Spent electrolyte from electrowinning is split roughly 60:40 between a recycle to ILR feed and a bleed to cyanide detoxification.

In electrowinning gold is plated onto steel wool cathodes. Loaded cathodes are removed periodically from the cells using a hoist and replaced with fresh cathodes. The loaded cathodes are washed and dried in a calcining oven where the steel wool of the cathodes is oxidised. The calcine is smelted in a barring furnace with a mixture of pre-weighed fluxes. Molten gold with other metallic impurities is poured into dore moulds, weighed and stored in the safe awaiting transport off site for refining.

Leach residue filter cake is repulped with electrowinning bleed solution and gravity launders into the cyanide destruction contactor, where it is contacted with Caro's Acid, a stoichiometric mix of sulphuric acid and hydrogen peroxide. Free cyanide and WAD cyanide complexes in solution are rapidly destroyed to a level of less than 5 ppm total cyanide. The discharge from this contacting tank flows into the final tails hopper, where it is combined with scavenger flotation tails to a final pulp density of 36% solids, and is pumped to a storage dam located some 3 km away. The two tailings pipelines (one duty/one standby) are heat traced to prevent freezing during the cold weather season. The tailings are considered environmentally acceptable, as cyanide contacted pulp that is to be diluted down by an order of magnitude by flotation tails slurry that has not been in contact with cyanide. Therefore, total cyanide in final tails should routinely be around 0.5 ppm, and never higher than 1 ppm, in accordance with current international guidelines. As the sulphides component in the tailings is low, and the tailings are to be stored under water cover, it is expected that there is minimal risk of sulphide degradation to acid products occurring. Provision has been made for emergency automatic diversion of tails pulp to plastic lined emergency ponds in the event of a pipe rupture further down the line or intermittent high cyanide levels in tails pulp leaving the plant.

Water supply for the plant is to be taken from a barren lake located 3.0 km from the proposed plant site. A high head borehole pump located in a decant well in the lake, accessed by a jetty or causeway, will allow all year round drawing of water from the lake as the intake to the pump will be located below any ice cap that forms. The water is pumped through a heat-traced pipe to the process water tank, with a takeoff to potable water treatment.

15. MINERAL RESOURCE AND MINERAL RESERVE ESTIMATES

15.1 Mineral Resource Estimates

The Hope Bay Mineral resource estimates for the Hope Bay belt have been updated to incorporate the results of all holes drilled during 2001 and are summarized below (Table 15.1). Further details, including a specific breakdown of measured and indicated mineral resources and inferred mineral resources for individual deposits, cut-off grades and other assumptions are outlined in the tables as set out in Appendix E.

TABLE 15.1
Summary of Hope Bay Project Mineral Resource Estimates to December 31, 2001

Catery/Deposit	Tonnes (000's)	Gold Grade (g/t)	Contained Gold (000's oz)
Measured & Indicated Resources			
Boston	1,386	15.4	687
Doris	887	21.5	614
Madrid	1,090	10.3	363
Sub-total Measured & Indicated Resources	**3,363**	**15.4**	**1,664**
Additional Inferred Resources*:			
Boston	2,574	10.9	901
Doris	1,679	15.0	811
Madrid	2,460	11.8	935
Sub-total Additional Inferred Resources*	**6,713**	**12.3**	**2,648**

*Inferred resources are in addition to measured and indicated resources.

All resource estimates have been prepared by the Hope Bay Joint Venture staff in accordance with Canadian regulatory requirements set out in National Instrument 43-101 and reviewed by Dean McDonald, P. Geo. Ph.D., Exploration Manager for Miramar Mining Corporation. Resource estimation models for the Boston, Doris (excluding the Doris Hinge and Doris Central zones) and Madrid (excluding Naartok and Suluk) were estimated utilizing a two dimensional polygonal approach. The Doris Hinge, Doris Central, Naartok and Suluk deposits were block modeled using ordinary kriging methods, whereas other zones applied inverse distance methods. Capping and cut off grades were applied as set out in the attached tables. Measured resources were estimated only in the Boston B2 Zone where the resource blocks have been undercut. Indicated resources for all the deposits generally lie within 25 m of a drill hole within detail drilled areas and inferred resources generally lie no more than 50 metres from a drill hole. Independent resource consultant Geostat Systems Inc. of Montreal has audited these estimates.

Mineral resources that are not mineral reserves do not have demonstrated economic viability. Mineral resource estimates do not account for mineability, selectivity, mining loss and dilution. These mineral resource estimates include inferred mineral resources that are normally considered too speculative geologically to have economic considerations applied to them that would enable them to be categorized as mineral reserves. There is also no certainty that these inferred resources will be converted to measured and indicated categories through further drilling, or into mineral reserves once economic considerations are applied

15.1 Scope of Mine Planning Work

The mine plan developed in this study is based on three of the Hope Bay deposits located between sections 15,200N and 15,800N:

- Doris Hinge resources
- Lakeshore Vein resources
- Central Vein resources

Resources of all classifications are considered in the mine plan including measured, indicated and inferred. Under a qualification that includes “inferred”, it does not serve the study objectives to include too much detail in terms of development and stope layout.

The scope of the mine planning work includes the development of conceptual open pit and underground mining scenarios and scoping level cost estimates for the extraction of the economic portions of these deposits.

15.2 Mine Planning Procedure

The following procedure was used in the mine planning:

- Hope Bay Joint Venture prepared Gemcom block models for the three deposits
- Plans and sections were plotted through the deposits
- Cut-off grades were estimated
- Mineable shapes were hand drawn on the sections, outlining continuous areas above cut-off grade
- A minimum mining thickness of 2.2 m was used
- The mineable shapes were entered into Gemcom and constructed in to excavation solids
- The in-situ tonnes and grades in the solids were estimated
- The solids were checked and adjusted as necessary to avoid excessive dilution
- A thickness of 0.4 m was added to the hanging wall and footwall to simulate external dilution
- Mining recovery factors were applied, yielding the "study resources"
- Open pit mining was assessed using the Whittle Optimizer
- For underground mining, conceptual plans were made for access and mining method
- Production rates were estimated
- Information packages were provided to mining contractors to allow them to prepare estimates of costs and manpower, and to confirm production rates
- A project production schedule was developed

15.3 Context of Mine Planning Work

Based on work done by Hope Bay Joint Venture, the mineralization can be characterized as follows.

General:

- Mining quartz veins easily identified visually
- Hanging wall and footwall rocks are altered mafic volcanics
- Competent rock mass significantly enhanced by permafrost
- Overlain by strongly foliated rocks, structure parallel to strike
- No major faulting identified that would significantly displace mineralization

- There is potential for significant short range variability in geometry; strike, dip and thickness

Doris Hinge:

- Geometry is a plunging fold-nose, refer to typical cross section
- High gold grades
- Offsetting post mineralization faults, mainly oriented West to NW, occur about every 10 m within the Hinge, with off sets of about 1 m

Doris Central & Lakeshore Vein:

- Steep and narrow geometry
- Variable thickness and gold content in Lakeshore vein

15.4 Mining Options

Mining options are described in the following sections for Doris Hinge Open Pit, Doris Hinge Underground, and Lakeshore and Central Underground.

15.4.1 Doris Hinge Open Pit

The Doris Hinge open pit is designed to recover the resources of the high-grade Hinge Zone which is a north plunging fold nose lying close to surface, located just north of Doris Lake. Refer to Figure 15.4.1(a), "Mining Site Plan".

The Whittle program was used to create an optimized pit shell. Input costs and parameters are shown below in Table 15.4.1(a) (note that underground costs are higher than estimated in the underground section as they include an element for capital and higher uncertainty for underground operations).

TABLE 15.4.1(a)
Optimization Parameters for Doris Hinge Open Pit Design

Optimization Parameter	Selected Value
Open pit mining	CN $4.50/tonne
Extra for ore selectivity	CN $2.00/tonne
Underground mining	CN $60.00/tonne
Processing	CN $24.00/tonne
General & Administration	CN $25.00/tonne
Total open pit	CN $51.00/tonne
Total underground	CN $109.00/tonne
Overall pit wall slope	50^{o}
Gold price	US $275.00/ounce
Exchange	0.65
Mill recovery	95%

Underground costs are included in the input parameters to allow the program to determine an economic changeover point to underground mining.

An open pit cut-off grade of 3.95 g/t Au has been used, based on the above inputs. Details are included in Appendix A, "Underground Mining Detailed Calculations".

For the purposes of this preliminary assessment, a pit design has not been completed, nor has the pit access ramp been designed into the pit walls. Tonnages of the study resources and waste rock have been based on the economic pit shell. Permafrost conditions will enhance wall stability. Refer to Figures 15.4.1(b), (c) and (d) showing a plan and sections of the Hinge Pit. The Hinge Pit data is given in Table 15.4.1(b).

TABLE 15.4.1(b)
Hinge Pit Data

Parameter	Value
Waste rock amount	375,000 tonnes
Study resources	82,500 tonnes at 12.1 g/t Au
Including: Dilution	10%
Including: Mining recovery	95%
Strip ratio	4.5
Total pit depth	40 m
Number of benches	8 x 5 m

Nuna Logistics prepared a cost estimate for open pit mining and the earthworks required for the project. The earthworks included an airstrip, roads and tailings impoundment wall. Nuna determined that the required waste tonnage for the earthworks was 486,000 tonnes, more than can be supplied from within the open pit shell.

For this reason it has been assumed that an additional 125,000 tonnes of waste will be excavated from the open pit. An unknown quantity of this extra stripping may be accounted for in the pit design. Incorporating a haulage ramp in the pit design would likely increase stripping requirements, but a design has not been completed.

Future work can be aimed at achieving a balance between waste requirements for earthworks, and the stripping requirements of the open pit.

The production rate has been estimated at 915 tonnes per day by Nuna. Split benching is envisaged for recovery of the study resources.

Equipment requirements have been specified by Nuna. One cat 988 loader and four Cat 773 50 tonne trucks will be capable of moving 190,000 tonnes per month. Waste will be hauled from the pit to construction areas. A Cat 235 excavator is planned to provide selective mining of ore grade equipment.

Nuna's complete equipment list and cost estimate are included in Appendix B, "Nuna Logistics Cost Estimate".

15.4.2 Doris Hinge Underground

The mining concept is to start from the bottom of the Doris Open Pit once it is completed, and to advance north at a minus grade following the plunge of the Doris Hinge study resources. Refer to Figure 15.4.1(a), "Mining Site Plan".

The study resources are mainly the high grade Doris Hinge zone from 15,300N to 15,800N. Cross sections were prepared at a 25 m spacing showing Doris Hinge, Lakeshore Vein, and Central Vein, as well as the block model grades for each of these zones.

Mining shapes were outlined on each section including some internal dilution. Irregular resource shapes were made more regular so they could be projected from section to section and made into a 3D solid in Gemcom. Maximum mining grades of –12 to –15% were respected in setting floor grades. The mining shapes were also controlled partly by the estimated cut-off grade of 7 g/t Au.

The Gemcom program estimated the resources listed in Table 15.4.2(a) within the 3D solid created from the mining shapes:

TABLE 15.4.2(a)
Estimated Resources For Underground Mining

Resource Area	Value
Central Vein	11,100 tonnes
Hinge	249,500 tonnes
Lakeshore Vein	15,200 tonnes
Waste rock at zero grade (21.1% internal dilution)	73,900 tonnes
Total resource	349,700 tonnes at 21 g/t Au

To estimate the study resources, factors were assessed for external dilution and mining recovery.

Some additional external dilution was modeled because the initial mining shapes assumed, on most sections, that mining would perfectly follow the hanging wall contact. This is not possible in practice. It is also known that there are offsetting faults about every 10 m along strike in this area. The offsets are fortunately small (<1m) but will add dilution.

To model the external dilution, the 3D mining solid was expanded 0.4 m on all sides. This effectively added 4.7% dilution (with a very low grade caused by the downward expansion of the sill into Lakeshore and Central) bringing total dilution to 25.8%. The external dilution percentage is low because the 0.4 m expansion is relatively small compared to the typical dimensions of the hinge mining shapes.

Mining recovery was estimated at 95%. Room and pillar mining is assumed, and this high recovery is based on achieving some pillar recovery on final retreat made possible by the good conditions (rock mass and permafrost) and relatively small spans.

The results of the above factors produce a study resource of 368,100 tonnes at 19.8 g/t Au. A small overlap with the open pit was corrected, resulting in the final study resource estimate of 358,600 tonnes at 19.9 g/t Au.

Generally, mine access is from the bottom of the Doris Hinge open pit. The face is in ore and can be advanced north. However, due to the steep initial plunge of this zone, this access must start near the sill at 15,300N and end up at the back (hanging wall contact) at 15,375N. Successive benches can be taken, never exceeding –15% (which for short distances is a conservative constraint). Refer to Figures 15.4.2(a), (b) and (c) showing a plan and sections of the Hinge Underground mining.

Mining cannot be completed in this zone, however, without a short waste access ramp from pit bottom (15,275N, 4910E, -17Elev) to section 15,350N at –39Elev. This ramp overcomes the problem of the steep initial plunge of the Hinge Zone.

The waste access ramp is sized at 5 x 5 m, driven at –15%. Drifting productivity is expected to be 1.8 m per 12 hr man-shift. Once set up, two crews of 2 miners can drive the ramp in 3 weeks.

The mining area is quite long in the strike direction at 500 m, and a secondary escape route is required. This will be provided by driving a ventilation/escape raise at section 15,650N, detailed in Table 15.4.2(b).

TABLE 15.4.2(b)
Raise Detail

Description	Value
Bottom	15650N, 5083E, –35 Elevation
Surface	15650N, 5100E, +11 Elevation
Length/dip	60 m at 50^o
Dimensions	2.4 m x 2.4 m

The raise can be driven by open raising and a manway must be constructed within the raise.

If cost effective, additional ventilation raises can be driven to reduce the dependency on auxiliary fans and ducting. The approximate raise length to surface is 60 m, regardless of position along strike. One such raise is included in the cost estimate.

The mining method is room and pillar, modeled on the Nanisivik operational procedures. Good ground conditions are expected in permafrost. The mining depth is very shallow and no backfilling is planned for ground support.

The mining will be done with a development jumbo and this will consist of a combination of drifting, slashing and benching. This method will provide the flexibility to follow the changes in the geometry of the zone.
The stope will be opened up to vertical heights ranging from 17 to 22 meters. As benching progresses from top down, the back and shoulders will be pattern bolted and screened where necessary. Pattern bolting will be installed in the upper portions of the walls. Bolts are assumed to be 1.8 m by 46 mm split set bolts driven by the jumbo. It is assumed that the lower walls are not bolted because:

- They are within easy reach of maintenance scaling.
- Exposure time is less and there will be no loss of the surface permafrost.

Pillars have not been detailed but will be left as required to reduce spans on the advance. Pillars will be recovered during the final retreat.

Additional definition diamond drilling and test hole drilling with the jumbo will be done from within the stope as mining progresses. The additional data can be collected with no significant interference to mining.

Equipment will include a 2 or 3 boom jumbo, 6 yards scoop, 2 yard scoop (for narrow areas), a boom and basket configuration bolting jumbo, and a 23 tonne underground haulage truck. Ore will be hauled to a pit bottom stockpile for pick up by surface mining equipment.

Ventilation requirements are estimated at 90,000 cfm. Intake air will be down the ventilation/escape raise from surface. This direction is best since the natural tendency will be for the heated air from the diesels to flow up plunge along the back and out of the stope. This is a low pressure ventilation application, and the main fan should be 50 HP or less. The fan can be mounted on surface or underground (but here it will be more subject to blast damage).

Auxiliary ventilation within the northern end of the stope can be provided by a 48 inch, 100 HP fan connected to 48 inch ducting.

15.4.3 Lakeshore and Central Underground

The mining concept is to mine the higher-grade portions of the Central Vein and Lakeshore Vein that lie below (down dip) the Doris Hinge underground stope. Refer to Figure 15.4.1(a), "Mining Site Plan".

Access ramps for the Lakeshore and Central mining will be driven from the Hinge stope. Pillar recovery in the Hinge stope can be started, but not completed until the Lakeshore and Central Vein access ramps are no longer needed.

Sections were prepared in the Doris Hinge area from 15,200N to 15,800N at a 25 m spacing showing Doris Hinge, Lakeshore Vein, and Central Vein, as well as the block model grades for each of these zones.

Mining shapes were outlined on cross sections considering an in-situ cut-off grade of 9 g/t Au. Four significant areas were identified above cut-off, referred to as shapes A, B, C and D. The approximate limits of these four areas are shown in Table 15.4.3(a).

TABLE 15.4.3(a)
Mining Shapes Data for Lakeshore and Central Veins (Section from 15,200N to 15,800N), using an in-situ cut-off grade of 9g/t Au

Number	Vein	Width (m)	Upper Elevation	Lower Elevation	Section (from)	Section (to)
A	Lakeshore	3 – 5	60 m	140 m	715N	770N
B	Central	2.2 – 5	50 m	70 m	400N	425N
C	Lakeshore	3.5	45 m	75 m	500N	n/a
D	Lakeshore	5 – 7	30 m	55 m	250N	275N

Gemcom 3D solids were created representing these areas. Refer to Figure 15.4.3, "Lakeshore & Central Mining Solids". The in-situ mineral resources within these shapes are shown in Table 15.4.3(b) below.

TABLE 15.4.3(b)
Mining Shapes In-situ Resources (not expanded) for Lakeshore and Central Veins (Section from 15,200N to 15,800N), using an in-situ cut-off grade of 9g/t Au

Mining Shape	Vein	Diluted (kt)	Au (g/t)	Included Waste (kt)	% Dilution
A	Lakeshore	40.7	10.0	4.9	12%
B	Central	8.4	31.1	2.3	27%
C	Lakeshore	6.7	14.2	0.1	1%
D	Lakeshore	6.2	12.7	0.1	2%
Total		62.0	13.5	7.4	12%

To estimate the mineable portion of the in-situ resources, the following procedure was used:

- The shapes were expanded by 0.4 m to add external dilution to the average 12% internal dilution.
- Concepts were developed for mining methods and access ramps, drifts, cross cuts and raises. No drawings were created, just concepts and development estimates.
- Costs per tonne were estimated for access (waste development) and mining.
- All-in cut-off grades were estimated for each shape. Capital costs for waste development were included.
- The diluted grade of each shape was compared against its cut-off grade to determine if it were economically viable.
- The economic shapes were included in the mine plan. These were B, C and D.
- A mining recovery factor of 95% was applied.

The study resources are 21,500 tonnes at 19.4 g/t Au as shown in Table 15.4.3(c) below.

TABLE 15.4.3(c)
Lakeshore and Central Study Resources (Cut-off grade with capital and mineability assessment)

Shape	Diluted Resource		Total Cost* $/t	Diluted cut-off grade g/t Au	Study Resources		Notes
	Diluted ktonnes	Grade g/t Au			Recovered (95%) ktonnes	Grade g/t Au	
A	48.0	8.7	130	10.1	-	-	Not in plan
B	8.4	31.1	145	11.2	8.0	31.1	In plan
C	7.8	12.4	147	11.4	7.4	12.4	In plan
D	6.4	12.6	142	11.0	6.1	12.6	In plan
Total					21.5	19.4	

*** Total cost includes access plus $50 mining, $24 milling & $25 G & A.**

Generally, mine access is from the bottom of the mined out Doris Hinge stope. The final pillar recovery in the Hinge stope cannot be completed until mining is finished in the Lakeshore/Central areas. This affects the timing of the last 10% of the Hinge stope tonnage.

The waste access ramps and cross cuts can be driven during the mining of the Hinge stope. It may be possible to place some of the development waste in the mined out north end of the Hinge stope. Shapes B, C and D can be readied for production before the Hinge stope is mined out, thus ensuring steady production until all of the study resources have been extracted.

The mining method planned for the three mineable shapes is sublevel retreat. Each shape is quite small and will require only one or two sublevels in the zone, with uphole drilling to recover the resources overhead. Slots will be opened by inverse raises or open raises. Good ground conditions are expected in permafrost. The mining depth is very shallow and no backfilling is planned for ground support.

Equipment will include a 2 or 3 boom jumbo, 6 yards scoop, 2 yard scoop (for narrow areas), a longhole drill and a 26 tonne underground haulage truck. Ore will be hauled from the stope draw point up ramp to the Hinge stope, and from there to a pit bottom stockpile for pick up by surface mining equipment.

Ventilation will be achieved by auxiliary fans and ducting, or optionally by driving open raises from the stope lower levels up to the mined out portion of the Hinge stope.

15.4.4 Other Potential Mining Areas

Two additional Hope Bay deposits that could be incorporated into the mining schedule in the future are Doris North and Doris Central. These deposits are located under Doris Lake. Refer to Figure 15.4.1(a), "Mining Site Plan". Development of a production plan for these deposits is dependent on the success of the initial mining described in this report.

A conceptual plan indicates that these deposits can be accessed with no additional surface infrastructure. An access ramp would be driven south from the bottom of the Hinge Open Pit, continuing below Doris Lake, to reach these deposits. Study resources would be hauled underground by truck to the bottom of the Hinge Pit, and then handled in the same manner as the Hinge Underground production described above.

15.5 Manpower

15.5.1 Open Pit Mining

Nuna has estimated a crew of 38 men to complete the earthworks and open pit mining.

15.5.2 Underground Mining

Underground mining activity begins in month 15 (November 2004) when the shipping season allows the underground contractor to mobilize to site. It continues until month 36. Only modest fluctuations are expected in the underground work force during this time. Mining personnel on site during a typical month are shown in the table below. Note that there are an equal number of workers on "days off" at any given time due to the fly in/fly out schedule.

TABLE 15.5.2
Typical Underground Mining Manpower On Site

Group	Sub-Group	Number
Contractor	Diamond drilling	2
	Supervision	2
	Production miners	6
	Development miners	2
	Mechanics	4
	Nippers	2
	Surveyors	2
	Sub-total contractor	20
Owner	Engineering	4
	Geology	3
	Sub-total owner	7
Camp Man-days/month		713

Mine operations are planned on a continuous basis with two 12 hour shifts per day. The estimate of total man-days on site for underground mining personnel over the project duration is 13,900.

15.6 Production Execution and Schedule

The production schedule is shown in the table below.

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HOPE BAY
Doris North Trial Operation
Ore Production Schedule

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Year 1
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
YEAR ONE																	
MINED																	
monthly g/t						12.1	12.1	12.1							19.9	19.9	16.2
monthly tonnes						27,500	27,500	27,500	-	-	-				18,000	18,600	119,100
month average tpd						917	917	917	-	-	-				600	600	
					31	28	31	30	31	30	31	31	30	31	30	31	

YEAR TWO	17	18	19	20	21	22	23	24	25	26	27	28	Year 2
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
MINED													
monthly g/t	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9
monthly tonnes	18,600	16,800	18,600	18,000	18,600	18,000	18,600	18,600	18,000	18,600	18,000	18,600	219,000
month average tpd	600	600	600	600	600	600	600	600	600	600	600	600	

YEAR THREE	29	30	31	32	33	34	35	36	37	38	39	40	Year 3
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
MINED	from year 1												
monthly g/t	19.9	19.9	19.9	19.9	19.9	19.8	19.4	19.4					19.8
monthly tonnes	18,600	16,800	18,600	18,000	18,600	20,100	9,300	4,500	-	-	-	-	124,500
month average tpd	600	600	600	600	600	670	300	300	-	-	-	-	

The production schedule is based on continuous, year round mining operations, seven days per week, averaging 600 tonnes per day. The total study resources scheduled are 462,600 tonnes at an average grade of 18.5 g/t gold.

The schedule is designed around the constraints imposed by the northern location; the summer shipping season for mobilizing equipment and supplies to Roberts Bay by barge, and the availability of winter roads on site in the winter until the all weather road is constructed. Mining and milling activities extend over a period of 3 years.

The open pit is somewhat lower in grade at 12.1 g/t Au, but must be mined first because underground mining is dependent on a pit bottom access. Open pit waste stripping begins in month 5 and ore production begins in month 6. The open pit ore will be stockpiled since the mill is not scheduled to start until month 16. The open pit waste totals approximately 500,000 tonnes and all of it will be used in the construction of an airstrip, apron, roads and tailings containment dam.

Underground mining begins in month 15 with a portal being collared in a face of ore at pit bottom. The underground mining rate at 600 tpd, matches the processing rate. The underground ore, being of higher grade, will be processed first while the stockpiled open pit ore will be processed last.

The schedule has been simplified to show the Hinge production (19.9 g/t) coming completely ahead of Lakeshore/Central production (19.4 g/t). This simplification is possible because the underground grades are nearly the same. In practice the Lakeshore/Central stopes would be developed and mined starting a few months sooner than shown. This is because they only support a lower mining rate of about 300 tpd and should be blended with Hinge production. Also, from a planning perspective, there are no constraints on starting them earlier. This simplification will not have any significant impact on results.

15.7 Cost Estimate

15.7.1 Operating Costs

A summary of the operating costs are listed in Table 15.71.1.

TABLE 15.7.1
Operating Cost Summary

Operating Cost Breakdown	Unit Cost/tonne
Engineering and Geology	$ 3.44
Mining – Underground	$ 45.99
Open Pit Mining	$ 36.76
Processing	$ 36.83
General and Administration	$ 18.39
Safety, Security and Environmental	$ 2.41

15.7.1.1 Engineering and Geology

Engineering and Geology costs have been estimated by SRK Consulting with input from Miramar Mining Corporation. Costs within this area include mine engineering, owner mine supervision, mine geology, definition drilling and miscellaneous supplies. Definition drilling requirements shown below are based on discussions between SRK and Hope Bay Joint Venture geology personnel.

TABLE 15.7.1.1(a)
Definition Drilling Summary

Area	Meters	Costs
Doris Hinge	2,484	$ 141,905
Lakeshore & Central	1,235	$ 63,093
Totals	3,719	$ 204,998
Average unit costs	$55.12	$ 0.54/tonne

The drilling costs are based on a budget quote from Advanced Drilling. The basic coring charge is $42.25 per meter for BQ thinwall. Provisions are included for mobilization, some standby time and acid tests.

A Kubota tractor mounted Gopher drill is proposed to provide good mobility within the stope. The total meters of drilling shown will provide for coverage ranging from 10 x 10 m to 15 x 10 m in the mining areas.

The estimated costs for mine engineering and geology are presented in the table below.

TABLE 15.7.1.1(b)
Engineering and Geology Salaries

Staff	Number on payroll	Annual salaries	Payroll burden 34%	Cost per year
Mining engineer	2	$ 109,800	$ 36,870	$ 146,670
Geologist	3	$ 167,500	$ 56,190	$ 223,690
Mining Supervision	2	$ 166,270	$ 53,809	$ 220,079
Total				$ 590,439
Average cost per tonne				$ 2.69

Technical personnel on site are roughly half the number shown as “on payroll”. One experienced mine engineer and one owner mine supervisor is required on site each day shift. Geology personnel must be available to the mine on both shifts to mark up faces and check muck piles.

In addition to drilling and technical staff, an allowance of $0.21 per tonne of ore mined has been included to cover technical staff field supplies etc.

The survey crew will be provided by the contractor, but will work closely with the owners technical staff.

15.7.1.2 Open pit mining

Open pit operating costs have been estimated by Nuna Logistics. SRK Consulting provided conceptual drawings and quantities of ore and waste on each bench, and Nuna estimated the operating costs for the Hinge open pit.

Nuna’s cost estimate did not specifically separate earthworks costs from open pit operating costs, but discussions with Nuna’s estimator indicate that $4.50 per tonne of material mined is a good estimate of the open pit portion of their project costs. Per tonne operating costs for ore have been increased by $1.50 to account for grade control activities. Based on the pit plan designed a total of 663,000 tonnes must be mined of which 82,500 tonnes is ore to be processed.

15.7.1.3 Underground mining

Underground operating costs are discussed in this section. Underground operating costs have been estimated by SRK Consulting with some input from Procon Mining and Hope Bay Joint Venture personnel (Procon reviewed conceptual drawings and quantities for the underground mining). Cost estimates are based on the tonnages and mining methods shown in the table below.

TABLE 15.7.1.3(a)
Underground Mining Tonnages

Area	Method	Percentage	Tonnage
Hinge Underground	Drifting	20%	71,720
	Slashing	30%	107,580
	Benching	50%	179,300
	Sub-total	100%	358,600
Lakeshore & Central Veins	Sublevel retreat	100%	21,500
TOTAL underground			380,100

Underground operating costs are estimated at $45.99 per tonne of ore as shown in the table below.

TABLE 15.7.1.3(b)
Underground Mining Costs

Mining Cost Breakdown	Unit Cost/tonne
Extraction	$ 39.11
Ground support	$ 2.42
Underground trucking	$ 1.73
Surface services	$ 2.73
Total mining	$ 45.99

Extraction and ground support operating costs have been estimated for Doris Hinge mining and these costs have been applied to mining of Lakeshore and Central vein areas even though the mining method will be different. A sublevel retreat method of open stoping will be used in the latter areas as differentiated from the benching method used in the Doris Hinge stope. This simplification is justified because of the level of study, the inferred category of some of the resources, and the small tonnage being mined in the Lakeshore and Central area, of less than 6% of the total.

The Hinge extraction cost includes drilling, blasting, mucking to a remuck bay or underground truck, installing services and nipping in supplies. It is an "all in" cost including supervision, mining, maintenance and surveying (Ground support is excluded and estimated separately). It is based on a contractor's drifting rate converted into a cost per tonne as shown below.

TABLE 15.7.1.3(c)
Extraction Unit Cost (unit costs are based on a contractors drifting cost)

Component	Value
Drift width	5.0 m
Drift height	5.0 m
Drift ore density	2.7 t/m3
Total drift tonnage per meter	67.5 tonnes/m
Contractor cost per meter (all in)	$ 3,000
Drifting cost per tonne	$ 44.44
Slashing cost per tonne @ 75%	$ 33.33
Benching cost per tonne @ 75%	$ 33.33

Slashing and benching costs are only 75% of the drifting cost due to less drilling, less explosives, better breakage and faster cycle. The above shown unit costs for extraction have been applied to the respective Hinge tonnages as shown below. A cost allowance has been added for some cost plus work or standby charges.

TABLE 15.7.1.3(d)
Total Mining Cost for Hinge Extraction

Method	Hinge u/g tonnes	Unit cost	Cost
Drifting	$ 71,720	$ 44.44	$ 3,187,556
Slashing	$ 107,580	$ 33.33	$ 3,586,000
Benching	$ 179,300	$ 33.33	$ 5,976,667
Sub-total	$ 358,600		$ 12,750,000
Add: Cost plus/stand by @ 10%			$ 1,275,000
Total			$ 14,025,000
Average cost per tonne			$39.11

The Hinge unit extraction cost is estimated at $39.11 per tonne. As discussed previously, this cost has also been applied to Lakeshore and Central vein mining.

Ground support costs are based on screening the back and shoulders of the Hinge stope, and pattern bolting (1.5 x 1.5 m) the upper portion of the walls. This is required due to the "man entry" mining method and the increasing height of the stope back as benching progresses down.

Ground control supplies are assumed to include 1.8 m split set bolts, sheets of weld mesh screen, and 0.6 m mechanical bolts to help pin the screen. The contractor's cost per installed split set bolt is $45 each and screening costs $22 per square meter. A cost summary is shown below.

TABLE 15.7.1.3(e)
Hinge Ground Support Summary

Location	Area	Screen	No. bolts	Cost
Back	12,550 m^2	Yes	8,715	$ 668,288
Walls	10,000 m^2	No	4,444	$ 200,000
Total				$ 868,288
Average cost per tonne				$ 2.42

Underground trucking costs have been estimated for the Hinge stope and the stoping planned for Lakeshore and Central veins. A 26 ton truck is assumed since there is currently one of these units at the Boston site. Haulage cycle times have been estimated from the stopes to the pit bottom where a transfer stockpile will be maintained.

The truck operating cost is estimated at $76 per hour exclusive of operator. A trucking summary is shown below.

TABLE 15.7.1.3(f)
Underground Trucking Summary

Area	Tonnes	One way distance (m)	Cycle time (min)	Cost per tonne
Doris Hinge	358,600	440	15.6	$ 1.71
Lakeshore & Central	21,500	465	17.8	$ 1.96
Total	380,100	-	-	$ 1.73

Costs have been based on trucking all of the ore tonnes. Some of the ore tonnes located near the pit bottom will likely be trammed by scoop with no requirements for trucking. It is assumed that these tonnes will be offset by the development waste tonnes that will likely require trucking. Development waste tonnage at 27,800 tonnes represents only 7% of total material to be moved.

Surface services, shown in the table below, amount to $2.73 per tonne of ore and include mine power and surface waste handling.

TABLE 15.7.1.3(g)
Surface Services Summary

Component	Cost/tonne
Underground Services	$ 0.27
Electricity	$ 2.46
Total	$ 2.73

Mine electrical power costs represent power for the main ventilation fans, some heating, pumps and the surface maintenance shop.

15.7.1.4 Processing Costs

Process operating costs are summarized in this section. Detailed discussion of these costs are contained within Bateman's report as referenced in Appendix C.

TABLE 15.7.1.4
Processing Cost Summary

Operating Cost Breakdown	Unit Cost/tonne
Labour	$ 9.12
Reagents and Consumables	$ 6.67
Power	$ 10.76
Maintenance and Mobile Equipment	$ 9.03
Assay Lab	$ 1.09
Miscellaneous	$ 0.16
Total	$ 36.83

15.7.1.5 General and Administration Costs

General and Administration costs have been estimated by the Hope Bay Joint Venture and have been verified by SRK Consulting. Costs within this area include plant buildings, general support including accounting, IS, purchasing and warehousing, camp costs, employee and mine contactor transportation, outside refining and miscellaneous.

TABLE 15.7.1.5
General and Administration Cost Summary

Operating Cost Breakdown	Unit Cost/tonne
Plant Buildings	$ 0.82
General Support	$ 3.86
Camp Costs	$ 3.82
Employee Transportation	$ 5.46
Outside Refining	$ 2.02
Miscellaneous	$ 2.41
Total	$ 18.39

Plant Buildings includes supplemental plant heating (main plant heating source is heat exchangers on the diesel generators) plus an allowance for general repairs.

General support is primarily related to labour costs associated with accounting services, purchasing and warehousing, surface labour, and general clerical functions. The total number of personnel in this category are 13.

Camp costs are derived from a per diem charge of $42 (estimate provided by Nuna Logistics) applied to an annualized number of camp man days of 19,893. This includes all owner employees, mining contractor employees plus visitors.

Employee transportation is based on an average airfare cost of $975 per employee per month. This is based upon a mix of employee travel costs to Yellowknife and Cambridge Bay. Employees include both owner and mining contractor personnel.

Outside refining costs are based upon actual refining and transportation costs per ounce as experienced by Miramar's Con Mine.

Miscellaneous costs include property insurance, communications and miscellaneous supplies.

15.7.1.6 Safety, Security and Environmental

These costs have been estimated by the Hope Bay Joint Venture and have been verified by SRK Consulting. Costs within this area include labour and supplies for onsite safety services and environmental monitoring and compliance requirements. Safety services will be provided by two full time camp nurses supplemented by trained safety personnel within the mine and mill operating groups. Environmental services are performed by one senior environmental coordinator and two technicians. Costs including labour and miscellaneous supplies have been estimated at $2.41 per tonne.

15.7.2 Capital Costs

15.7.2.1 Site Earthworks and Infrastructure

Site Earthworks and Infrastructure costs shown below have been estimated by Nuna Logistics with assistance from SRK Consulting. SRK Consulting developed plans for the site layout including roads, airstrip, tailings dam etc. and provided quantities to Nuna Logistics for cost development. Mobilization costs have been estimated based on a total of 3,300 tonnes of freight (in and out) barged between Hay River, NT and site. Per tonne barge rates have been estimated at $648 per tonne (NTCL). Contractor standby charges of $45,000 per month have been included during the period equipment remains idle awaiting demobilization.

TABLE 15.7.2.1
Site Earthworks and Infrastructure

Capital Costs	Cost
Mobilization and Demob	$ 2,138,000
Contractor Standby Charges	$ 315,000
Earthworks (lump sum)	$ 2,231,000
Sub-total	$ 4,684,000

15.7.2.2 Underground mining

Underground capital costs shown below have been estimated by SRK Consulting with some review by Procon Mining.

TABLE 15.7.2.2
Underground Mining Costs

Capital Costs	Cost
Mobilization	$ 308,000
Portal	$ 40,000
Mine access (waste development	$ 1,719,000
Sub-total	$ 2,067,000

The mobilization cost is based on Procon Mining performing the work since they have a small fleet of mining equipment at the Boston site. The allowance for mobilization which includes mining supplies, additional equipment and manpower has been discussed with Procon since they are experienced in moving men and equipment to the site.

The portal costs reflect one pit bottom portal to be collared in the bottom of the open pit.

It is assumed that all waste development will be capitalized since it all represents main underground access to support production. None of this waste development is required before the start of production. It can be driven concurrently with ore production and the mining cost schedule reflects this.

15.7.2.3 Process Plant

Process Plant capital costs shown below have been estimated by Bateman Engineering. Details of the estimate are contained within the Bateman study referenced. Costs include all plant equipment, engineering, construction and support costs.

TABLE 15.7.2.3
Process Plant Costs

Civils	270,375
Mechanical Equipment including conveyors & tanks	3,373,918
Platework & Liners included in 002	-
Structural Steelwork	455,931
Piping & Valves excl tailings & overland pipes	468,750
buildings, container office - allowance	103,841
Electrical including PLC, MCC	640,462
Instrumentation	586,737
Tails Lines and Water Supply	873,266
Desom Ventilation	403,350
Mech Eqt, Plw, elec, struct, & Instrum. Erect mobilise	16,667
First fill - allowance	96,364
Electrical mobilise	16,276
Instrumentation mobilise	4,167
Trial assemble, Strip plant and load into containers	83,333
Transportation - CIF to Hope Bay - 15% of FOB value	1,006,856
Commissioning Spares - allowance 1% of mech, elect, 67% inst.	40,256
Commissioning labour	44,258
Vendor assist during Constr & Comm-Allow 1%	36,344
12 month's Op Spares - allow 4% of mech & elect, 67% inst.	161,023
DIRECT FIELD COSTS	**8,687,290**
Sprung Steel Dome	1,913,771
Transportation to Hope Bay	43,906
TOTAL DIRECT FIELD COSTS	**10,644,967**
Home Office & Indirect Field Costs	2,233,391
TOTAL NET COST	**12,878,358**
Fee - 10% of Total DFC	1,064,497
Fee - "Technical know-how" 15% of Tot HO costs	335,009
Insurance - CAR & marine - allowance	133,333
Contingency @ 12% of TNC	1,545,403
TOTAL OTHER COSTS	**3,078,242**
OVERALL PROJECT COST	**15,956,599**

15.7.2.4 Other

Other costs have been developed by the Hope Bay Joint Venture and have been verified by SRK Consulting.

TABLE 15.7.2.4
Other Costs

Capital Costs	Cost
Mobile and Miscellaneous Equipment	$ 750,000
Systems and Communication	$ 1,000,000
Start up Labour	$ 1,238,000
Camp Costs	$ 175,000
Fuel Farm	$ 562,000
Miscellaneous	$ 250,000
Sub-total	$ 3,975,000

Mobile and Miscellaneous equipment is intended for light vehicles, a fuel truck, miscellaneous supply trucks and small shop tools

Systems and Communications covers site Information systems, phones, mine planning systems and associated hardware. Costs are based on quotes received by Con operations and recent Miramar experience.

Start up labour has been estimated as two full months of operating labour and support for the purposes of hiring and training.

Camp costs are the estimated costs to move the Boston man camp to the Doris site (60 km) and to upgrade the kitchen facility.

Fuel farm costs are lease costs for a six million liter tank farm for the project duration.

Miscellaneous costs primarily cover site geotechnical drilling, tailings dam engineering and other small engineering studies.

15.8 Economics

A detailed economic analysis was completed based upon the developed study resources, capital and operating costs as discussed in the sections above.

This analysis assumes the following schedule of events

- Ongoing feasibility and permitting activities support a Q3 2003 production decision
- Open Pit and site earthworks contractor mobilizes equipment and materials in Q3 2003
- Actual site construction and open pit mining begins in Q1 2004
- Process plant construction begins in late Q1 2004 with delivery to the site in Q3 2004
- Underground mining and process plant operations begin in Q4 2004

Table 15.8.1 below summarizes the economics of the Doris North Trial Operation. The detailed model is presented in Appendix E, along with sensitivity tables for gold price and $US:$C exchange, grade and recovery, and capital and operating costs.

15.8.1 Key Assumptions for the Economic Model

The following parameters have been used in the development of the economic model:

- All $ are stated in $Canadian unless otherwise specified
- Base gold price has been set at $US 280 per ounce
- Exchange Rate has been set at 1.570 $US:$C
- Capital Costs do not include feasibility or permitting costs
- All open pit costs are treated as an operating expense. Although costs are incurred prior to mill start up they are deferred against the ore stockpile created and charged to expense as the stockpiled ore is processes.
- Royalties payable are set at the minimum 1.8% of gross gold revenues

15.8.2 Bonding and Closure Assumptions for the Economic Model

Bonding and closure costs were developed by HBJV and reviewed by SRK Consulting. Although the actual bonding requirement will be established as part of the permitting process this study assumes a bond of $5 million will be required prior to the commencement of operations. It is expected that as part of the permitting process both the Boston and Windy campsites will be reclaimed. The rationale for this is:

- The camp, fuel, fuel farm, and miscellaneous equipment at Boston are to be used at the Doris North plant site
- There is 8,933 tonnes of 17.7 g/t ore stockpiled at Boston that will be processed in the mill
- All belt exploration will be conducted from the new operating site (Windy camp is redundant)
- Cleanup of these sites will release approximately $3.9 million in existing securities associated with disturbance at Boston
- Costs associated with the closure of Boston and Doris campsites has been estimated at $650,000. This includes ore haulage to the Doris North site, waste haul underground at Boston, garbage haul to the Doris North site, camp and tank farm tear down and haulage to the Doris North site.

As this study deals only with the mining and processing of Doris North resources, project closure costs have been developed. These costs would be incurred in the year following cessation of operations. Factors included include:

- Employee severance, as per Nunavut Labour Standards
- Scarifying roads, airstrip etc. and revegetation of disturbed areas
- Doris North underground closure
- Building teardown and removal

Closure costs have been estimated at $2.9 million. Offsetting this, a salvage value of $3.2 million is included.

TABLE 15.8.1
Summary Results

HOPE BAY PROJECT - DORIS NORTH							
SUMMARY RESULTS:		*2003*	*2004*	*2005*	*2006*	*2007*	*TOTAL*
Cash Operating Cost per Ounce	**$Cdn**	**$ -**	**$ 212**	**$ 197**	**$ 154**	**$ -**	**$ 179**
	$US	**$ -**	**$ 135**	**$ 126**	**$ 98**	**$ -**	**$ 114**
All-in Cash Operating Cost per Oz	**$Cdn**	**$ -**	**$ 1,218**	**$ 203**	**$ 142**	**$ -**	**$ 277**
	$US	**$ -**	**$ 776**	**$ 129**	**$ 91**	**$ -**	**$ 177**
Direct Operating Cost Per Tonne	**$Cdn**	**$ -**	**$ 67**	**$ 107**	**$ 139**	**$ -**	**$ 105**
	$US	**$ -**	**$ 43**	**$ 68**	**$ 88**	**$ -**	**$ 67**
MINE PRODUCTION							
Doris Hinge - North	Tonnes	-	119,100	219,000	124,500	-	462600
Ore Milled	Tonnes	-	55,200	219,000	197,400	-	471600
Grade	gpt	-	14.00	18.46	19.74	-	18.48
Recovery	%	0.0%	97.0%	97.0%	97.0%	0.0%	97.0%
Total Gold Recovered	**Oz**	**-**	**24,103**	**126,105**	**121,516**	**-**	**271,724**
Market Prices:							
Gold (Spot) $US	$280	280.00	280.00	280.00	280.00	280.00	280.00
Exchange Rate $US:$C	1.570	0.637	0.637	0.637	0.637	0.637	0.64
Sales Revenues:							
Gold (Spot)	$Cdn	-	10,595,788	55,435,580	53,418,615	-	119,449,983
Total Sales Revenue:	$Cdn	-	10,595,788	55,435,580	53,418,615	-	119,449,983
Cost of Goods Sold							
Mine Operations	$Cdn	-	4,916,347	10,826,895	6,225,799	-	21,969,040
Processing Operations		-	2,017,103	8,066,554	7,294,367	-	17,378,024
Surface Maintenance		-	45,100	180,400	165,367	-	390,867
Administration		-	970,186	4,374,014	3,612,763	-	8,956,962
Royalties	1.8%	-	190,724	997,840	961,535	-	2,150,100
Other / Amortization		313,731	4,071,945	11,639,647	11,476,646	(833,322)	26,668,646
Total Property Costs		313,731	12,211,405	36,085,350	29,736,475	(833,322)	77,513,639
Net Income	$Cdn	(313,731)	(1,615,617)	19,350,230	23,682,140	833,322	41,936,344
CASH FLOW							
Net Income	$Cdn	(313,731)	(1,615,617)	19,350,230	23,682,140	833,322	41,936,344
Non-cash		313,731	3,421,945	11,639,647	11,309,967	-	26,685,290
PP&E Capital		(3,119,000)	(21,400,590)	(2,165,700)	-	-	(26,685,290)
Reclamation/Cash Bonds		-	(1,150,000)	-	-	4,000,000	2,850,000
NET CASH FLOW	**$Cdn**	**(3,119,000)**	**(20,744,262)**	**28,824,176**	**34,992,107**	**4,833,322**	**44,786,344**
CUMULATIVE NET CASH	$Cdn	(3,119,000)	(23,863,262)	4,960,914	39,953,022	44,786,344	
NET PRESENT VALUE	0.4%	(3,004,304)	(19,439,200)	25,657,307	30,114,096	3,886,802	37,214,701
CUMULATIVE NPV	5.0%	(3,004,304)	(22,443,503)	3,213,803	33,327,899	37,214,701	
IRR	85.2%						

16. OTHER RELEVANT DATA AND INFORMATION

Crown mineral claims are subject to standard royalties under the provisions of the Canadian Mining Regulations ("CMR"). For each fiscal year, royalties shall be paid to the Crown by the owner or operator of every mine on Crown lands on the value of the output of the mine during that fiscal year, in an amount equal to the lesser of:

- 13% of the value of the output of the mine; and
- the amount calculated in accordance a sliding scale of 5% for value output of less than $5 million increasing to 14% for value output in excess of $45 million.

The value of the output is net of allowable deductions, including the following:the costs, incurred during the fiscal year, of sorting, valuing, marketing and selling the minerals or mineral-bearing substances produced from the mine;

- the costs, incurred during the fiscal year, of insurance, storage, handling and transportation to the smelter, treatment plant or refinery or to market of, and any duties payable in respect of, the minerals or mineral-bearing substances produced from the mine;
- the costs, incurred during the fiscal year, of mining and processing ore or mineral-bearing substances from the mine or of reprocessing tailings from the mine;
- the costs, incurred during the fiscal year, of repair and maintenance at the mine;
- general and indirect costs incurred during the fiscal year for property, employees or operations at the mine that are not otherwise allocated to operating costs;
- exploration costs incurred during the fiscal year by an owner of the mine
- a depreciation allowance, not exceeding the undeducted balance of the depreciable assets at the end of the fiscal year of the mine;
- a development allowance, determined by the operator, not exceeding the undeducted balance at the end of the fiscal year of the mine of
    - undeducted exploration costs incurred prior to the date of commencement of production
    - all costs incurred for the purposes of bringing the mine into production, less certain adjustments

- a qualifying environmental trust contribution allowance, determined by the operator, not exceeding the undeducted balance at the end of the fiscal year of amounts contributed to the qualifying environmental trust in respect of the mine; and
- if ore or mineral-bearing substances are processed by the operator of the mine prior to sale, an annual processing allowance equal to the lesser of
    - 8 per cent of the original cost of processing assets owned by the operator at the end of the fiscal year of the mine, and
    - 65 per cent of the value of the output of the mine, after deduction of the amounts referred to in the paragraphs above.

In respect of Inuit owned lands, Nunavut Tunngavik Inc. ("NTI") has reserved a royalty equal to 12% of the net profit derived from the operations as determined in accordance with the terms set out in the production lease. The royalty will be calculated based on gross revenues adjusted after the following considerations:

- Gross revenues shall include all proceeds from the sales of minerals, whether or not sold or paid for, sales of assets, insurance proceeds, withdrawals from an approved environmental trust and other sources of revenues but excluding any gains or losses from hedging.
- Allowable deductions, to the extent that they have not previously been deducted either under the NTI agreement or under CMR, including but not limited to the following:
    - All reasonable direct expenditures paid by the lessee in carrying out operations, including operating, preproduction and capital costs necessary to carry out such operations, both before and after the commencement of commercial production
    - All reasonable direct capital costs paid by the lessee after the commencement of commercial production for the purpose of improving, modifying or replacing any assets situated on the production lease and reasonably required to carry out operations;
    - Payment into an approved and qualifying environmental trust for the reclamation of the production lease area;
    - All prior payments under the royalty agreement;
    - Prior exploration costs within the production lease area, such amounts not to exceed the lessee's purchase price for the property.
- No allowance or deductions for items including the following:

- Corporate or general expenses not related to the carrying out of the operations;
- Amortization, depletion or depreciation, the royalty being determined on a cash basis;
- Off site facilities or costs not directly related to the carrying out of operations;
- Financing or taxes or costs deducted elsewhere under the NTI agreement or CMR.

Notwithstanding the available deductions, the aggregate amount of available deductions shall not exceed 85% of gross revenues with the effect of setting a minimum royalty payable of 1.8% pf gross revenues.

17. INTERPRETATION AND CONCLUSIONS

Based upon the work completed by SRK Consulting, Bateman Engineering, Nuna Logistics and the Hope Bay Joint Venture, development of the Doris North trial operation has the potential to generate significant cash flow while providing a wealth of operating experience. The performance of this trial operation could be instrumental in developing the full potential of the Hope Bay project.

The relevant features derived from this study which support this conclusion are:

- Project location
  - Good access as the site is within 3.5 km of tidewater
- Grade of the Doris North resources
  - High grade ores with a diluted grade of 18.9 g/t
- Geometry of the resource
  - Relatively simple lending itself to productive lower cost room and pillar mining techniques
- Near surface location of the resources
  - Shallow ore body provides both open pit potential and minimal development to access underground resources
- Readily available source of construction materials from the waste rock from the pit operation
  - Use of modular process plant construction which allows for most construction to take place away from site, this results in improved scheduling and reduced costs
- Low capital costs

- modular nature of the plant and use of contractor services

18. RECOMMENDATIONS

The Hope Bay Joint Venture, having determined that pursuit of a trial operation on the Doris North resources has the potential to meet internal economic thresholds, while providing invaluable operating experience is recommending pursuit of a detailed feasibility to support a construction decision. To this end the Joint Venture partners will seek approval from their respective Boards for funding to support the following program related to this study:

- An additional 7,200 m of infill drilling designed to confirm the resource numbers, upgrade the resources to the measured and indicated categories, and to facilitate detailed mine planning and ore release schedules
- Additional metallurgical studies to further optimize the process flow sheet
- Additional engineering work encompassing infrastructure, mine and process design to support a feasibility study
- Commencement of permitting activities to support construction and operations

If funding is made available, it is the Joint Venture's expectations that a feasibility study could be completed by the fall of 2002.

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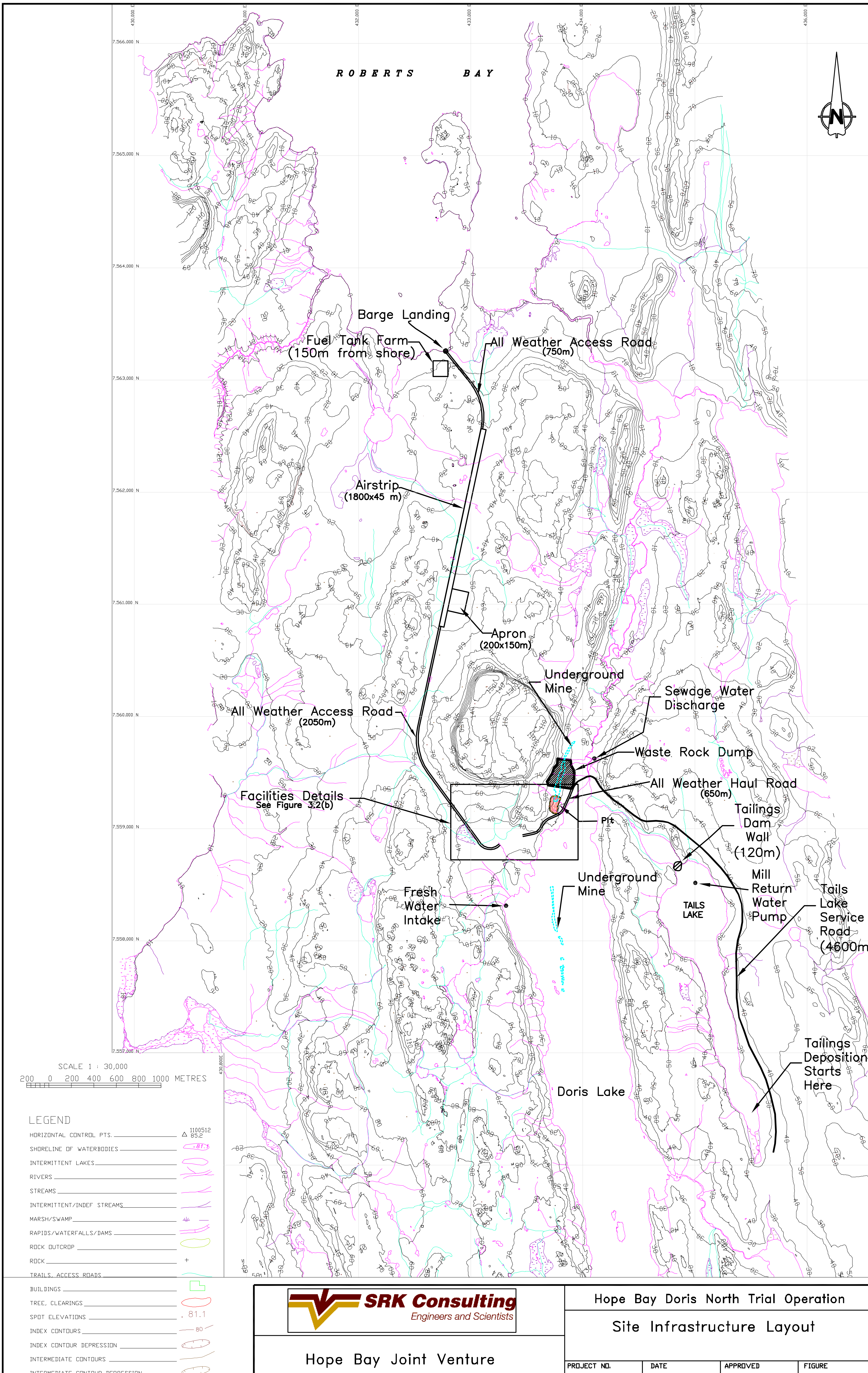
FIGURES


ROBERTS BAY
Barge Landing
Fuel Tank Farm (150m from shore)
All Weather Access Road (750m)
Airstrip (1800x45 m)
Apron (200x150m)
Underground Mine
Sewage Water Discharge
All Weather Access Road (2050m)
Waste Rock Dump
All Weather Haul Road (650m)
Facilities Details See Figure 3.2(b)
Pit
Tailings Dam Wall (120m)
Underground Mine
Fresh Water Intake
Mill Return Water Pump
TAILS LAKE
Tails Lake Service Road (4600m)
Tailings Deposition Starts Here
Doris Lake
SCALE 1 : 30,000
200 0 200 400 600 800 1000 METRES
LEGEND
HORIZONTAL CONTROL PTS.
SHORELINE OF WATERBODIES
INTERMITTENT LAKES
RIVERS
STREAMS
INTERMITTENT/INDEF STREAMS
MARSH/SWAMP
RAPIDS/WATERFALLS/DAMS
ROCK OUTCROP
ROCK
TRAILS, ACCESS ROADS
BUILDINGS
TREE, CLEARINGS
SPOT ELEVATIONS
INDEX CONTOURS
INDEX CONTOUR DEPRESSION
INTERMEDIATE CONTOURS
INTERMEDIATE CONTOUR DEPRESSION
SRK Consulting
Engineers and Scientists
Hope Bay Joint Venture
Hope Bay Doris North Trial Operation
Site Infrastructure Layout
PROJECT NO. 2CH005.02
DATE Jan. 16, 2002
APPROVED M.R.
FIGURE 3.2(a)

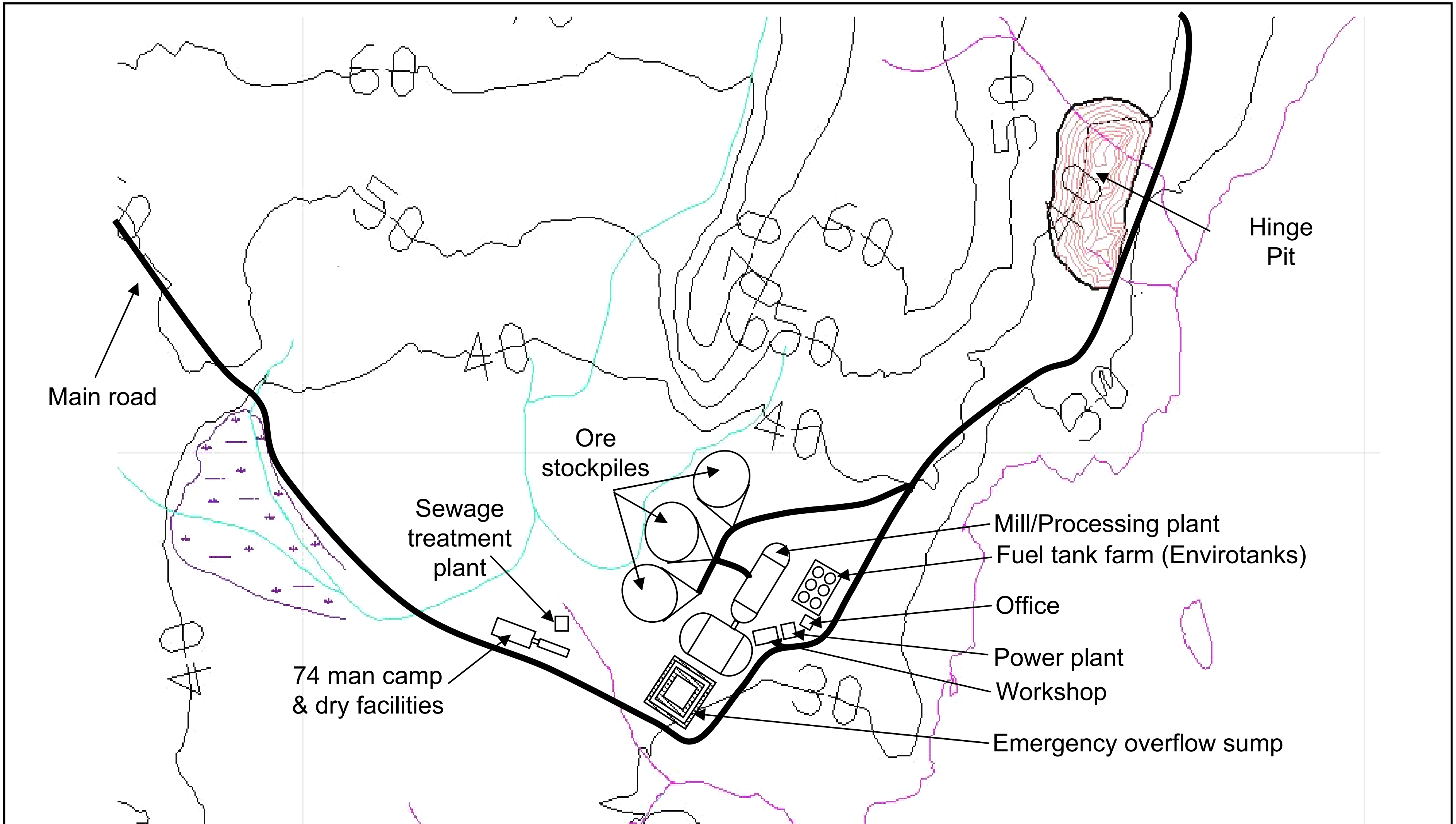
SRK Consulting
Engineers and Scientists

HOPE BAY JOINT VENTURE

Project Name: Doris North Trial Operation
Project Location: Hope Bay, Nunavut, Canada

General Site Location Map

PROJECT:	DATE:	APPROVED:	FIGURE:
2CH005.02	Feb 2002	EMR	2.1



0 50 100 150 200 250 m

SRK Consulting
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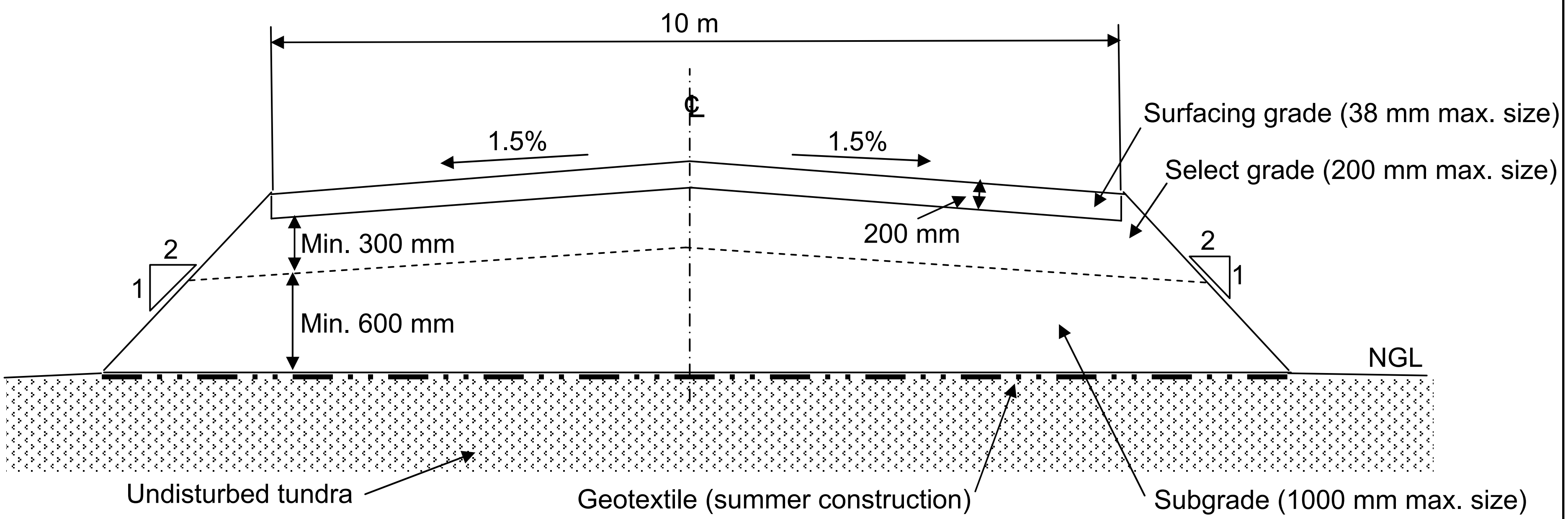
HOPE BAY JOINT VENTURE

Project Name: Doris North Trial Operation
Project Location: Hope Bay, Nunavut, Canada

Plan layout of mine surface infrastructure

PROJECT:	DATE:	APPROVED:	FIGURE:
2CH005.02	Feb 2002	EMR	**3.2(b)**



Drawing not to scale

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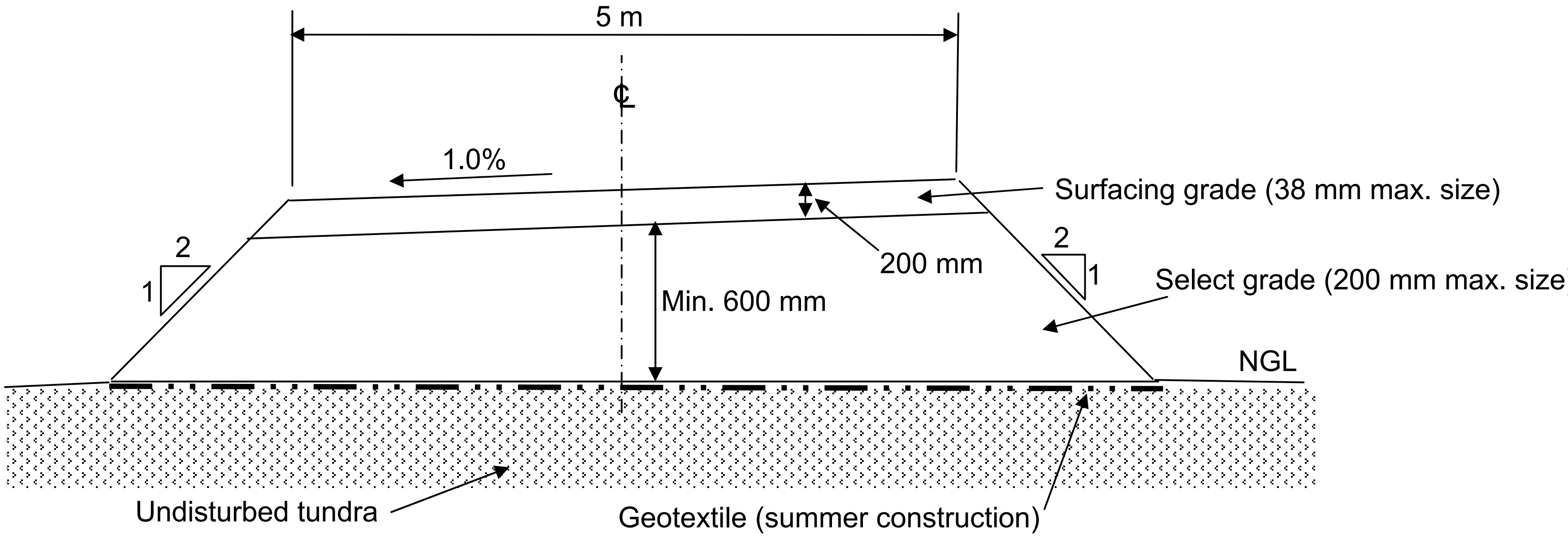
HOPE BAY JOINT VENTURE

Project Name: Doris North Trial Operation
Project Location: Hope Bay, Nunavut, Canada

Typical cross-section for HBJV permanent roads

PROJECT:	DATE:	APPROVED:	FIGURE:
2CH005.02	Feb 2002	EMR	**3.1.1.1**



Drawing not to scale

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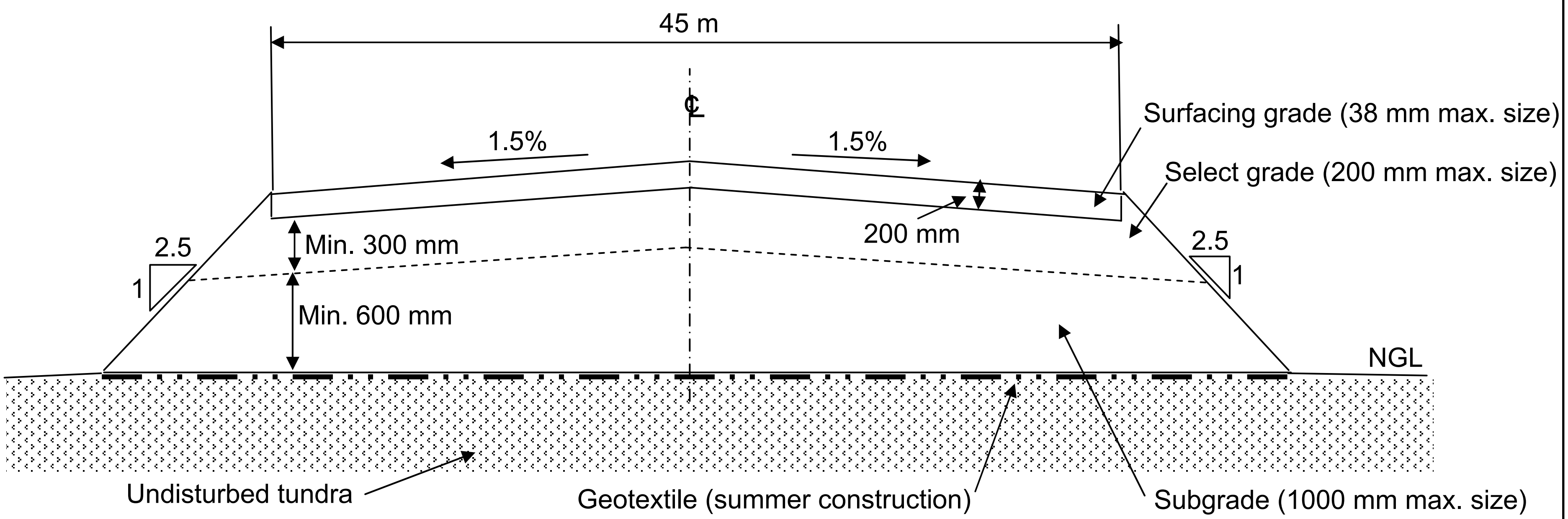
HOPE BAY JOINT VENTURE

Project Name: Doris North Trial Operation
Project Location: Hope Bay, Nunavut, Canada

Typical cross-section for HBJV permanent tailings dam service road

PROJECT:	DATE:	APPROVED:	FIGURE:
2CH005.02	Feb 2002	EMR	**3.1.1.2**



Drawing not to scale

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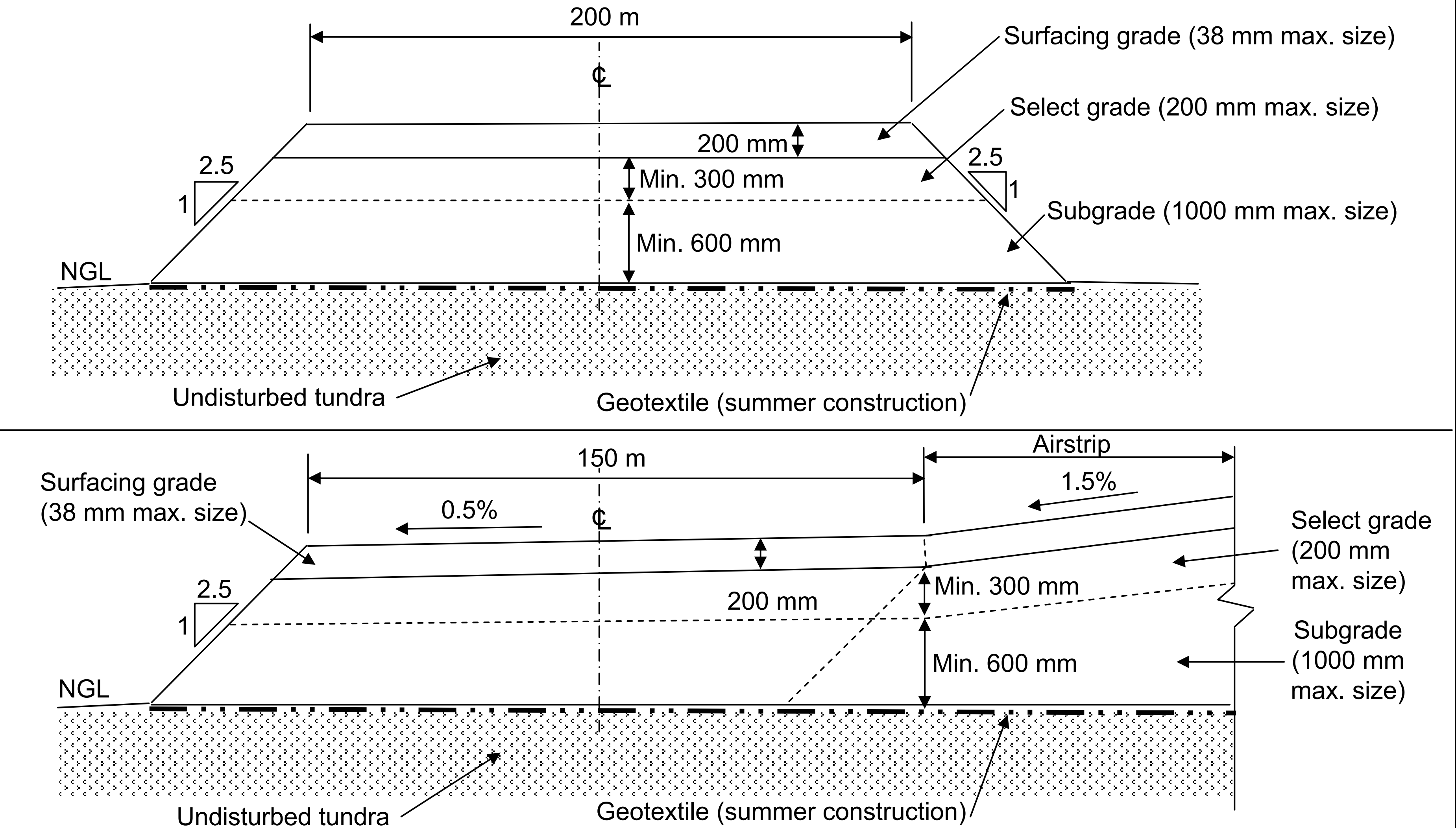
HOPE BAY JOINT VENTURE

Project Name: Doris North Trial Operation
Project Location: Hope Bay, Nunavut, Canada

Typical cross-section for HBJV airstrip (Class 3-D)

PROJECT:	DATE:	APPROVED:	FIGURE:
2CH005.02	Feb 2002	EMR	**3.1.2(a)**



Drawing not to scale

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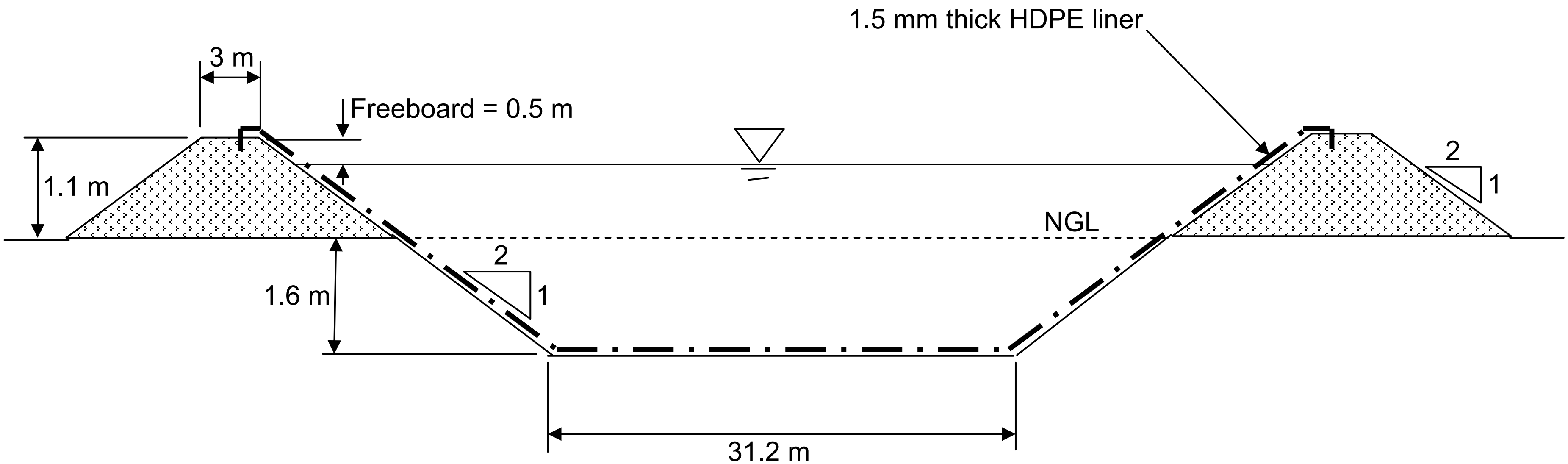
HOPE BAY JOINT VENTURE

Project Name: Doris North Trial Operation
Project Location: Hope Bay, Nunavut, Canada

Typical cross-sections for HBJV airstrip apron

PROJECT:	DATE:	APPROVED:	FIGURE:
2CH005.02	Feb 2002	EMR	3.1.2(b)



Drawing not to scale

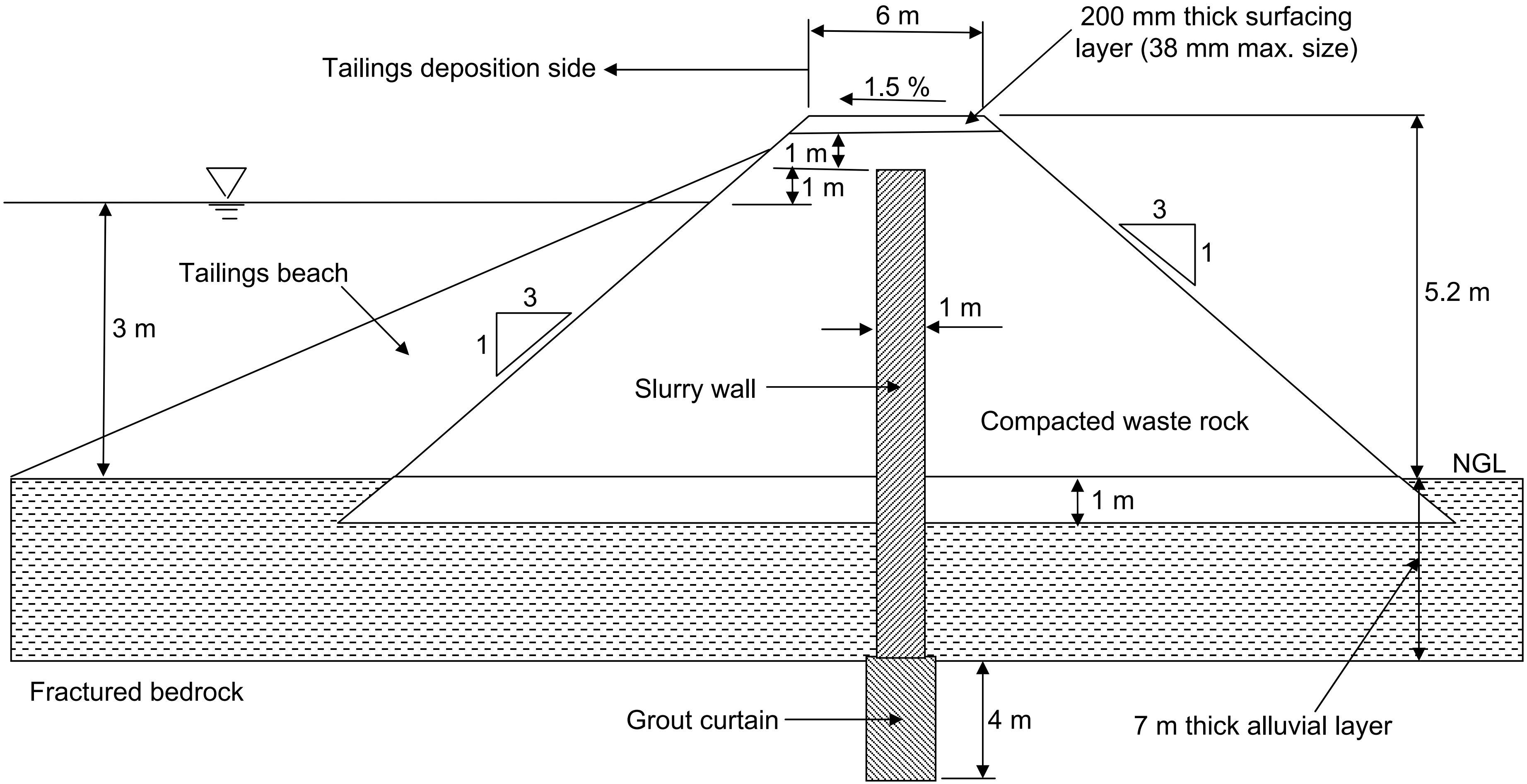
SRK Consulting
Engineers and Scientists

HOPE BAY JOINT VENTURE

Project Name: Doris North Trial Operation
Project Location: Hope Bay, Nunavut, Canada

Typical cross-section through Mill emergency sump overflow

PROJECT:	DATE:	APPROVED:	FIGURE:
2CH005.02	Feb 2002	EMR	**3.6.5**



Drawing not to scale

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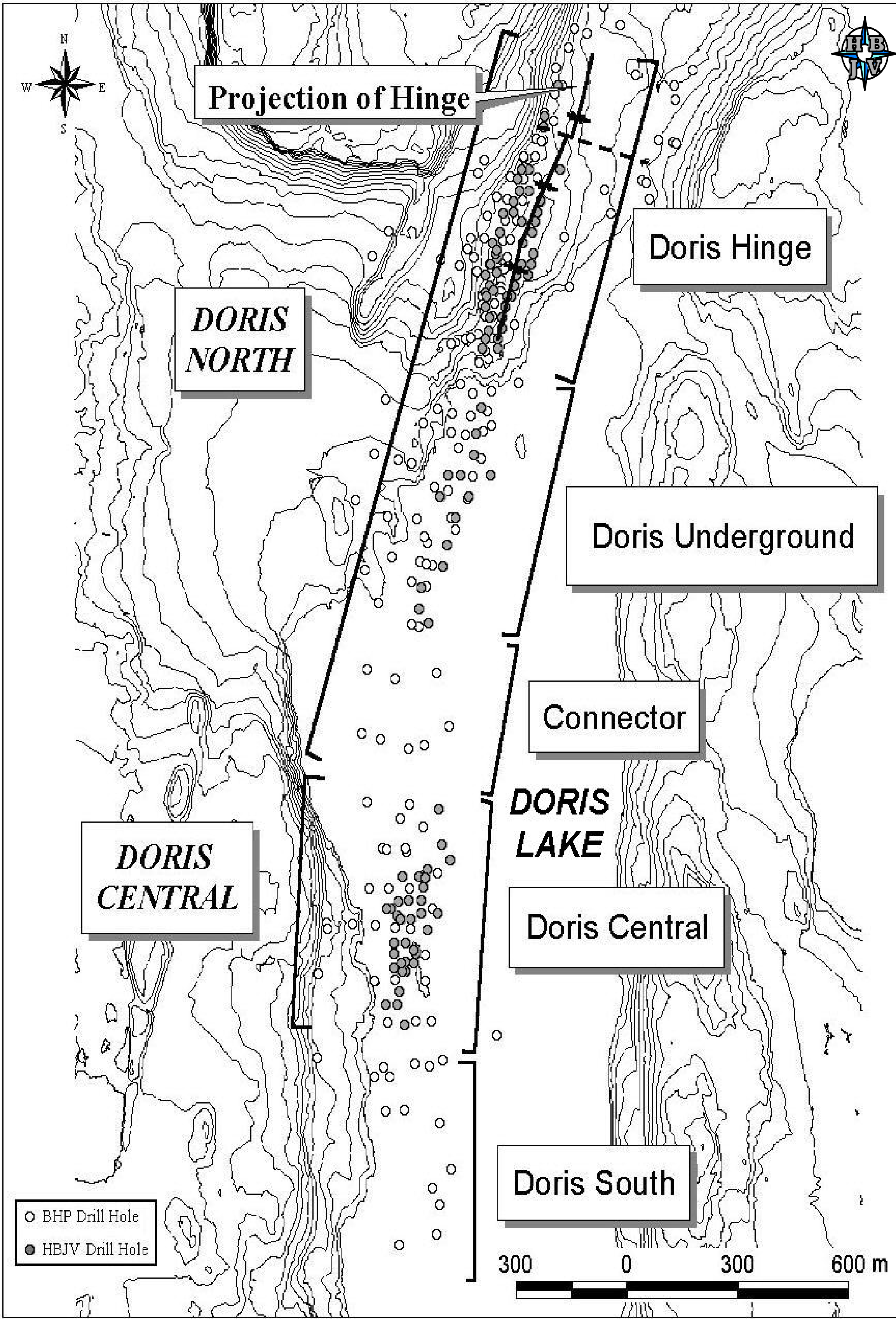
HOPE BAY JOINT VENTURE

Project Name: Doris North Trial Operation
Project Location: Hope Bay, Nunavut, Canada

Typical section through tailings impoundment dam

PROJECT:	DATE:	APPROVED:	FIGURE:
2CH005.02	Feb 2002	EMR	**3.8**



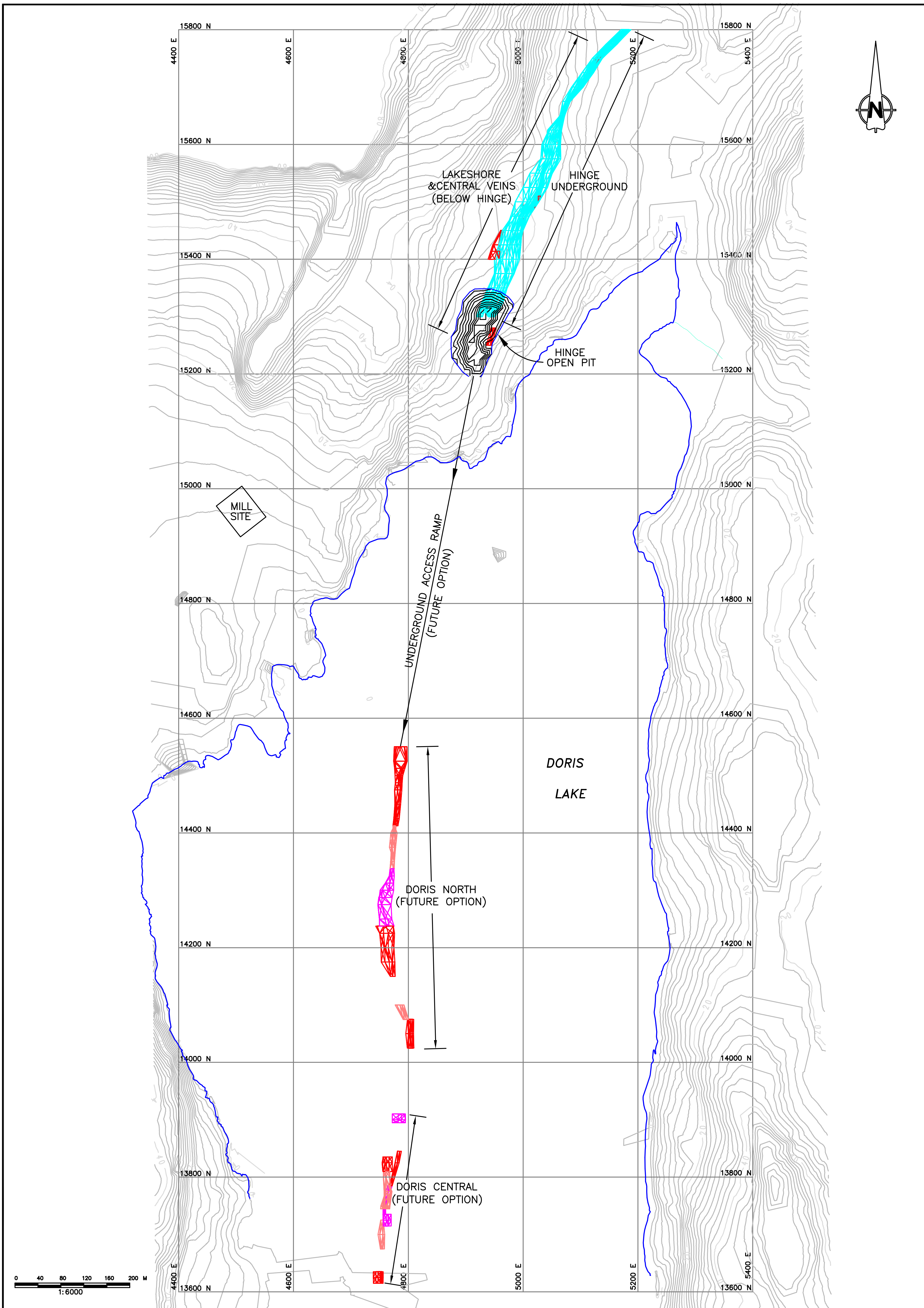
SRK Consulting
Engineers and Scientists

Project Name: Doris North Trial Operation
Project Location: Hope Bay, Nunavut, Canada

Location of Zones and Resources for the Doris System

HOPE BAY JOINT VENTURE

PROJECT:	DATE:	APPROVED:	FIGURE:



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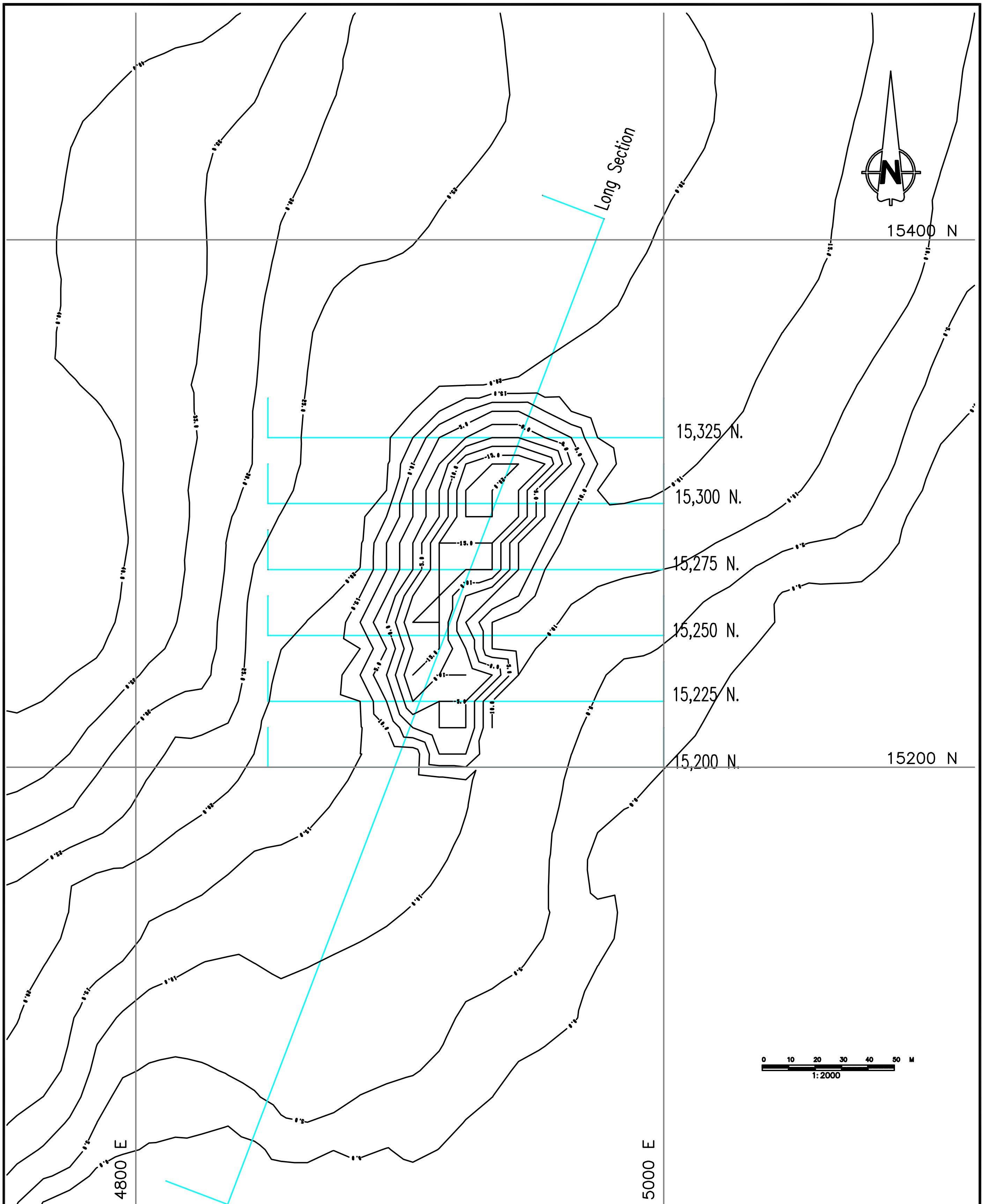
HOPE BAY JOINT VENTURE

DORIS NORTH TRIAL OPERATION

MINING SITE PLAN

PROJECT NO.	DATE	APPROVED	FIGURE
2CH005.00	Jan, 2002		15.4.1(a)



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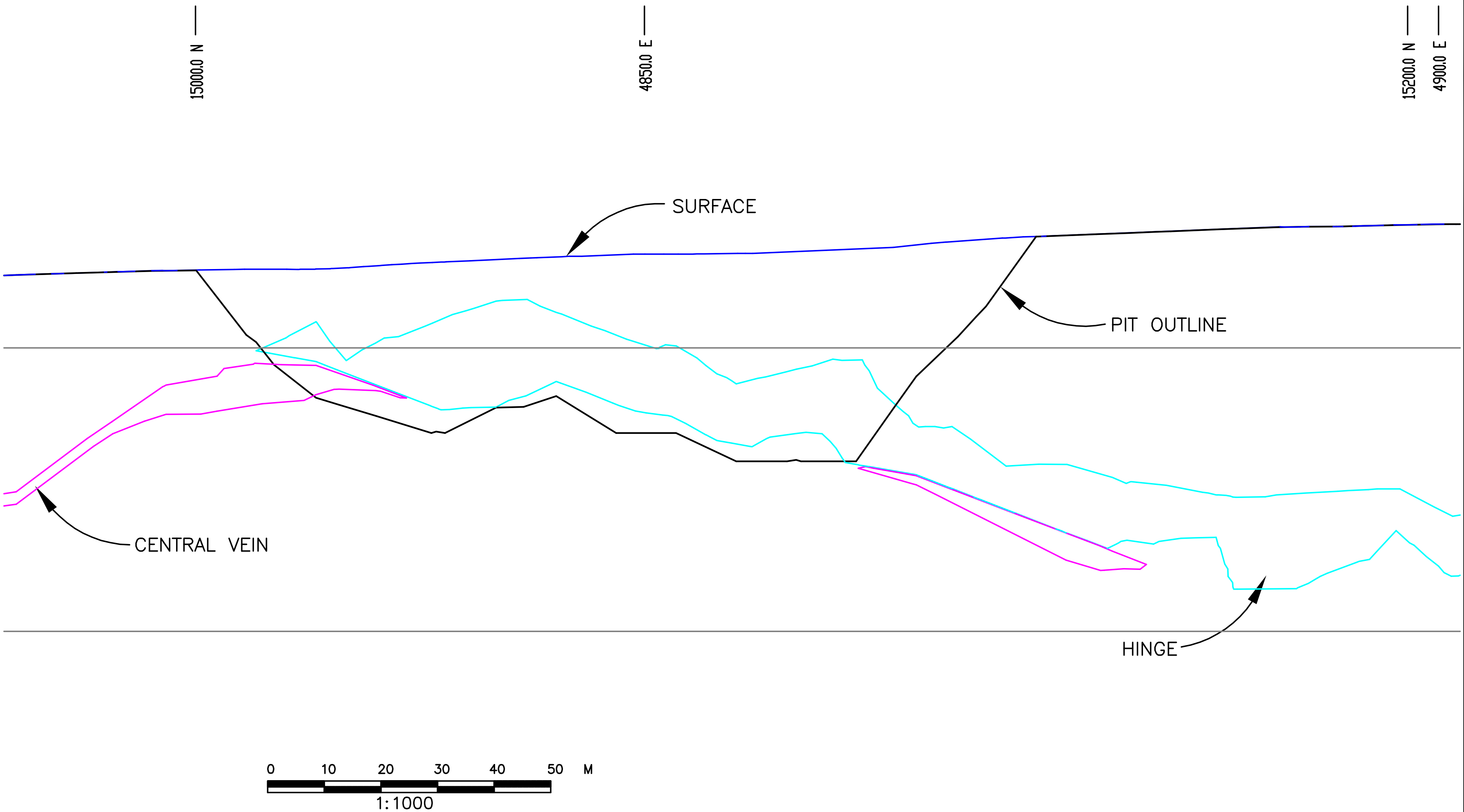
HOPE BAY JOINT VENTURE

DORIS NORTH TRIAL OPERATION

HINGE PIT PLAN

PROJECT NO.	DATE	APPROVED	FIGURE
2CH005.00	Jan, 2002		15.4.1(b)

Dwg Ref: PITPLAN.dwg



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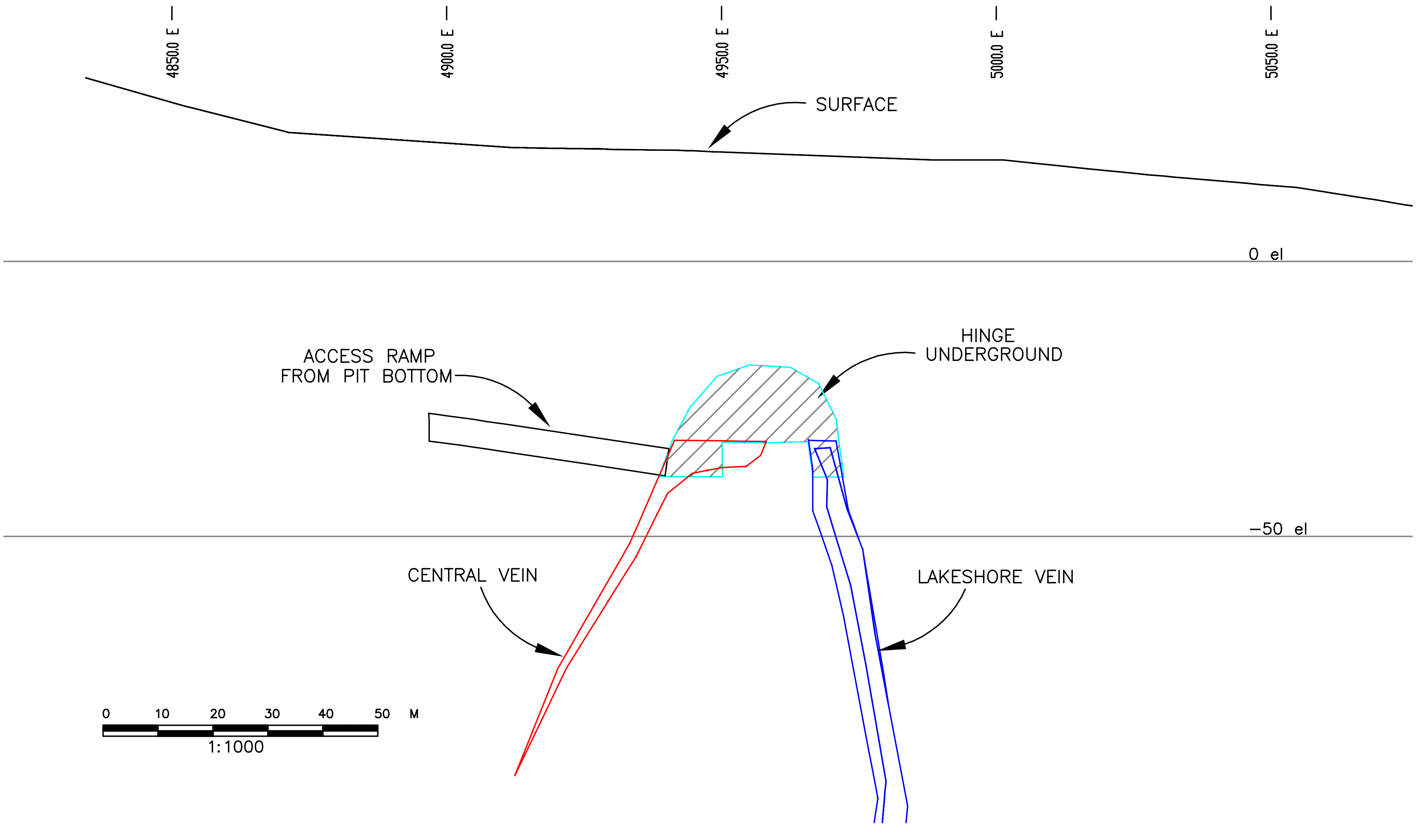
HOPE BAY JOINT VENTURE

DORIS NORTH TRIAL OPERATION

HINGE PIT LONG SECTION

PROJECT NO.	DATE	APPROVED	FIGURE
2CH005.00	Jan, 2002		15.4.1(c)

Dwg Ref: PIT_LSEC.dwg



Dwg Ref: Pit_Xsec.dwg

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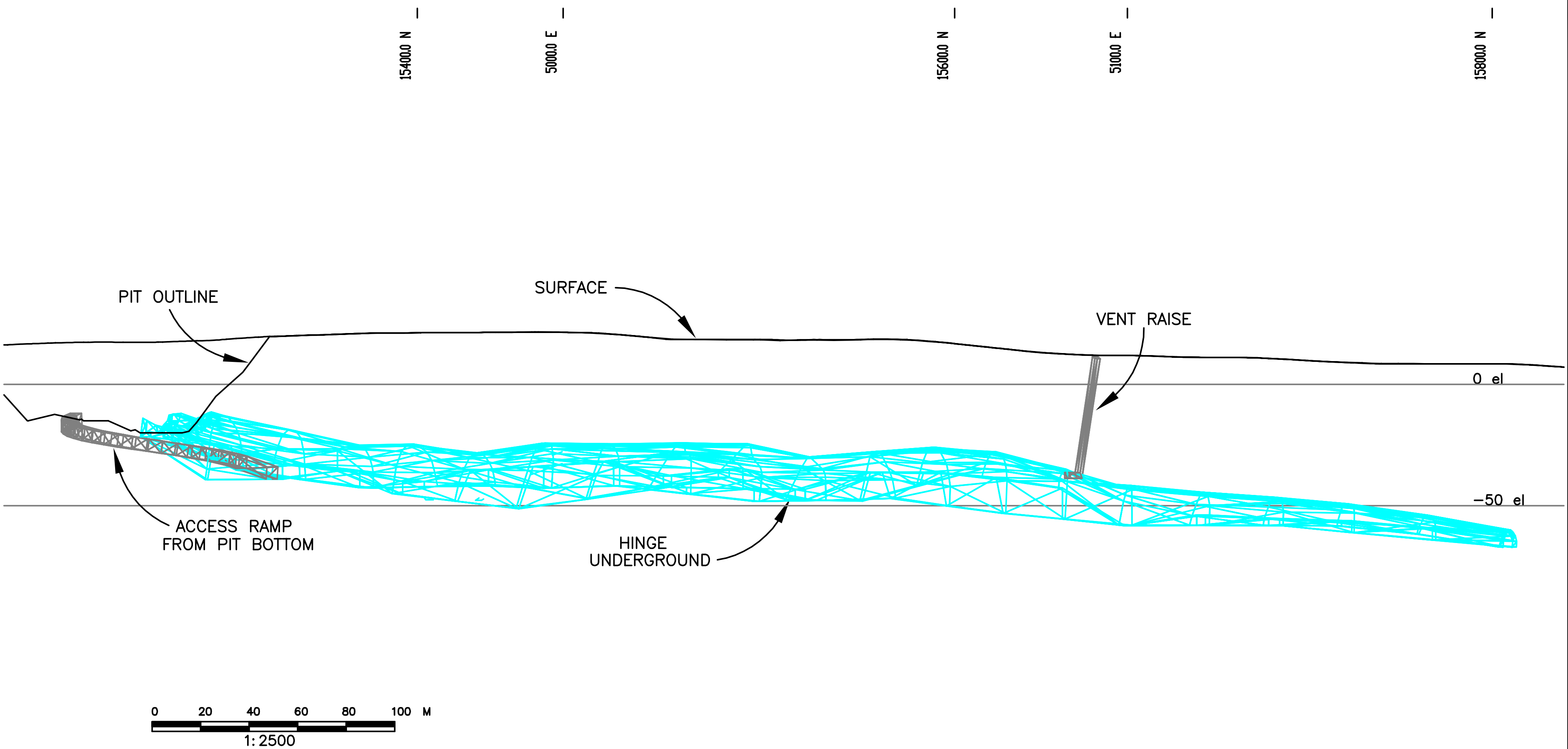
HOPE BAY JOINT VENTURE

DORIS NORTH TRIAL OPERATION

HINGE UNDERGROUND
SECTION 15350 N

PROJECT NO.	DATE	APPROVED	FIGURE
2CH005.00	Jan, 2002		15.4.2(c)



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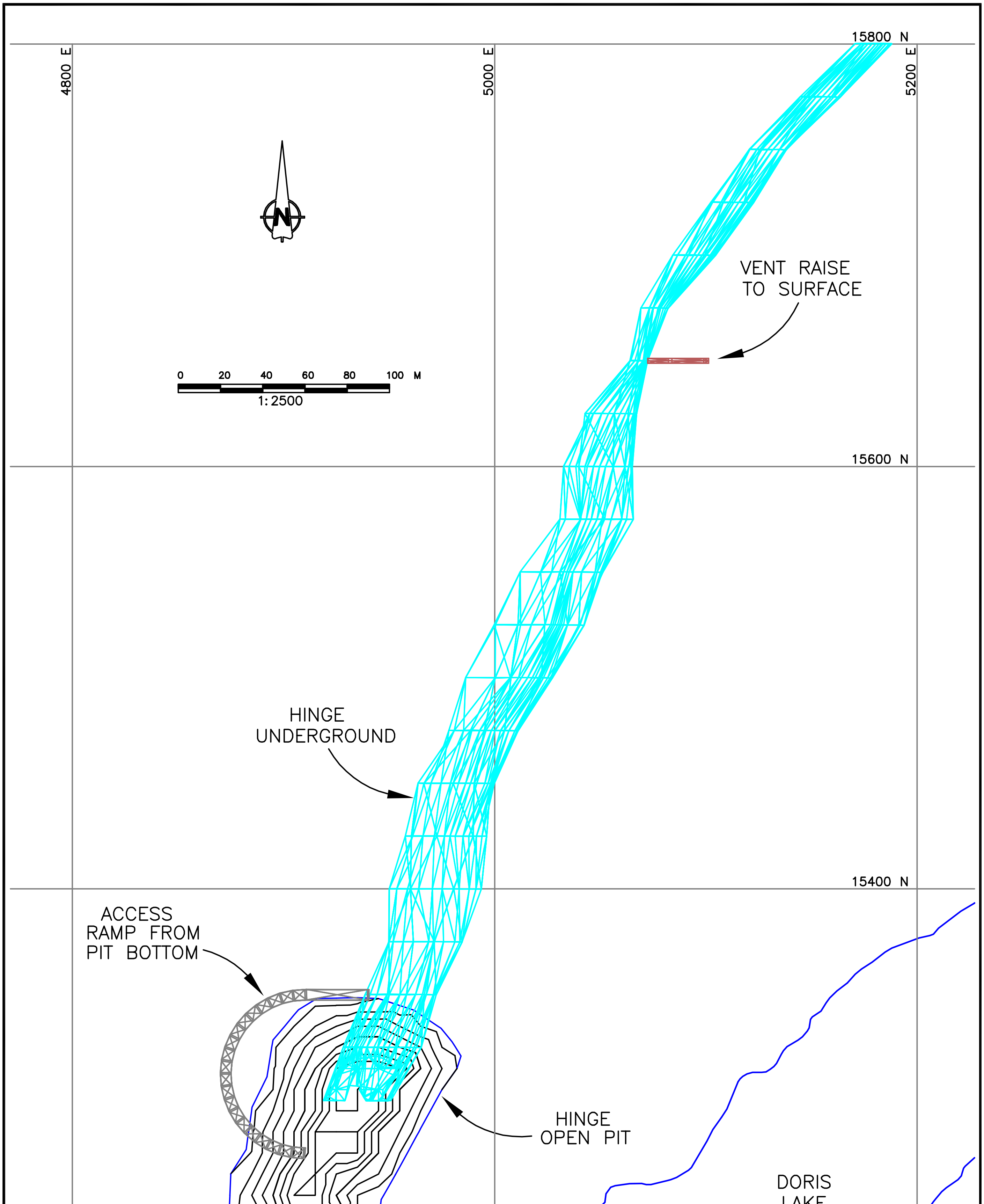
HOPE BAY JOINT VENTURE

DORIS NORTH TRIAL OPERATION

HINGE UNDERGROUND LONG SECTION

PROJECT NO.	DATE	APPROVED	FIGURE
2CH005.00	Jan, 2002		15.4.2(b)

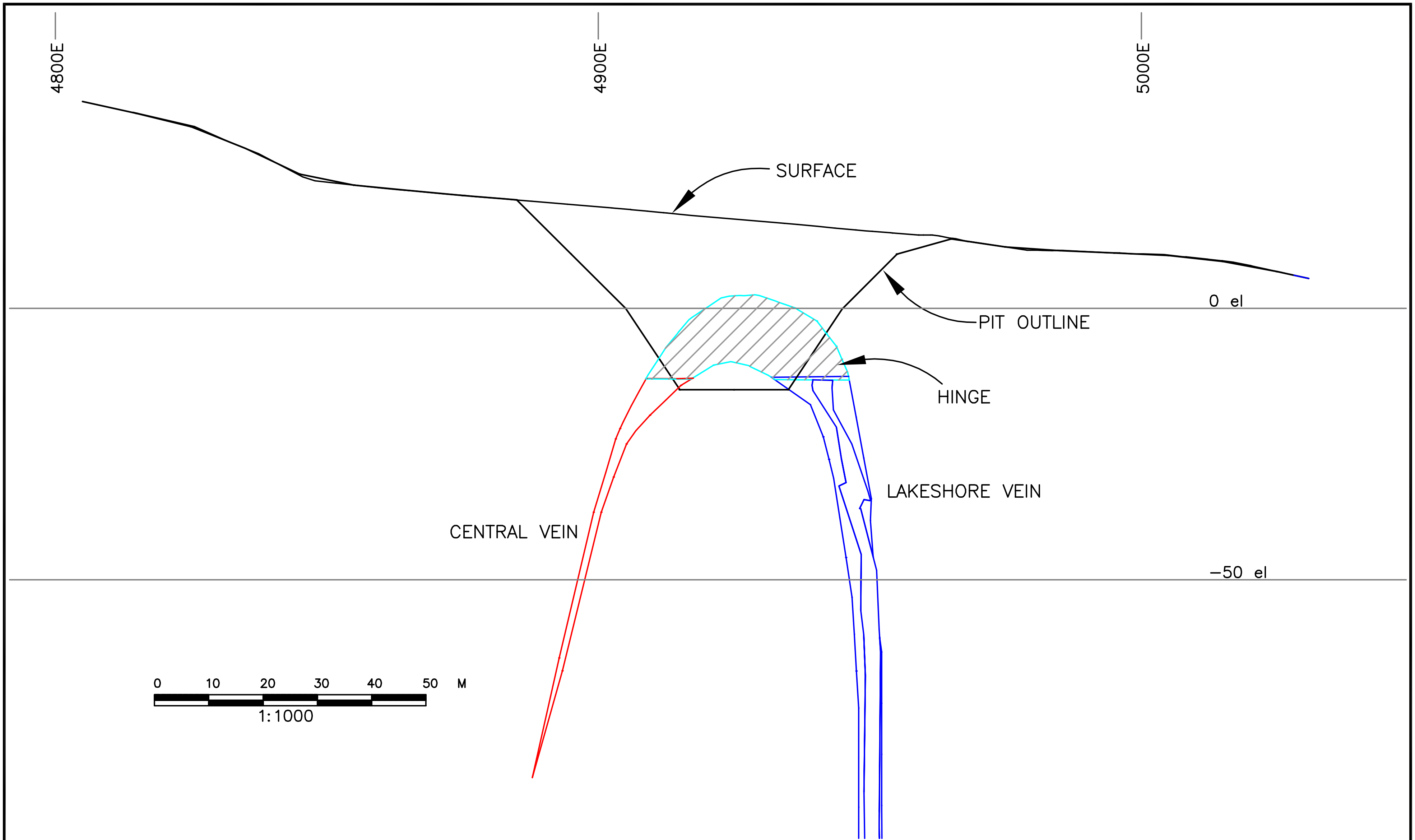
Dwg Ref: Pit_Lsec.dwg



SRK Consulting Engineers and Scientists	DORIS NORTH TRIAL OPERATION
HOPE BAY JOINT VENTURE	HINGE UNDERGROUND PLAN

PROJECT NO.	DATE	APPROVED	FIGURE
2CH005.00	Jan, 2002		15.4.2(a)

Dwg Ref: Hinge_plan.dwg



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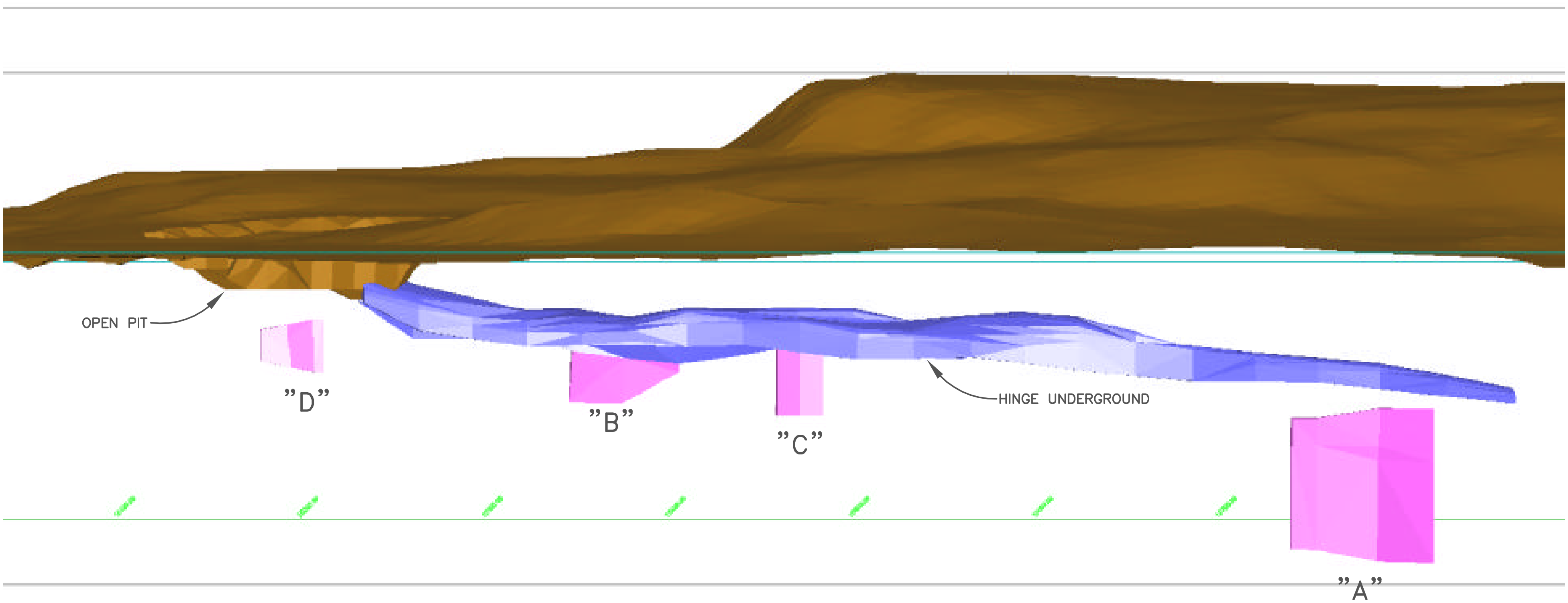
HOPE BAY JOINT VENTURE

DORIS NORTH TRIAL OPERATION

HINGE PIT SECTION 15275 N

PROJECT NO.	DATE	APPROVED	FIGURE
2CH005.00	Jan, 2002		15.4.1(d)

Dwg Ref: Pit_Xsec.dwg



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HOPE BAY JOINT VENTURE

DORIS NORTH TRIAL OPERATION

LAKESHORE & CENTRAL MINING SOLIDS

PROJECT NO.	DATE	APPROVED	FIGURE
2CH005.00	Jan, 2002		15.4.3

Dwg Ref: Pit_Xsec.dwg

APPENDIX A
Underground Mining Detailed Calculations

APPENDIX A

Section 15. Mineral Resources and Mineral Reserve Estimates

Underground Mining Detailed Calculations:

Doris Hinge Ground Support
Definition Drilling
Mobilization and Diesel Fuel
Underground Ore Trucking
Underground Waste Development
Personnel Logistics
Underground Mining Equipment
Monthly Rental Charges (Modified by HBJV)
Surface Services (Modified by HBJV)
Mineable Resources Summary
Open Pit Cut-Off Grade

Doris Hinge Ground Support

Ground Support	Assumption:		Back & shoulder will be bolted and screened	
			Walls spot bolted	
		Screen	1.8 x 3.0m weld mesh sheets	
			(includes 0.6m mechanical anchor bolt to pin screen)	
		Bolts	1.8m length split set SS46	
		Installed costs	$ 45.00	per bolt
			$ 22.00	per m2 screen

Area of back to screen:

Back — Back area:

section	**width (m)**	**avg width**	**length (m)**	**area (m2)**	
15,300N	30				
		32.5	100	3,250	
15,400N	35				
		32.5	100	3,250	
15,500N	30				
		26.5	100	2,650	
15,600N	23				
		19	100	1,900	
15,700N	15				
		15	100	1,500	
15,800N	15				
		Total =	500	12,550	m2

Bolts required:

SS46	pattern:	1.2	1.44	m2 per bolt
		1.2	8,715	bolts required

Ground support cost for back:

	units		unit cost	cost
Screening	12,550	m2	$ 22.00	276,100
Bolting	8,715	each	$ 45.00	392,188
Total back				**$ 668,288**

Walls — Assumption: Walls spot bolted
Split set 1.8m SS46
Pattern: 1.5 x 1.5m

Area of wall to screen:

strike length	500	
no. of walls	2	
height	10	
area	10,000	m2

Area per bolt	2.25	
Number of bolts	4,444	each
Unit cost	$ 45.00	
Total walls	**$ 200,000**	

Hinge Ground Support Summary

			Area (m2)	Screen	No. bolts	Cost
Ground Support Summary	Costs:	Back	12,550	yes	8,715	$ 668,288
		Walls	10,000	no	4,444	$ 200,000
		Total				**$ 868,288**
					Avg. per tonne	**$ 2.42**

Definition Drilling

Definition Drilling Hinge

Cost estimate based on information from Advanced Drilling.
Drilling requirements as per discussion with HBJV and sketches by K.Reipas

Equipment: Kubota tractor mounted Gopher drill
Coring with BQ thin wall

Pattern:
North area 15 x 10m
South area 10 x 10m

Drill factors from sketches of drill patterns:

Area	Sections	Percent of ore	Ore Tonnage	Drill Factor tonnes per DDH meter	DDH meters
North	15,600N to 15,800N	25%	89,650	177	506
South	15,300N to 15,600N	75%	268,950	136	1,978
	Total DDH meters required				2,484

Mob. & demob.			15,000
Coring	$ 42.25	per m	104,952
Estimated standby charges @15%			15,743
Acid test (every 20m at $50 each)			6,210
Total DDH costs for Doris Hinge			$ 141,905

Definition Drilling Lakeshore & Central

Estimated DDH meters required from cross sections:

Mining Shape	No. of holes	DDH meters	
B	9	435	
C	6	240	
D	12	560	
Total		1,235	m

Costs:

Coring	$ 42.25	per m	52,179
Estimated standby charges @15%			7,827
Acid test (every 20m at $50 each)			3,088
Total DDH costs for L & C			$ 63,093

DDH Cost Summary

Definition Drilling Summary

Area	Meters		Costs
Doris Hinge	2,484		$ 141,905
Lakeshore & Central	1,235		$ 63,093
Totals	3,719	m	$ 204,998
Average unit costs	$ 55.12	per m	$ 0.54 avg.per tonne

Equipment & Fuel to Mobilize

Procon's fuel	646,000	liters
Procon gear at	360	tonnes
Nuna's 1 million liters of diesel	1,000,000	liters
Nuna gear and facilities	4,180	tonnes
Fuel for generators	8,610,000	liters

Information from NTCL Northern Transportation Company Limited

Diesel Fuel Cost Estimate

Assumed rack price in Edmonton	$	0.30	per liter
Differential to Hay River	$	0.07	
Tariff: Hay River to Roberts Bay	$	0.38	
Haulage to site	$	0.05	
TOTAL	$	0.80	per liter

1 liter of diesel is about 0.83 kg per Nuna		
1liter of diesel fuel is 1.8 pounds per NTCL		
1liter of diesel fuel is:	0.82	kg

Underground Trucking

Underground Mining Cost
UNDERGROUND ORE TRUCKING

Ore will be hauled from underground to a pit bottom transfer stockpile.
Procon has a 26 ton truck at Boston so this size of truck is assumed.
Assume truck loading (scoop time) is included in extraction cost.

Operating costs

Truck:	Tires		8	(18.00R25)
	Fuel and lube		32	(275hp, $0.95 per liter)
	Maintenance parts		20	(field repair plus overhaul allowance)
	Maintenance labour		16	
	Sub-total	$	76	per operating hour
Operator:	Wages		23	per hr
	Burden		40%	
	Bonus		9	per hr
	Sub-total	$	41	per operating hour
Total:		**$**	**117**	**per operating hour**

Productivity:

Cycle: **Hauling to pit bottom from Doris Hinge stope**

Loaded					Loading time	5.00 min	
			Grade	Speed		Tramming time (loaded)	
1	250	m	12%	6.0	km/h	2.50 min	up grade in stope
2	150	m	15%	6.0	km/h	1.50 min	up ramp 150m to pit bottom
3	40	m	2%	6.0	km/h	0.40 min	within pit
4	0	m	1%	1.0	km/h	0.00 min	
5	0	m	1%	1.0	km/h	0.00 min	
6	0		1%	1.0	km/h	0.00 min	
Total One way	440					**4.40** min	
					Dumping time	2.00 min	
Empty			Grade	Speed		Tramming time (loaded)	
6	0		-1%	1.0	km/h	0.00 min	
5	0		-1%	1.0	km/h	0.00 min	
4	0		-1%	1.0	km/h	0.00 min	
3	40		-2%	6.0	km/h	0.40 min	
2	150		-15%	10.0	km/h	0.90 min	
1	250		-12%	8.0	km/h	1.88 min	
Total One way	440					**3.18** min	

Fixed cycle time		7.0 min
Travel time		7.6 min
Traffic delay		1.0 min
Total cycle time		**15.6** min
Loads per hour, assuming 50 minutes per hour		3.2 loads
Tonnes per load, assuming 90% fill factor		21.3 tonnes
Tonnes per hour		68 tonnes
Cost per hour	$	117
Cost per tonne	**$**	**1.71 per tonne ore**

Underground Trucking

Cycle:	**Hauling to pit bottom from Lakeshore shape "C"**							
Loaded					Loading time	5.00	min	
			Grade	Speed		Tramming time (loaded)		
1	150	m	15%	6.0	km/h	1.50	min	up "C" access ramp
2	125	m	12%	6.0	km/h	1.25	min	up grade in Hinge stope
3	150	m	15%	6.0	km/h	1.50	min	up ramp 150m to pit bottom
4	40	m	2%	6.0	km/h	0.40	min	within pit
5	0	m	1%	1.0	km/h	0.00	min	
6	0		1%	1.0	km/h	0.00	min	
Total One way	465					**4.65**	min	
					Dumping time	2.00	min	
Empty			Grade	Speed		Tramming time (loaded)		
6	0		-1%	1.0	km/h	0.00	min	
5	0		-1%	1.0	km/h	0.00	min	
4	40		-2%	1.0	km/h	2.40	min	
3	150		-15%	10.0	km/h	0.90	min	
2	125		-12%	8.0	km/h	0.94	min	
1	150		-15%	10.0	km/h	0.90	min	
Total One way	465					**5.14**	min	
				Fixed cycle time		7.0	min	
				Travel time		9.8	min	
				Traffic delay		1.0	min	
				Total cycle time		**17.8**	min	
	Loads per hour, assuming 50 minutes per hour					2.8	loads	
	Tonnes per load, assuming 90% fill factor					21.3	tonnes	
	Tonnes per hour					60	tonnes	
	Cost per hour					$ 117		
	Cost per tonne					**$ 1.96**	**per tonne ore**	

Underground Trucking Summary

Area	Tonnes	One way distance (m)	Cycle time (min)	Cost per tonne
Doris Hinge	358,600	440	15.6	$ 1.71
Lakeshore & Central	21,500	465	17.8	$ 1.96
Total	**380,100**			**$ 1.73**
				avg per tonne

Underground Mining Cost
WASTE DEVELOPMENT for MINE ACCESS

Doris Hinge Portal

A portal must be collared at the bottom of the completed open pit.
The work that is anticipated is:
- regrading and levelling of the collar area
- extra ground support of collar
- set up generator
- set up of vent fan and ducting
- set up air compressor and piping
- some type of small structure may be needed to house generator and compressor

The cost estimate for this work is estimated to be equivalent to 4 rounds of normal advance:
Portal cost = 4 rounds x 3.3m x $3,000/m = $ 39,600 L.S.

Doris Hinge

Cost and Tonnes of waste

Item	Length (m)	Width (m)	Height (m)	Density (t/m3)	Waste Tonnes (t)	Unit Cost ($/m)	Cost ($)	
Access ramp	150	5	4	2.9	8,700	3000	450,000	ramp from pit bottom
Main vent raise	60	2.4	2.4	2.9	1,002	2000	120,000	includes ladders and landings
Second vent raise	60	2.4	2.4	2.9	1,002	1500	90,000	to reduce aux. vent requirements
Raise access drifts	14	2.4	2.4	2.9	234	1500	21,000	
Totals	**284 m**				**10,938**	**waste t**	**$ 681,000**	

Lakeshore & Central

Cost and Tonnes of waste

Item	Length (m)	Width (m)	Height (m)	Density (t/m3)	Waste Tonnes (t)	Unit Cost ($/m)	Cost ($)
"B" Access ramp	140	3.500	4.000	2.9	5,684	2,500	350,000
"B" Cross cut	15	3.500	4.000	2.9	609	2,500	37,500
"C" Access ramp	150	3.500	4.000	2.9	6,090	2,500	375,000
"D" Access drift	110	3.500	4.000	2.9	4,466	2,500	275,000
Totals	**415 m**				**16,849**	**waste t**	**$ 1,037,500**

Summary of waste development

	Waste tonnes	Waste dev.'t cost	
Grand totals	**27,800**	**$ 1,719,000**	
		$ 4.52	**per tonne ore**

Underground Mining Cost
LOGISTICS

Underground Mining Personnel

Turn around costs:	Yellowknife to Edmonton		
Personnel on site		20	
Schedule	3	weeks in	
	3	weeks out	
Every 3 weeks there is a crew change			
3 weeks of production is		12,600	tonnes
Air fare estimate (Nuna)	$	1,050.00	return ticket
No. of employees		20	
Total cost	$	21,000	
Cost per tonne	$	1.67	per tonne ore
L.O.M. cost	$	633,500	

Underground Mining Cost
EQUIPMENT

Mining Equipment

The estimated underground mining equipment list is shown below:

Underground Mining Equipment

Unit Description	Unit Cost CDN$ (000's)	Doris Hinge	Lakeshore & Central	
Development				
Diamond Drill	250	1		definition drilling
Development jumbo 2 boom	650	0.5		access development
2 Yard Scoop	300	0.5		development in narrow veins
6 Yard Scoop	600	1		development, remuck waste
Scissor Lift	250	1		scaling, bolting development
Production				
Production Drill 62mm	500		1	production drilling
Production jumbo 3 boom	650	0.5		drifting, slashing, benching
2 Yard Scoop	300	0.5		narrow stopes
6 Yard Scoop	600	1		production mucking
High Reach Bolting Rig (boom/basket)	500	1		ground control, loading powder, pillar recovery
30 Tonne Truck	600	1		truck ore and waste
Services				
2 Yard Scoop/Forklift	300	1		nipper
Boom Truck	250	1		mechanics
Supervisor Buggy	50	1		supervision, maintenance
Surface Pick Up	40	2		engineering, geology, contractor
Crew van	50	1		mining crews
Support				
Air compressor	n/a	2		
Diesel electric generator	n/a	1		
Ventilation fans	n/a	4		
Anfo loaders	n/a	4		
Sub-Total Cost CDN$ (000's)		4,480	500	
Freight and Insurance to site	20%	896	100	
ESTIMATED TOTAL COST CDN$ (000's)		6,000		

Monthly Rental Charges

				Monthly rent
Monthly Rentals	74 man camp and dry			48,900
	5 person office			1,600
	communications			15,000
	fuel storage			15,700
	fold away shop			18,400
	Monthly total		$	99,600
Electric power	Generators for mill, shop, camp, u/g		$	46,600
	plus fuel per month	300,000 liter/mo		

Surface Services

Surface Services	In this service cost category, the cost model includes: 1 - Crew transportation on site 2 - Electricity cost 3 - Mine air heating 4 - Diesel fuel price adjustments 5 - Mine dry, yard maintenance, waste handling

Crew transportation

1 Crew transportation
A van will be needed to transport crew from mine to camp
Assume there are 8 operating hours per day on the van(s).
Operating cost of $20 per hour to cover parts, tires, fuel

Also some operating time on pick up trucks for engineering and geology personnel.

	hrs/day	cost/hr		cost	
Van	8	$ 20		$ 160.00	per day
Pick up	6	$ 15		$ 90.00	
				$ 0.42	per tonne

Electricity

2 Electricity
The mines electricity cost is included in the cost estimate as follows:

Power demand is estimated (by others) at:

Mill	1.3
Camp	0.5
Underground	0.5
Total	2.3

The cost estimate includes		$	46,600	per month generator rentals
Fuel for generators			300,000	liters per month
Fuel cost at:	$ 0.80	$	240,000	per month
Total power costs per month =		$	286,600	per month
Portion attributed to underground		$	62,304	per month
	equivalent	$	3.46	per tonne

Note: This cost is not included in surface services. It is part of generator rental and overall diesel fuel costs shown.

3 Mine air heating
The mine air will not be heated.

4 - Diesel fuel price adjustments
Contractors cost already incorporates project fuel price assumption

5 Nuna will capture the mine dry cost.
Nuna will include road maintenance.

Surface waste handling

There is a cost to estimate for taking development waste from underground and disposing of it on surface.

Quantity of development waste:		27,800	tonnes waste
Assumed surface handling cost	$	3.00	per tonne waste
Total cost	$	83,400	over project
	$	0.22	per tonne ore

Surface Services Summary

Summary

	Cost/tonne	
Crew transportation	$	0.42
Electricity: Included elsewhere		
Waste handling	$	0.22
Total	$	0.64

HOPE BAY - Doris North Trial Operation

Mineable Resources Summary

OPEN PIT

	Mineable Resource		Includes		Approx Mining
	tonnes	g/t Au	dilution	recovery	Rate TPD
Doris Hinge Pit	82,500	12.1	10%	95%	915

UNDERGROUND

	Mineable Resource		Includes		Approx Mining
	tonnes	g/t Au	dilution	recovery	Rate TPD
Doris Hinge U/G	358,600	19.9	26%	95%	600
Lake & Cent Veins	21,500	19.4	16%	95%	300

TOTAL	**462,600**	**18.5**

Hope Bay Cut-Off Grade — Hinge Open Pit

Gold price: $US	$	275.00	US$/ounce
Exchange rate:		0.65	
Gold price: $Canadian	$	423.08	CDN$/ounce
	$	13.60	CDN$/gram
Estimated costs:		CDN$/tonne	
Mining		2.00	extra amount for ore mining selectivity
Milling		24.00	
Gen. & Admin.		25.00	
Total ore costs (excludes $4.50 mining)	$	51.00	
Mill recovery		95%	
Mill feed grade required		**3.95**	**grams Au/tonne**

APPENDIX B
Nuna Logistics Cost Estimate

January 17, 2002

Mr. Brian Labadie
Senior VP Operations
Miramar Mining Corporation
311 West First Street
North Vancouver, B.C.
V7M 1B5

and

Mr. Maritz Rykaart
Senior Engineer
SRK Consulting
Suite 800, 580 Hornby Street
Vancouver, B.C.
V6C 3B6

Dear Sirs:

RE: HOPE BAY PROJECT OPEN PIT MINING AND CONSTRUCTION COST ESTIMATE

Nuna Logistics Limited is pleased to submit three copies of our estimate for mining and earthworks construction at the Hope Bay Project Doris Hinge site.

The Executive Summary contained in the proposal describes our approach to startup and development of the open pit.

Nuna Logistics is available to present and discuss this proposal at your convenience. Doug Fossen, a mining consultant to Nuna Logistics, was instrumental in the preparation of the cost estimate.

Thank you for the opportunity to submit our proposal. Please contact me at 604-682-4667 if you have any questions.

Respectfully submitted,

NUNA LOGISTICS LIMITED

Courtland Smith, P.Eng.
Vice President
CS/jaz

COST ESTIMATE FOR HOPE BAY PROJECT DORIS HINGE OPEN PIT MINING AND EARTHWORKS CONSTRUCTION

Prepared For:
Brian Labadie, Senior VP Operations, Miramar Mining Corporation
Maritz Rykaart, Senior Engineer, SRK Consulting

Respectfully Submitted By:

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January 17, 2002

Cost Estimate For
Hope Bay Project Doris Hinge
Open Pit Mining and
Earthworks Construction

Index

EXECUTIVE SUMMARY

INTRODUCTION

Nuna Logistics is an Inuit company with extensive experience in Northern Canada. We have a demonstrated commitment to hiring northerners and providing subcontract and supply opportunities to northern firms. For this project we would anticipate using the following subcontractors.

1. NWT Rock Services, Yellowknife -- drill & blast work

2. Nahanni Construction, Yellowknife -- concrete work if required

3. Sub-Arctic Surveys, Yellowknife -- surveying

4. JSL Mechanical, Yellowknife -- mechanical work

5. JT Electric, Yellowknife -- electrical work

Nuna Logistics' estimated work plan is intended to meet the Hope Bay Project design and schedule as developed by SRK Consulting. Our interpretation of the work plan and schedule are presented in detail within this estimate. We believe that a well planned and well executed work plan minimizes the cost to our clients. Tonnages, cycle times, equipment and labour hours, and costs are presented on a month-by-month basis.

Nuna Logistics intends to mobilize a mid-life aged fleet of equipment for this project. This fleet would provide adequate availability and capacity to do the work without attracting the higher carrying cost of an all-new fleet.

OUR APPROACH

Nuna Logistics' understanding is that the project will commence with the all of the necessary mine equipment, camp and fuel being shipped in to Roberts Bay in summer 2002 and off loading after freeze-up, probably in December. The first requirements will be to establish temporary camp facilities and to develop a winter road to the Doris Hinge. Over the winter, the final camp, shop and fuel storage facilities would be established at the site.

It is assumed that all of the necessary permitting will be complete by the end of February and that mine operations could commence in March. Over the next four months, the mine operation would develop the pit, delivering material for construction of the permanent access, air strip and tailings dyke. Ore from within the pit design will have been mined and stockpiled. With the pit completed, most of the mine equipment would remain idle from then until demobilization, probably in September. Processing and underground operations could begin after the equipment arrives during the 2003 shipping season.

START UP

Initial activities will be the off-loading of equipment from the barge, after freeze-up. Construction of the 4 km winter road from the south end of Roberts Bay to the Doris Hinge should be complete within a few days. The installation of facilities and transfer of fuel from the barge to the storage tanks would be carried out over the next several months.

FACILITIES

Site preparation and establishment of a 12m x 24m fold-away shop, a 70 man camp, an office and a dry, as well as storage facilities for 1.3 million litres of fuel, will be completed over the first few months. A package, made up of four generators complete with a synchronized load distribution center, will provide up to 3.3MW of electric power, specifically for the mill and U/G operation. Only two of the generators will be required onsite prior to the start of mill operations. It is assumed that during mill operation, a fuel barge will be beached or frozen-in and fuel will be transferred as necessary to maintain levels in the storage tanks.

MOBILIZATION

All equipment, facilities and supplies for the mine operations will be mobilized by barge from Hay River. The deadline for shipping is probably mid-July, 2002. Most of the mine equipment will be returned to Hay River the following year, loaded back on the barge in Hope Bay in August or September 2003.

PIT DESIGN

The specified mineable resource is 82,500 mt ore and 375,000 mt of waste material within the optimized pit shell. It is estimated that actual mining will require an additional 205,500 metric tonnes of waste stripping to provide for a 10% haulage ramp from daylight (at 0.0 m bench) to the bottom of the pit. Revised (Nov 26th) estimates of the material quantities that are required for construction of the airstrip, apron, roads and tailings containment berm amounts to 226,000 cubic meters or 500,000 metric tonnes.

The first ore will be mined in the second month of operation. There will likely be an ore stockpile inventory of 82,500 mt at the completion of pit operations, requiring an approximate storage area of 20,000 square meters (160m x 160m).

PRODUCTION SCHEDULE AND COST ESTIMATE

Based on the mineable resource and the expanded stripping requirements, production scheduling indicates completion of the open pit within a four month time frame. Conceptually, the equipment would arrive by barge and be frozen in by late November. The 4 km winter road would be built in late December, at an estimated cost of $40,000. Mining would begin in March. Waste rock would be hauled from the pit to the construction areas as it is mined. One CAT 988 loader and four CAT 773-50 ton haulage trucks operating 20.5 hours per day would move about 6,400 tonnes per day or 190,000 mt per month. A CAT 330 excavator will be available to provide selective mining of ore grade material. The overall cost of the open pit mining project and the earthworks construction activities, assuming a 38 man crew onsite and equipment as listed below, is estimated at $5.2M including fuel, camp catering, and personnel air transport. The costs of sub-contracting for drilling, blasting and survey control are included in this amount.

The cost does not include the rental of facilities or the cost of equipment on standby as outlined below.

Most of the mining equipment will not be required to operate beyond the fourth month; it will, however, remain onsite until the next shipping season. The "standby cost" for the entire fleet is estimated at $45,000 per month, not including the standby cost of the sub-contractor's blasthole drills.

MINE EQUIPMENT

4 - CAT 773 (50t) Haul Trucks
2 - CAT 988 Loaders
1 - IR DM45 Production Blasthole Drills
2 - CAT D-8 Dozer
1 - CAT 330 Excavator
1 - 24 x 36 Portable Jaw Crusher
1 - CAT 14G Grader
1 - Service / Fuel Truck
1 - Plow Truck
1 - 25t Picker Truck
5 - Crewcabs
3 - Lighting Plants
7 - Heaters

SUPPLIES AND STORAGE

Fuel consumption for the mine equipment, as listed above, is estimated at 1.3 million litres for the four-month mining and construction project. When the mill and U/G become operational, in the second year, the fuel requirement for power generation is likely to be about 300,000 litres per month. This estimate is based on the specified consumption rate of 128.6 l/hour under 50% load, assuming three of the four units operating.

Assuming an average powder factor of 0.9 kg/BCM, 210 tonnes of ammonium nitrate (ANFO) will be required for the open pit mining.

We have assumed landed costs for fuel of $0.70 per litre and $535 per tonne for ammonium nitrate in one tonne totes.

BASIS OF THE ESTIMATE

Nuna Logistics' cost estimate is based on a schedule of rates basis with no allowances made for contingency or quantity variance. Labour and equipment rates include all consumables (except for those specified as Owner-supplied items) and include overheads and profit. The following provides base rates for the equipment and labour as scheduled.

CAT 773 (50t) Haul Trucks	$ 175.29 per hour
CAT 988 Loaders	206.81 per hour
IR DM45 Production Blasthole Drills	181.00 per hour
CAT D-8 Dozer	174.85 per hour
CAT 330 Excavator	140.37 per hour
24 x 36 Portable Jaw Crusher	200.00 per hour
CAT 14G Grader	101.45 per hour
Service / Fuel Truck	85.80 per hour
Plow Truck	134.69 per hour
25t Picker Truck	100.80 per hour

Crewcabs	$ 2,365 per month
Lighting Plants	1,400 per month
Heaters	2,450 per month

Equipment costs include fuel based on a landed cost of $0.70 per litre.

Equipment rates are based, for each piece of equipment, on hourly operating rates, which include an ownership component and an operating component. The ownership component includes carrying costs, depreciation, and equipment specific insurance. The operating component includes tires, repair parts, wear parts, maintenance labour (with the same inclusions and exclusions as operating labour), overheads and profit.

Superintendent	$ 73.27 per hour
Foreman	64.92 per hour
Administrator	53.24 per hour
Loader operator	63.25 per hour
Truck driver	56.58 per hour
Dozer operator	63.25 per hour
Grader operator	61.58 per hour
Serviceman	58.24 per hour
Labourer	51.57 per hour

Nuna Labour costs include camp catering and air transport to site.

Drill foreman	53.00 per hour
Driller	48.00 per hour
Blaster	49.00 per hour
Helper	36.00 per hour
Mechanic	60.00 per hour

Subcontract Labour costs exclude camp catering and air transport to site.

Labour rates are based on a 3 x 2, 3 x 1 work schedule. The rates consist of our current labour pay rates, scheduled overtime, employee benefits (CPP, EI, WCB), statutory holiday pay, vacation pay, overheads and profit. The rates do not include allowances for unscheduled overtime, incidental overtime, non-productive time, short-turnarounds, standby time, or escalation and these items have not been included in the cost estimate.

Complete accommodation and maintenance facilities are provided at rental costs as outlined below.

Complete 70 man camp accommodation & dry (including cost of erection)	$36,000 per month
Electrical power generation package (2.4 to 3.3 MW synchronized load with dist. Center provides power to mill, shop, camp, U/G, etc. Includes jacket water heat recovery system)	$46,600 per month ($23,300 per month first year, half capacity)
Communications (2 voice, 1 data line, including usage)	$30,000 per month
Site radios	$500 per month
Fuel storage (1.3 million litre capacity)	$4,000 per month
12m x 24m fold-away shop (with tooling and including erection)	$18,400 per month
Camp catering, excluding freight for food	$42 per man-day.

The above rental rates do not include maintenance costs of the above facilities.

Mobilization and Demobilization

The cost of freight from Hay River to site is not included; however, the costs of preparation and setup are included in these estimates. The combined shipping weight of mining equipment, camp, fuel and supplies is estimated at 2,200 metric tonnes.

Owner Supplied Items

The estimate excludes Owner-supplied items as follows:

1) Air transport of parts and supplies between Yellowknife or northern communities and Hope Bay;
2) Unscheduled idle time
3) First-aid and safety orientation; and
4) Emergency facilities and personnel
5) Mine Engineering and Geology
6) Pit dewatering if required
7) Permanent materials if required

8) Mobilization and Demobilization
9) Contingency.

It is understood that the processing plant will require crusher feed at a maximum 600mm. This is typical pit-run sized material. The Nuna crushing plant will provide crushed rock only for construction purposes.

We have not included any allowance for contingency, quantity variance, financing costs (due to payment timing or holdbacks), bonding, risk allowance, or schedule contingency.

The estimate includes only the items and quantities specifically listed in the estimate. It is expected that the owner will apply appropriate contingencies based on their understanding of the Consultant's design and their understanding of the Contractor's (Nuna Logistics') estimate.

The Estimate also assumes that there is no detail earthworks construction. Therefore, all earthwork construction is dozed and bladed without further detail preparations.

ASSUMPTIONS

This cost estimate is based on the following Owner parameters and Nuna Logistics' assumptions.

1) The cost estimate is based on constant Year 2001 Canadian dollars.

2) The quantities (tonnes, cubic meters) and resulting haulage hours are assumed to be approximate only and the numbers may change based on equipment, quantity variances, and scheduling.

3) Specific gravities, swell factors and density of the material is assumed to be:

	Ore	Waste
Specific Gravity	2.90	2.50
Swell	30%	40%
LCM Density	2.23	1.79
Moisture Content	4%	4%
Reconsolidation	50%	50%
Reconsolidated Density	2.52	2.08

4) Whiteout days have not been included in the cost estimate or the schedule, however, sufficient backup equipment is provided to recover schedule losses.

5) An operating schedule of three weeks on-site followed by two weeks off-site then, three weeks onsite and one week off-site is used in the cost estimate (two 12-hour shifts per day). The estimate assumes that all hours are chargeable and does not include non-scheduled or incidental overtime.

6) The haul cycle profiles that are used are assumed to be representative of the average haul to deliver and free-dump ore in the stockpile area and to deliver waste to the dump and to the required construction areas. Deviations from the profiles or speeds attained could impact haul hours and subsequent costs.

7) We have assumed average truck speeds of: 10.0 km/h for + 10% ramp
20.0 km/h returning empty on –10% ramp
16.0 km/h on rough surface (bench floor)
30.0 km/h on smooth road.

8) We have used a spotting time of 2.0 minute at the shovel and an allowance of 2.0 minutes to spot and dump. The loading cycle for CAT loaders is estimated at 0.7 minutes per pass.

9) The carrying cost of the capital value of equipment is assumed to be 9%.

Nuna Logistics Ltd.

Hope Bay Project

Open Pit Mining & Earthworks Construction

Schedule 1: Quantities Schedule - Year 1

Prefeasibility Level Cost Estimate

Prepared by Nuna Logistics Ltd.

1-Feb-02

DJF/CDS

	Sept Month 1	Oct Month 2	Nov Month 3	Dec Month 4	Jan Month 5	Feb Month 6	Mar Month 7	Apr Month 8	May Month 9	June Month 10	July Month 11	Aug Month 12	Year 1 Total
Quantities (Dry Tonnes)													
Doris Waste													
Bench 20							22,875						22,875
Bench 15							110,125	10,905					121,030
Bench 10								134,345	12,753				147,098
Bench 05									115,178				115,178
Bench 00									20,744	66,230			86,974
Bench -05										43,300			43,300
Bench -10										30,500			30,500
Bench -15										12,000			12,000
Bench -20										1,500			1,500
Doris Ore													
Bench 20													-
Bench 15													-
Bench 10								4,750					4,750
Bench 05									13,511				13,511
Bench 00									8,814	8,814			17,628
Bench -05										19,422			19,422
Bench -10										18,578			18,578
Bench -15										8,128			8,128
Bench -20										528			528
Total	-	-	-	-	-	-	133,000	150,000	171,000	209,000	-	-	663,000
Quantity Equivalents													
Equivalent Quantities (ECMs)													
Doris Waste	-	-	-	-	-	-	63,840	69,720	71,364	73,694	-	-	278,618
Doris Ore	-	-	-	-	-	-	-	1,884	8,853	21,997	-	-	32,733
Other	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	63,840	71,604	80,217	95,691	-	-	311,352
Equivalent Quantities (Wet Tonnes)													
Doris Waste	-	-	-	-	-	-	138,320	151,060	154,622	159,671	-	-	603,673
Doris Ore	-	-	-	-	-	-	-	4,940	23,218	57,689	-	-	85,847
Other	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	138,320	156,000	177,840	217,360	-	-	689,520
Equivalent Quantities (BCMs)													
Doris Waste	-	-	-	-	-	-	53,200	58,100	59,470	61,412	-	-	232,182
Doris Ore	-	-	-	-	-	-	-	1,638	7,698	19,128	-	-	28,464
Other	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	53,200	59,738	67,168	80,540	-	-	260,646
Equivalent Quantities (LCMs)													
Doris Waste	-	-	-	-	-	-	74,480	81,340	83,258	85,977	-	-	325,055
Doris Ore	-	-	-	-	-	-	-	2,129	10,008	24,866	-	-	37,003
Other	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	74,480	83,469	93,266	110,843	-	-	362,058

Nuna Logistics Ltd.
Hope Bay Project
Open Pit Mining & Earthworks Construction

Schedule 2: Haul Distances and Cycle Times - Year 1

Prefeasibility Level Cost Estimate

Prepared by Nuna Logistics Ltd.
1-Feb-02
DJF/CDS

	Sept Month 1	Oct Month 2	Nov Month 3	Dec Month 4	Jan Month 5	Feb Month 6	Mar Month 7	Apr Month 8	May Month 9	June Month 10	July Month 11	Aug Month 12	Year 1 Average
Haul Distances													
Total Average Haul Distance (km)													
Doris Waste													
Bench 20 -- to Road Const.	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Bench 15 -- to Road Const.	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Bench 10 -- to Airstrip Const.	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Bench 05 -- to Airstrip Const.	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Bench 00 -- to Airstrip Const.	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Bench -05 -- to Tailings Const.	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Bench -10 -- to Tailings Const.	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Bench -15 -- to Tailings Const.	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Bench -20 -- to Tailings Const.	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Doris Ore													
Bench 20	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-
Bench 15	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-
Bench 10	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Bench 05	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Bench 00	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Bench -05	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Bench -10	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Bench -15	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Bench -20	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Weighted Average	-	-	-	-	-	-	1.6	3.3	3.2	1.7	-	-	2.4
Haul Distances by Rock Type													
Smooth Terrain													
Doris Waste	-	-	-	-	-	-	1.4	3.2	3.4	1.9	-	-	2.5
Doris Ore	-	-	-	-	-	-	-	0.4	0.4	0.4	-	-	0.4
Other	-	-	-	-	-	-	-	-	-	-	-	-	-
Rough Terrain													
Doris Waste	-	-	-	-	-	-	0.2	0.2	0.2	0.2	-	-	0.2
Doris Ore	-	-	-	-	-	-	-	0.2	0.2	0.2	-	-	0.2
Other	-	-	-	-	-	-	-	-	-	-	-	-	-
Total													
Doris Waste	-	-	-	-	-	-	1.6	3.4	3.6	2.1	-	-	2.7
Doris Ore	-	-	-	-	-	-	-	0.6	0.6	0.6	-	-	0.6
Other	-	-	-	-	-	-	-	-	-	-	-	-	-
Weighted Average	-	-	-	-	-	-	1.6	3.3	3.2	1.7	-	-	2.4
Pit Average Depth (m)	-	-	-	-	-	-	5.0	5.0	10.0	15.0	-	-	
Cycle Times													
Average Truck Cycle Times - 988 Loading 773s (min)													
Doris Waste	-	-	-	-	-	-	14.7	21.8	22.8	17.1	-	-	19.2
Doris Ore	-	-	-	-	-	-	-	9.9	10.2	10.4	-	-	10.4
Other	-	-	-	-	-	-	-	-	-	-	-	-	-
Weighted Average	-	-	-	-	-	-	14.7	21.5	21.4	15.6	-	-	18.3
Operating Days	-	-	-	-	-	-	31	31	30	31	-	-	123

Nuna Logistics Ltd.

Hope Bay Project

Open Pit Mining & Earthworks Construction

Schedule 3: Production Equipment Requirements - Year 1

Prefeasibility Level Cost Estimate

Prepared by Nuna Logistics Ltd.

1-Feb-02

DJF/CDS

	Sept Month 1	Oct Month 2	Nov Month 3	Dec Month 4	Jan Month 5	Feb Month 6	Mar Month 7	Apr Month 8	May Month 9	June Month 10	July Month 11	Aug Month 12	Year 1 Total
Directs - Production Equipment - Nuna													
Operating Hours													
Cat 773 Trucks	-	-	-	-	-	-	843	1,390	1,562	1,386	-	-	5,182
Cat 988 Loaders	-	-	-	-	-	-	314	353	397	477	-	-	1,540
D8 Dozers	-	-	-	-	-	-	420	472	530	635	-	-	2,057
Equipment Required on Site													
Cat 773 Trucks	-	-	-	-	-	-	2	4	4	4	-	-	
Cat 988 Loaders	-	-	-	-	-	-	2	2	2	2	-	-	
D8 Dozers	-	-	-	-	-	-	2	2	2	2	-	-	
Production Equipment Costs ($ thousands)													
Cat 773 Trucks	$ -	$ -	$ -	$ -	$ -	$ -	$ 147.8	$ 243.7	$ 273.8	$ 242.9	$ -	$ -	$ 908.3
Cat 988 Loaders	$ -	$ -	$ -	$ -	$ -	$ -	$ 64.9	$ 72.9	$ 82.1	$ 98.6	$ -	$ -	$ 318.5
D8 Dozers	$ -	$ -	$ -	$ -	$ -	$ -	$ 73.5	$ 82.5	$ 92.7	$ 111.1	$ -	$ -	$ 359.7
	$ -	$ -	$ -	$ -	$ -	$ -	$ 286.2	$ 399.1	$ 448.6	$ 452.6	$ -	$ -	$ 1,586.6
Directs - Production Equipment - Crushing													
Operating Hours - Crushing													
30"x48" Jaw & 4.25' Cone Plant							130	180	180	180	-	-	670
Equipment Required on Site													
30"x48" Jaw & 4.25' Cone Plant	-	-	-	-	-	-	1	1	1	1	-	-	
Production Equipment Costs ($ thousands)													
30"x48" Jaw & 4.25' Cone Plant	$ -	$ -	$ -	$ -	$ -	$ -	$ 26.0	$ 36.0	$ 36.0	$ 36.0	$ -	$ -	$ 134.0
	$ -	$ -	$ -	$ -	$ -	$ -	$ 26.0	$ 36.0	$ 36.0	$ 36.0	$ -	$ -	$ 134.0
Directs - Production Equipment - Drilling Contractor													
Operating Hours - Drilling													
Production Drills	-	-	-	-	-	-	220	248	283	346	-	-	1,098
Pioneering Drills	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment Required on Site													
Production Drills	-	-	-	-	-	-	1	1	1	1	-	-	
Pioneering Drills	-	-	-	-	-	-	-	-	-	-	-	-	
Production Equipment Costs ($ thousands)													
Production Drills	$ -	$ -	$ -	$ -	$ -	$ -	$ 39.9	$ 45.0	$ 51.3	$ 62.6	$ -	$ -	$ 198.7
Pioneering Drills	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	$ -	$ -	$ -	$ -	$ -	$ -	$ 39.9	$ 45.0	$ 51.3	$ 62.6	$ -	$ -	$ 198.7

Note: Equipment Hours reflects requirement before taking availability and usage into account. Equipment on-site reflects the requirement after taking availability and usage into account.

Nuna Logistics Ltd.
Hope Bay Project
Open Pit Mining & Earthworks Construction

Schedule 4: Support Equipment Requirements - Year 1

Prefeasibility Level Cost Estimate

Prepared by Nuna Logistics Ltd.
1-Feb-02
DJF/CDS

	Sept Month 1	Oct Month 2	Nov Month 3	Dec Month 4	Jan Month 5	Feb Month 6	Mar Month 7	Apr Month 8	May Month 9	June Month 10	July Month 11	Aug Month 12	Year 1 Total
Directs - Support Equipment - Nuna Hourly													
Support Equipment Operating Hours													
14G Grader	-	-	-	-	-	-	318	318	308	318	-	-	1,261
Cat 330 Excavator	-	-	-	-	-	-	477	477	461	477	-	-	1,891
Cat CS563C Packer	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel/Service Truck	-	-	-	-	-	-	318	318	308	318	-	-	1,261
Western Star Plow Truck	-	-	-	-	-	-	191	191	185	64	-	-	629
Picker Truck - 25 ton	-	-	-	-	-	-	64	64	62	64	-	-	252
Support Equipment Required On-Site													
14G Grader	-	-	-	-	-	-	1	1	1	1	-	-	
Cat 330 Excavator	-	-	-	-	-	-	1	1	1	1	-	-	
Cat CS563C Packer	-	-	-	-	-	-	-	-	-	-	-	-	
Fuel/Service Truck	-	-	-	-	-	-	1	1	1	1	-	-	
Western Star Plow Truck	-	-	-	-	-	-	1	1	1	1	-	-	
Picker Truck - 25 ton	-	-	-	-	-	-	1	1	1	1	-	-	
Support Equipment Costs ($ thousands)													
14G Grader	$ -	$ -	$ -	$ -	$ -	$ -	$ 32.2	$ 32.2	$ 31.2	$ 32.2	$ -	$ -	$ 127.9
Cat 330 Excavator	$ -	$ -	$ -	$ -	$ -	$ -	$ 66.9	$ 66.9	$ 64.7	$ 66.9	$ -	$ -	$ 265.5
Cat CS563C Packer	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fuel/Service Truck	$ -	$ -	$ -	$ -	$ -	$ -	$ 23.6	$ 23.6	$ 22.8	$ 23.6	$ -	$ -	$ 93.7
Western Star Plow Truck	$ -	$ -	$ -	$ -	$ -	$ -	$ 25.7	$ 25.7	$ 24.9	$ 8.6	$ -	$ -	$ 84.8
Picker Truck - 25 ton	$ -	$ -	$ -	$ -	$ -	$ -	$ 6.4	$ 6.4	$ 6.2	$ 6.4	$ -	$ -	$ 25.4
	$ -	$ -	$ -	$ -	$ -	$ -	$ 154.8	$ 154.8	$ 149.8	$ 137.7	$ -	$ -	$ 597.2
Directs - Support Equipment - Drilling Contractor													
Support Equipment Operating Hours													
Blasting Truck	-	-	-	-	-	-	-	-	-	-	-	-	-
Crew Cab	-	-	-	-	-	-	372	372	360	372	-	-	1,476
Support Equipment Required On-Site													
Blasting Truck	-	-	-	-	-	-	-	-	-	-	-	-	
Crew Cab	-	-	-	-	-	-	1	1	1	1	-	-	
Support Equipment Costs ($ thousands)													
Blasting Truck	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Crew Cab	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.1	$ 1.1	$ 1.1	$ 1.1	$ -	$ -	$ 4.4
	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.1	$ 1.1	$ 1.1	$ 1.1	$ -	$ -	$ 4.4
Directs - Support Equipment - Nuna Monthly													
Support Equipment Operating Hours													
Crew Cabs	-	-	-	-	-	-	2,224	2,224	2,153	2,224	-	-	8,825
Lighting Plants	-	-	-	-	-	-	1,335	1,144	923	191	-	-	3,592
Heaters	-	-	-	-	-	-	3,178	3,178	3,075	3,178	-	-	12,608
Support Equipment Required On-Site													
Crew Cabs	-	-	-	-	-	-	5	5	5	5	-	-	
Lighting Plants	-	-	-	-	-	-	3	3	2	1	-	-	
Heaters	-	-	-	-	-	-	7	7	7	7	-	-	
Support Equipment Costs ($ thousands)													
Crew Cabs	$ -	$ -	$ -	$ -	$ -	$ -	$ 12.1	$ 12.1	$ 11.7	$ 12.1	$ -	$ -	$ 47.9
Lighting Plants	$ -	$ -	$ -	$ -	$ -	$ -	$ 4.3	$ 4.3	$ 2.8	$ 1.4	$ -	$ -	$ 12.7
Heaters	$ -	$ -	$ -	$ -	$ -	$ -	$ 17.5	$ 17.5	$ 8.5	$ 3.5	$ -	$ -	$ 46.9
	$ -	$ -	$ -	$ -	$ -	$ -	$ 33.8	$ 33.8	$ 22.9	$ 17.0	$ -	$ -	$ 107.5

Note: Equipment Hours reflects requirement before taking availability and usage into account. Equipment on-site reflects the requirement after taking availability and usage into account.

Nuna Logistics Ltd.
Hope Bay Project
Open Pit Mining & Earthworks Construction

Schedule 5: Support Facilities Requirements - Year 1

Prefeasibility Level Cost Estimate

Prepared by Nuna Logistics Ltd.
1-Feb-02
DJF/CDS

	Sept Month 1	Oct Month 2	Nov Month 3	Dec Month 4	Jan Month 5	Feb Month 6	Mar Month 7	Apr Month 8	May Month 9	June Month 10	July Month 11	Aug Month 12	Year 1 Total
Support Facilities - Nuna													
Support Facilities Required On-Site													
Camp & Office Facility	-	-	-	-	-	-	1	1	1	1	-	-	
Shop Facility	-	-	-	-	-	-	1	1	1	1	-	-	
Fuel Storage	-	-	-	-	-	-	1	1	1	1	-	-	
Electric Power (gen. & distrib.)	-	-	-	-	-	-	1	1	1	1	-	-	
Communications - Site Radios	-	-	-	-	-	-	4	4	4	4	-	-	
Communications - Satellite Phone	-	-	-	-	-	-	1	1	1	1	-	-	
Support Facilities Costs ($ thousands)													
Camp & Office Facility	$ -	$ -	$ -	$ -	$ -	$ -	$ 36.7	$ 36.7	$ 35.5	$ 36.7	$ -	$ -	$ 145.7
Shop Facility	$ -	$ -	$ -	$ -	$ -	$ -	$ 18.8	$ 18.8	$ 18.2	$ 18.8	$ -	$ -	$ 74.4
Fuel Storage	$ -	$ -	$ -	$ -	$ -	$ -	$ 4.1	$ 4.1	$ 3.9	$ 4.1	$ -	$ -	$ 16.2
Electric Power (gen. & distrib.)	$ -	$ -	$ -	$ -	$ -	$ -	$ 23.8	$ 23.8	$ 23.0	$ 23.8	$ -	$ -	$ 94.3
Communications - Site Radios	$ -	$ -	$ -	$ -	$ -	$ -	$ 2.0	$ 2.0	$ 2.0	$ 2.0	$ -	$ -	$ 8.1
Communications - Satellite Phone	$ -	$ -	$ -	$ -	$ -	$ -	$ 30.6	$ 30.6	$ 29.6	$ 30.6	$ -	$ -	$ 121.4
	$ -	$ -	$ -	$ -	$ -	$ -	$ 115.9	$ 115.9	$ 112.2	$ 115.9	$ -	$ -	$ 460.0

Nuna Logistics Ltd.

Hope Bay Project

Open Pit Mining & Earthworks Construction

Schedule 6: Labour Requirements - Year 1

Prefeasibility Level Cost Estimate

Prepared by Nuna Logistics Ltd.

1-Feb-02

DJF/CDS

	Sept Month 1	Oct Month 2	Nov Month 3	Dec Month 4	Jan Month 5	Feb Month 6	Mar Month 7	Apr Month 8	May Month 9	June Month 10	July Month 11	Aug Month 12	Year 1 Total
Labour Requirement - Nuna													
Supervisory and Administrative (per 24 hour day)													
Project Superintendent	-	-	-	-		-	1.0	1.0	1.0	1.0	-	-	
Foremen	-	-	-	-	-	-	1.0	1.0	1.0	1.0	-	-	
Safety	-	-	-	-	-	-	-	-	-	-	-	-	
Training	-	-	-	-	-	-	-	-	-	-	-	-	
Warehousemen	-	-	-	-	-	-	-	-	-	-	-	-	
Administrator	-	-	-	-		-	1.0	1.0	1.0	1.0	-	-	
Purchaser	-	-	-	-	-	-	-	-	-	-	-	-	
Operators (per 24 hour day)			-	-		-		-	-	-	-	-	
Production Equipment			-	-		-		-	-	-	-	-	
Trucks	-	-	-	-	-	-	3.0	6.0	6.0	5.0	-	-	
Shovel/ME Operator	-	-	-	-	-	-	-	-	-	-	-	-	
Loaders	-	-	-	-	-	-	3.0	3.0	3.0	3.0	-	-	
Dozers	-	-	-	-	-	-	4.0	4.0	4.0	4.0	-	-	
Excavators	-	-	-	-	-	-	-	-	-	-	-	-	
Crusher	-	-	-	-	-	-	1.0	1.0	1.0	1.0	-	-	
Support Equipment			-	-		-		-	-	-	-	-	
Graders	-	-	-	-		-	1.0	1.0	1.0	1.0	-	-	
Packers	-	-	-	-	-	-	-	-	-	-	-	-	
Other Equipment	-	-	-	-	-	-	2.0	2.0	2.0	2.0	-	-	
Labourers	-	-	-	-	-	-	-	-	-	-	-	-	
Mechanical (per 24 hour day)			-	-									
Mechanics	-	-	-	-	-	-	4.0	4.0	4.0	4.0	-	-	
Welders	-	-	-	-	-	-	2.0	2.0	2.0	2.0	-	-	
Servicemen/Support	-	-	-	-	-	-	2.0	2.0	2.0	2.0	-	-	
Labourers	-	-	-	-	-	-	2.0	2.0	2.0	2.0	-	-	
Facility Support (per 24 hour day)			-	-									
Carpenters	-	-	-	-	-	-	-	-	-	-	-	-	
Electricians	-	-	-	-	-	-	-	-	-	-	-	-	
Operators	-	-	-	-	-	-	-	-	-	-	-	-	
Labourers	-	-	-	-	-	-	-	-	-	-	-	-	
Labour Requirement - Drilling Contractor			-	-									
Superintendent	-	-	-	-	-	-	-	-	-	-	-	-	
Foreman	-	-	-	-	-	-	1.0	1.0	1.0	1.0	-	-	
Driller	-	-	-	-	-	-	2.0	2.0	2.0	2.0	-	-	
Blaster	-	-	-	-	-	-	1.0	1.0	1.0	1.0	-	-	
Helper	-	-	-	-	-	-	1.0	1.0	1.0	1.0	-	-	
Mechanic	-	-	-	-	-	-	1.0	1.0	1.0	1.0	-	-	
Administrator	-	-	-	-	-	-	-	-	-	-	-	-	
Labour Requirement - Projects Contractor			-	-									
Foreman	-	-	-	-	-	-	-	-	-	-	-	-	
Labourer	-	-	-	-	-	-	-	-	-	-	-	-	
Labour Requirement - Survey Contractor			-	-									
Crew Chief	-	-	-	-		-	1.0	1.0	1.0	1.0	-	-	
Instrumentman	-	-	-	-		-	-	-	-	-	-	-	
Survey Assistant	-	-	-	-		-	1.0	1.0	1.0	1.0	-	-	
			-	-									
Total On-Site (per 24 hour day)	-	-	-	-	-	-	35	38	38	37	-	-	
Camp Man-Days	-	-	-	-	-	-	*1,085*	*1,178*	*1,140*	*1,147*	-	-	*4,550*
Round Trip Airfares	-	-	-	-	-	-	*52*	*56*	*54*	*55*	-	-	*217*

Nuna Logistics Ltd. | **Schedule 7: Manhours Estimate - Year 1** | **Prepared by Nuna Logistics Ltd.**

Hope Bay Project | **Prefeasibility Level Cost Estimate** | 1-Feb-02

Open Pit Mining & Earthworks Construction | DJF/CDS

	Sept Month 1	Oct Month 2	Nov Month 3	Dec Month 4	Jan Month 5	Feb Month 6	Mar Month 7	Apr Month 8	May Month 9	June Month 10	July Month 11	Aug Month 12	Year 1 Total
Manhours - Nuna (includes Incidental O/T)													
Supervisory and Administrative													
Project Superintendent	-	-	-	-	-	-	341	341	330	341	-	-	1,353
Foremen	-	-	-	-	-	-	341	341	330	341	-	-	1,353
Safety	-	-	-	-	-	-	-	-	-	-	-	-	-
Training	-	-	-	-	-	-	-	-	-	-	-	-	-
Warehousemen	-	-	-	-	-	-	-	-	-	-	-	-	-
Administrator	-	-	-	-	-	-	341	341	330	341	-	-	1,353
Purchaser	-	-	-	-	-	-	-	-	-	-	-	-	-
Operators													
Production Equipment													
Trucks	-	-	-	-	-	-	1,023	2,046	1,980	1,705	-	-	6,754
Shovel/ME Operator	-	-	-	-	-	-	-	-	-	-	-	-	-
Loaders	-	-	-	-	-	-	1,023	1,023	990	1,023	-	-	4,059
Dozers	-	-	-	-	-	-	1,364	1,364	1,320	1,364	-	-	5,412
Excavators	-	-	-	-	-	-	-	-	-	-	-	-	-
Crusher	-	-	-	-	-	-	341	341	330	341	-	-	1,353
Support Equipment													
Graders	-	-	-	-	-	-	341	341	330	341	-	-	1,353
Packers	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Equipment	-	-	-	-	-	-	682	682	660	682	-	-	2,706
Labourers	-	-	-	-	-	-	-	-	-	-	-	-	-
Mechanical													
Mechanics	-	-	-	-	-	-	1,364	1,364	1,320	1,364	-	-	5,412
Welders	-	-	-	-	-	-	682	682	660	682	-	-	2,706
Servicemen/Support	-	-	-	-	-	-	682	682	660	682	-	-	2,706
Labourers	-	-	-	-	-	-	682	682	660	682	-	-	2,706
Facility Support													
Carpenters	-	-	-	-	-	-	-	-	-	-	-	-	-
Electricians	-	-	-	-	-	-	-	-	-	-	-	-	-
Operators	-	-	-	-	-	-	-	-	-	-	-	-	-
Labourers	-	-	-	-	-	-	-	-	-	-	-	-	-
Manhours - Drilling Contractor													
Superintendent	-	-	-	-	-	-	-	-	-	-	-	-	-
Foreman	-	-	-	-	-	-	341	341	330	341	-	-	1,353
Driller	-	-	-	-	-	-	682	682	660	682	-	-	2,706
Blaster	-	-	-	-	-	-	341	341	330	341	-	-	1,353
Helper	-	-	-	-	-	-	341	341	330	341	-	-	1,353
Mechanic	-	-	-	-	-	-	341	341	330	341	-	-	1,353
Administrator	-	-	-	-	-	-	-	-	-	-	-	-	-
Manhours - Projects Contractor													
Foreman	-	-	-	-	-	-	-	-	-	-	-	-	-
Labourer	-	-	-	-	-	-	-	-	-	-	-	-	-
Manhours - Survey Contractor													
Crew Chief	-	-	-	-		-	341	341	330	341	-	-	1,353
Instrumentman	-	-	-	-		-	-	-	-	-	-	-	-
Survey Assistant	-	-	-	-		-	341	341	330	341	-	-	1,353
Total Manhours	-	-	-	-	-	-	11,935	12,958	12,540	12,617	-	-	50,050

Nuna Logistics Ltd.
Hope Bay Project
Open Pit Mining & Earthworks Construction

Schedule 8: Labour Cost Estimate - Year 1

Prefeasibility Level Cost Estimate

Prepared by Nuna Logistics Ltd.
1-Feb-02
DJF/CDS

	Sept Month 1	Oct Month 2	Nov Month 3	Dec Month 4	Jan Month 5	Feb Month 6	Mar Month 7	Apr Month 8	May Month 9	June Month 10	July Month 11	Aug Month 12	Year 1 Total
Labour Cost - Nuna ($ thousands)													
Supervisory and Administrative													
Project Superintendent	$ -	$ -	$ -	$ -	$ -	$ -	$ 30.7	$ 30.7	$ 29.7	$ 30.7	$ -	$ -	$ 121.7
Foremen	$ -	$ -	$ -	$ -	$ -	$ -	$ 22.1	$ 22.1	$ 21.4	$ 22.1	$ -	$ -	$ 87.8
Safety	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Training	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Warehousemen	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Administrator	$ -	$ -	$ -	$ -	$ -	$ -	$ 18.2	$ 18.2	$ 17.6	$ 18.2	$ -	$ -	$ 72.0
Purchaser	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operators													
Production Equipment													
Trucks	$ -	$ -	$ -	$ -	$ -	$ -	$ 57.9	$ 115.8	$ 112.0	$ 96.5	$ -	$ -	$ 382.1
Shovel/ME Operator	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Loaders	$ -	$ -	$ -	$ -	$ -	$ -	$ 64.7	$ 64.7	$ 62.6	$ 64.7	$ -	$ -	$ 256.7
Dozers	$ -	$ -	$ -	$ -		$ -	$ 86.3	$ 86.3	$ 83.5	$ 86.3	$ -	$ -	$ 342.3
Excavators	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Crusher	$ -	$ -	$ -	$ -	$ -	$ -	$ 21.0	$ 21.0	$ 20.3	$ 21.0	$ -	$ -	$ 83.3
Support Equipment													
Graders	$ -	$ -	$ -	$ -	$ -	$ -	$ 21.0	$ 21.0	$ 20.3	$ 21.0	$ -	$ -	$ 83.3
Packers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Other Equipment	$ -	$ -	$ -	$ -	$ -	$ -	$ 42.0	$ 42.0	$ 40.6	$ 42.0	$ -	$ -	$ 166.6
Labourers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Mechanical													
Mechanics	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	$ -
Welders	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	$ -
Servicemen/Support	$ -	$ -	$ -	$ -	$ -	$ -	$ 39.7	$ 39.7	$ 38.4	$ 39.7	$ -	$ -	$ 157.6
Labourers	$ -	$ -	$ -	$ -	$ -	$ -	$ 35.2	$ 35.2	$ 34.0	$ 35.2	$ -	$ -	$ 139.5
Facility Support													
Carpenters	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Electricians	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operators	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Labourers	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Labour Cost - Drilling Contractor ($ thousands)													
Superintendent	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Foreman	$ -	$ -	$ -	$ -	$ -	$ -	$ 18.1	$ 18.1	$ 17.5	$ 18.1	$ -	$ -	$ 71.7
Driller	$ -	$ -	$ -	$ -	$ -	$ -	$ 32.7	$ 32.7	$ 31.7	$ 32.7	$ -	$ -	$ 129.9
Blaster	$ -	$ -	$ -	$ -	$ -	$ -	$ 16.7	$ 16.7	$ 16.2	$ 16.7	$ -	$ -	$ 66.3
Helper	$ -	$ -	$ -	$ -	$ -	$ -	$ 12.3	$ 12.3	$ 11.9	$ 12.3	$ -	$ -	$ 48.7
Mechanic	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	$ -
Administrator	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Labour Cost - Projects Contractor ($ thousands)													
Foreman	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Labourer	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Labour Cost - Survey Contractor ($ thousands)													
Crew Chief	$ -	$ -	$ -	$ -		$ -	$ 19.8	$ 19.8	$ 19.1	$ 19.8	$ -	$ -	$ 78.5
Instrumentman	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Survey Assistant	$ -	$ -	$ -	$ -		$ -	$ 9.5	$ 9.5	$ 9.2	$ 9.5	$ -	$ -	$ 37.9
Total Labour Cost Estimate	$ -	$ -	$ -	$ -	$ -	$ -	$ 547.8	$ 605.7	$ 586.2	$ 586.4	$ -	$ -	$ 2,326.2

Note: Supervisory & Administration Personnel denoted N/C are non-chargeable (included as overheads in hourly rates). Mechanics & Welders denoted N/C are non-chargeable (included in equipment rates).

Nuna Logistics Ltd.
Hope Bay Project
Open Pit Mining & Earthworks Construction

Schedule 9: Standby Costs - Year 1

Prefeasibility Level Cost Estimate

Prepared by Nuna Logistics Ltd.
1-Feb-02
DJF/CDS

	Sept Month 1	Oct Month 2	Nov Month 3	Dec Month 4	Jan Month 5	Feb Month 6	Mar Month 7	Apr Month 8	May Month 9	June Month 10	July Month 11	Aug Month 12	Year 1 Total
Standby Costs ($ thousands)													
Nuna Mobile Equipment	$45.0	$45.0	$45.0	$45.0	$45.0	$45.0	$0.0	$0.0	$0.0	$0.0	$45.0	$45.0	$360.0
Nuna Facilities	$81.7	$81.7	$81.7	$81.7	$81.7	$81.7	$0.0	$0.0	$0.0	$0.0	$81.7	$81.7	$653.6
Drill Contractor Equipment	$8.0	$8.0	$8.0	$8.0	$8.0	$8.0	$0.0	$0.0	$0.0	$0.0	$8.0	$8.0	$64.0
	$134.7	$134.7	$134.7	$134.7	$134.7	$134.7	$0.0	$0.0	$0.0	$0.0	$134.7	$134.7	$1,077.6

Nuna Logistics Ltd.

Hope Bay Project

Open Pit Mining & Earthworks Construction

Schedule 10: Cost Summary - Year 1

Prefeasibility Level Cost Estimate

Prepared by Nuna Logistics Ltd.

1-Feb-02

DJF/CDS

Estimated Costs ($ thousands)	Sept Month 1	Oct Month 2	Nov Month 3	Dec Month 4	Jan Month 5	Feb Month 6	Mar Month 7	Apr Month 8	May Month 9	June Month 10	July Month 11	Aug Month 12	Year 1 Total
Mobilization													
Off-Site Preparations	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Freight	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
On-Site Assembly	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Labour													
Nuna Logistics													
Supervision & Administration	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$71.0	$71.0	$68.7	$71.0	$0.0	$0.0	$281.6
Truck Drivers	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$57.9	$115.8	$112.0	$96.5	$0.0	$0.0	$382.1
Equipment Operators	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$214.0	$214.0	$207.1	$214.0	$0.0	$0.0	$849.0
Crusher Operators & Helpers	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$21.0	$21.0	$20.3	$21.0	$0.0	$0.0	$83.3
Servicemen	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$39.7	$39.7	$38.4	$39.7	$0.0	$0.0	$157.6
Labourers	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$35.2	$35.2	$34.0	$35.2	$0.0	$0.0	$139.5
Drilling Contractor	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$79.8	$79.8	$77.2	$79.8	$0.0	$0.0	$316.6
Survey Contractor	$0.0	$0.0	$0.0	$0.0		$0.0	$29.3	$29.3	$28.4	$29.3	$0.0	$0.0	$116.4
	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$547.8	$605.7	$586.2	$586.4	$0.0	$0.0	$2,326.2
Equipment													
Nuna Logistics													
Production Equipment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$312.2	$435.1	$484.6	$488.6	$0.0	$0.0	$1,720.6
Support Equipment	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$188.6	$188.6	$172.7	$154.7	$0.0	$0.0	$704.7
Drilling Contractor	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$41.0	$46.1	$52.3	$63.8	$0.0	$0.0	$203.2
Survey Contractor	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$5.0	$5.0	$5.0	$5.0	$0.0	$0.0	$20.0
	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$546.8	$674.8	$714.7	$712.1	$0.0	$0.0	$2,648.4
Other													
Explosives (Incl. Freight)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$38.4	$43.1	$48.5	$58.2	$0.0	$0.0	$188.3
Fuel for Explosives	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$2.4	$2.7	$3.1	$3.7	$0.0	$0.0	$11.9
Camp Catering	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Airfares	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Pit Dewatering	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Permanent Materials	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Winter Road Access	$0.0	$0.0	$0.0	$0.0	$0.0	$40.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$40.0
	$0.0	$0.0	$0.0	$0.0	$0.0	$40.0	$40.8	$45.9	$51.6	$61.8	$0.0	$0.0	$240.1
Demobilization													
On-Site Preparations	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Freight	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
On-Site Disassembly	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Subtotal Mining & Construction	$0.0	$0.0	$0.0	$0.0	$0.0	$40.0	$1,135.5	$1,326.4	$1,352.4	$1,360.3	$0.0	$0.0	$5,214.7
Facilities & Standby Costs													
Facilities & Gensets	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$115.9	$115.9	$112.2	$115.9	$0.0	$0.0	$460.0
Fuel for Gensets	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$70.0	$70.0	$70.0	$70.0	$0.0	$0.0	$280.0
Standby Costs	$134.7	$134.7	$134.7	$134.7	$134.7	$134.7	$0.0	$0.0	$0.0	$0.0	$134.7	$134.7	$1,077.6
Subtotal Facilities & Standby Costs	$134.7	$134.7	$134.7	$134.7	$134.7	$134.7	$185.9	$185.9	$182.2	$185.9	$134.7	$134.7	$1,817.6
Contingency	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Quantity Increase Allowance	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Total Estimated Costs	$134.7	$134.7	$134.7	$134.7	$134.7	$174.7	$1,321.4	$1,512.4	$1,534.6	$1,546.3	$134.7	$134.7	$7,032.3

Note: Fuel Costs are included in the costs. Transportation Costs are included in the costs. (in Labour Rates) Camp Catering Costs are included in the costs. (in Labour Rates)

Nuna Logistics Ltd.
Hope Bay Project
Open Pit Mining & Earthworks Construction

Attachment A: Fuel Requirements - Year 1

Prefeasibility Level Cost Estimate

Prepared by Nuna Logistics Ltd.
1-Feb-02
DJF/CDS

	Sept Month 1	Oct Month 2	Nov Month 3	Dec Month 4	Jan Month 5	Feb Month 6	Mar Month 7	Apr Month 8	May Month 9	June Month 10	July Month 11	Aug Month 12	Year 1 Total
Fuel Consumption (Litres)													
Production Equipment - Nuna													
Cat 773 Trucks	-	-	-	-	-	-	44,696	73,692	82,795	73,442	-	-	274,624
Cat 988 Loaders	-	-	-	-	-	-	14,748	16,569	18,657	22,417	-	-	72,390
D8 Dozers	-	-	-	-	-	-	18,909	21,229	23,858	28,588	-	-	92,585
Crushing Equipment - Nuna													
30"x48" Jaw & 4.25' Cone Plant	-	-	-	-	-	-	20,800	28,800	28,800	28,800	-	-	107,200
Production Equipment - Drilling Contractor													
Production Drills	-	-	-	-	-	-	24,228	27,325	31,150	38,073	-	-	120,776
Support Equipment - Nuna (Hourly)													
14G Grader	-	-	-	-	-	-	8,897	8,897	8,610	8,897	-	-	35,301
Cat 330 Excavator	-	-	-	-	-	-	12,869	12,869	12,454	12,869	-	-	51,060
Fuel/Service Truck	-	-	-	-	-	-	6,355	6,355	6,150	6,355	-	-	25,215
Western Star Plow Truck	-	-	-	-	-	-	6,101	6,101	5,904	2,034	-	-	20,139
Picker Truck - 25 ton	-	-	-	-	-	-	953	953	923	953	-	-	3,782
Support Equipment - Nuna (Monthly)													
Crew Cabs	-	-	-	-	-	-	2,224	2,224	2,153	2,224	-	-	8,825
Lighting Plants	-	-	-	-	-	-	2,669	2,288	1,845	381	-	-	7,183
Heaters	-	-	-	-	-	-	12,710	12,710	12,300	12,710	-	-	50,430
Support Equipment - Drilling Contractor													
Crew Cab	-	-	-	-	-	-	744	744	720	744	-	-	2,952
Fuel for Explosives	-	-	-	-	-	-	3,461	3,887	4,370	5,240	-	-	16,958
Fuel for Facilities	-	-	-	-	-	-	100,000	100,000	100,000	100,000	-	-	400,000
Total Litres	-	-	-	-	-	-	280,364	324,642	340,688	343,726	-	-	1,289,421

Note: Fuel Costs are included in Nuna Logistics Total Costs.

APPENDIX C
Bateman Engineering Scoping Study

HOPE BAY JOINT VENTURE

(A 50:50 Joint Venture between Miramar Hope Bay Limited and Hope Bay Gold Corporation Inc.)

c/o Miramar Mining Corporation
311 West First Street
North Vancouver BC V7M 1B5 Canada

DORIS NORTH TRIAL OPERATION SCOPING STUDY

(Preferred Option)

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13 January 2002

Study Number: MAP102
Report No: 002

Submitted by:

BATEMAN ENGINEERING PTY LTD

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Victoria Park WA 6100

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APPENDICES

DISCLAIMER

This report (Doris North Trial Operation Scoping Study) has been prepared for the Hope Bay Joint Venture in accordance with the scope of services and the terms of reference both of which were defined by the Hope Bay Joint Venture in their inquiry document.

Bateman followed standard professional procedures in preparing the Scoping Study Report, the contents of which is based in part on data, information and assumptions provided by the Hope Bay Joint Venture.

Save as expressly set out in the Scoping Study Report, Bateman did not attempt to verify the accuracy or sufficiency of such data, information and assumptions and Bateman does not warrant or guarantee the correctness of such data, information assumptions nor any findings, observations and conclusions based upon such information data and assumptions.

This Scoping Study Report has been prepared for the sole and exclusive use of the Hope Bay Joint Venture and Bateman accepts no liability whatsoever, to any other organisation or person to whom this report is presented for any loss or damage arising from the use, reliance upon or the interpretation of this report or for any design, engineering or other work performed by others using this report.

1 INTRODUCTION

Bateman Engineering Pty Ltd (Bateman) received an invitation from the Hope Bay Joint Venture (HBJV) to complete a scoping study on its Hope Bay project. This study examines process options that would allow HBJV to fast-track the project by concentrating on processing Doris North ore at a design rate of 600 tonnes per day over an initial 2 year period. The intention would be to commence production in autumn 2004.

HBJV initially looked at two options to determine the best approach to gain fast approval for the project. The first option was essentially identical to the 1000 tpd modular plant option previously considered, producing gold dore from cyanide leached gravity and flotation concentrates on site. The second option aimed to produce gold dore from gravity concentrate on site and to produce a high grade flotation concentrate for shipping thereby eliminating the need for cyanide usage on site. During the course of the study, the second option was eliminated so that only a single option is included in the final study.

The selected option is very similar to the 1000 tpd circuit presented in the previous study, which had been costed to 25% accuracy. Therefore, the option presented in this study uses the previous model as a foundation, revising down to a 600 tpd treatment rate. The current option also incorporates water supply and tails delivery to the storage dam.

Additional test work has been completed on Doris North ore to establish key design parameters. Design criteria, PFDs and equipment list have been generated reflecting this new information. A capital estimate has been prepared for the option using this data. Operating costs have also been estimated for the option.

2 SCOPE OF STUDY

2.1 PROCESSING

Two scenarios were given preliminary consideration in this study:

- Option A - an integrated modular plant to produce gold dore on site using the base case configuration presented in Bateman's first scoping study for the HBJV earlier this year. This features rougher gravity and flotation concentration followed by intensive cyanide leaching, direct electrowinning and dore smelting

- Option B - this is a truncated flowsheet compared with Option 1. It features gravity and flotation steps only. The objective is to produce a high-grade gravity concentrate that can be converted to gold dore by direct smelting and a higher grade flotation concentrate for shipping out during the summer months to another facility for processing to dore.

Both options assume that a modular facility will be installed in the vicinity of the Doris ore tenements and that the facility can be built on a level bedrock base. The rock base is critical if expensive foundations to protect the permafrost are to be avoided.

In discussion with the client following an assessment of both options, Option B was eliminated from further consideration, with only Option A being given full consideration for the study.

This study covers the processing plant from the ROM pad through to the discharge to the tailings containment area, as well as supply of water from a nearby lake to the process plant. Other battery limits are reagent and stores delivery to the usage or mix point in the plant, the low voltage side of the power transformer and the bullion into the safe.

Preliminary engineering has been performed to a level sufficient to generate a ±25% capital cost and operating cost estimate for the selected process route. The plant is based on the design criteria and philosophy derived for the RFP and discussions with the client before and during the course of the study, and on the new test work on the Doris North ore. The process route consist of the following process steps:

- Crushing and fine ore storage
- Milling and classification
- Flash flotation
- Rougher gravity concentration
- Scavenger flotation

- Flotation concentrate regrind
- Intensive cyanide leaching
- Concentrate or residue filtration
- Gold room
- Cyanide destruction of leach tails
- Tails disposal
- Process plant services and utilities
- Water supply

2.2 TAILINGS

Bateman has provided for detoxified tails slurry to be delivered to a containment dam located 3 km away via insulated pipes. Emergency tails slurry dumping to lined ponds is also provided.

2.3 SCOPE DEFINITION

The Study was developed based on the following functional areas that together form the overall integrated facility:

- Two stage crushing circuit and fine ore stockpile.
- Primary ball mill circuit including gravity recovery and flash flotation.
- Scavenger flotation circuit.
- Flotation concentrate regrind
- Combined concentrate intensive cyanide leach circuit with residue solid/liquid separation.
- Direct electrowinning of filtrate and doré production.
- Leach residue/electrowinning bleed cyanide detoxification and combined tailings disposal.
- Plant services and reagents.
- Water supply.
- Some plant infrastructure generally within the plant area.

2.3.1 GENERAL

The project scope includes all the physical aspects of the respective areas including:

- Civil works.

- Structural steelwork.
- Platework.
- Tankage.
- Mechanical equipment.
- Piping, including external water supply and tailings disposal.
- Electrical equipment and power distribution.
- Instrumentation and control systems.
- Some site buildings including switchrooms.
- Allowance for spare parts and first fills.

All designs allow for a 10-year plant life and conform to the appropriate industry standards. The design allows for an extension of operation beyond the initial Trial Operation of 2 years. Alternatively the plant could be relocated to another site for further use.

2.3.2 EXCLUSIONS

Items excluded from the project scope are:

- Process plant site preparation to form a level, rock base for construction.
- Provision of services and infrastructure to the plant battery limits.
- Other Owner's costs such as, permits, insurance, financing, patents, licenses and technology fees.
- Environmental monitoring systems.
- Environmental impact studies.
- Environmental reinstatement.
- Sustainability of water supply source.
- Potable water treatment plant.
- Water supply issues – environmental, sustainability, quality, logistics, etc.
- ROM ore pad.
- Mine haul roads.
- Site access roads.
- Tailing disposal access roads.
- All mining activities.
- Metallurgical testwork (although some cost allowance is made in Owners costs).

- Materials testing.
- Power station and HV protection.
- Heating of plant and infrastructure buildings. An allowance has been made for an indicative cost for heating the process buildings only.
- Workshop equipment, mobile equipment and wash-down facilities.
- Site construction camp.
- Tailing containment dams and ponds.
- Insurance spares.
- Land acquisition, rights of way and royalties.
- Financial analysis model.

2.4 BATTERY LIMITS

The battery limits for the process plant described in the study are:

- Receipt of the ore at the ROM bin.
- Discharge of tailings into the containment dam.
- Entry of water to the decant tower at the lake.
- HV terminal from the power station located at the plant site (by others).

Capital costs for the project are based on the purchase of all-new equipment and materials, with appropriate shipping costs being built in to equalise the costs "as landed" at Hope Bay. The use of second-hand equipment has not been investigated.

3 TEST WORK REVIEW

Considerable testwork for the Doris deposit has been undertaken prior to the current study by PRA Laboratories in Vancouver under instruction from the client. Much of this work relates to whole ore treatment by cyanide leaching, and as such is not directly applicable to the proposed modular plant flowsheet. Some preliminary flotation work has also been completed, including batch cleaner flotation evaluation, with only limited success being achieved due to the open circuit nature of these tests.

In consultation with the client, Bateman devised a new test programme of narrow focus which aimed at producing key process criteria to assist with design of the modular gravity/flotation/leach plant adopted for the option selected for this study.

A bulk composite of Doris North material was used for all aspects of this work, which was also completed by PRA Laboratories. This programme consisted of the following elements:

- Head analysis – gold, silver and sulphur
- Feed preparation – stage crushing and grinding down to a P_{80} size of around 150 um
- Gravity concentration – two passes through a Falcon SB40 batch concentrator without subsequent cleaning
- Flotation – rougher/scavenger flotation of gravity tails at natural pH, exploring the effects of different xanthate collectors, addition of a gold/pyrite activator and the addition of a gangue depressant.
- Cyanide leaching – timed intensive leaching of gravity concentrate (test F41), and leaching of flotation concentrates from three flotation tests (tests F42 to F44)
- Thickening and filtration – static tests on a combined flotation tails sample
- Cyanide detoxification – batch cyanide destruction of leach liquors using hydrogen peroxide

A completed testwork report has not been forwarded to Bateman for inclusion in the report, but selected results have been included in this report section as a basis for discussion.

3.1 HEAD ASSAYS

The composite sample provided for testing returned the following analysis, presented as average calculated values:

Gold	6.24 ppm
Silver	1.25 ppm
Sulphur	0.47%

The gold analysis for the sample was substantially lower than the design values of 15 to 20 g/t adopted for the study, although this does not appear to have adversely affected overall gold recovery to concentrate.

Silver content is only 20% of the gold content, meaning that adoption of Merrill-Crowe zinc precipitation should not be necessary.

Sulphur grade is quite low also, suggesting a correspondingly low sulphide yield to flotation concentrate.

3.2 GRAVITY CONCENTRATION

The bulk composite, after grinding to around 80% -150 um, was passed through a laboratory batch Falcon SB40 centrifugal concentrator to produce a rougher gravity concentrate, the intent being to subject this to intensive cyanide leaching rather than upgrading further to smeltable grade.

A very favourable upgrade of gold to gravity concentrate was achieved, with nearly 70% of feed gold being recovered in only 4.4% of feed mass. Silver recovery was somewhat lower, which could possibly be attributed to association with sulphides, whereas the majority of the gold content is likely to be either free or alloyed with silver as electrum. Mineralogy is required to confirm the silver and gold associations within the concentrate.

Relevant results are presented as Table 3.1.

Table 3.1 **DORIS NORTH BULK GRAVITY CONCENTRATE TESTWORK RESULTS**

	Feed	Concentrate	Tail
Mass Splits (%)	100	4.4	95.6
Assays			
Au (ppm)	6.24	101	1.97
Ag (ppm)	1.25	13.7	0.68
Metal Dist.n (%)			

	Feed	Concentrate	Tail
Au	100.0	69.9	30.1
Ag	100.0	48.2	51.8

3.3 FLOTATION

Four tests were conducted on gravity tails at "natural" pH (no pH modifier added to pulp), which was reported previously to be in the range 8 to 8.5, but was not reported by PRA for the tests discussed here. The matrix of conditions being summarised below as Table 3.2.

Table 3.2 **SUMMARY OF PROCESS CONDITIONS FOR FLOTATION TESTS**

TEST	**F41**	**F42**	**F43**	**F44**
Feed P_{80} Size (um)	148	149	153	148
Time (mins)				
Conditioning (Rougher + Scavenger)	3	3	3	10
Rougher Flotation	15	15	15	15
Scavenger Flotation	15	15	15	15
Total	33	33	33	40
Reagent Additions (g/t)				
$CuSO_4$		80	80	
PAX	50	50		50
SIPX			50	
MIBC	30	30	30	30
CMC				75

Test F41 was designed to represent "base case" conditions, adopting a regime of a strong collector, PAX (potassium amyl xanthate), and a universal frother, MIBC (methyl iso-butyl carbinol).

Test F42 examined the effect of adding copper sulphate to Test F41 base conditions to activate pyrite and tarnished free gold.

Test F43 examined the effect of using a more selective collector, SIPX (sodium iso-propyl xanthate) in conjunction with copper sulphate activator in order to target free gold and sulphides associated gold, whilst rejecting barren gangue.

Test F44 reverted to the use of PAX as a collector in conjunction with a depressant, CMC (carboxymethylcellulose) to reject carbonate and graphitic gangue.

Table 3.3 summarises pertinent results of the bench scale flotation tests performed on gravity tail material, adopting the process conditions in Table 3.2.

Table 3.3 **SUMMARY OF FLOTATION TEST RESULTS**

	F41	**F42**	**F43**	**F44**
Mass Pull to Concentrate (% of new feed)	13.2	14.2	12.3	11.9
Recovery to Concentrate (% of flotation feed)				
Gold	94.4	92.4	88.6	93.0
Silver	78.1	88.6	75.9	88.4
Sulphur	97.1	97.8	96.6	97.7
Flotation Concentrate Assays				
Gold (ppm)	46.2	42.5	48.4	52.9
Silver (ppm)	3.5	6.8	6.9	9.0
Sulphur (%)	3.24	3.70	3.11	4.27
Flotation Tails Assays				
Gold (ppm)	0.12	0.16	0.23	0.16
Silver (ppm)	0.10	0.10	0.20	0.10
Sulphur (%)	0.01	0.01	0.01	0.01

Test F41

Base conditions provided an acceptable gold recovery of 94.4% to concentrate, which is the highest produced for this round of testing. This was achieved at the expense of a higher than desirable mass pull of 13.2% of new feed, implying a degree of non-selectivity occurred. Silver recovery was lower at 78%, which may be related to lack of activation of silver sulphosalts. Sulphur recovery was high at 97.1%.

Test F42

The addition of copper sulphate to the base conditions had the result of increasing mass pull to concentrate, due probably to increased yield of barren pyrite. Recovery was seen to drop slightly, which is puzzling, as copper sulphate is a common activator for free gold as well. Silver recovery improved to 88.6% over base conditions, implying that copper sulphate has assisted with activation of sulphide-associated silver. Sulphur recovery was high at 97.8%, but overall copper sulphate addition appears to have not had an overly beneficial effect on performance.

Test F43

Addition of SIPX in place of PAX as the collector improved selectivity, as evidenced by the reduction of concentrate mass pull to 12.3% of new feed, but gold recovery suffered as a consequence, dropping to 88.6%. Silver recovery also decreased below the level of the previous test, which indicates that a strong collector is required to achieve sufficient gold recovery. Sulphur recovery was down slightly to 96.6%, which is also attributed to the use of a weaker collector.

Test F44

The use of CMC as a depressant resulted in gold recovery being increased to 93%, which still sits below base case conditions. However, mass pull has been reduced to 11.9% through rejection of gangue. Silver recovery was 88,4%, which is equivalent to Test F42 and higher than that seen under base case conditions. Sulphur recovery is also on par with Test F42 and superior to base case conditions.

Overall, however, this limited test series indicates that high gold and sulphur recoveries can be achieved using a simple reagent regime of PAX and MIBC at natural pH conditions, with acceptably low mass pulls in the region of 12 to 14% of new feed. There is some concern as to the high pH of 8 to 8.5 measured by PRA without the addition of an alkali to the slurry, as optimal recoveries are normally seen at neutral pH. It is uncertain if the slightly alkaline conditions have adversely affected flotation performance. However, the results are definitely encouraging and form a solid foundation for optimisation in the feasibility study.

Cleaning tests have not been performed in this test series, as the main aim of these tests was to obtain high recovery to a rougher concentrate for leaching on site. It is likely that closed circuit cleaning would result in a significant drop in concentrate mass, which can pursued in the feasibility study if minimising concentrate mass becomes a critical factor.

3.4 CYANIDE LEACHING

Timed cyanide leach tests were undertaken on concentrates from the three variability flotation tests F42 to F44. An additional test was undertaken on gravity concentrate prepared for Test F41 to confirm that coarse gold can be leached within reasonable leaching durations. All tests adopted the following conditions:

- 48 hrs total leach duration
- pH target of 10.5
- free cyanide level of 3000 ppm
- pulp density of 30% solids w/w

The results of these tests are summarised in Table 3.4.

Table 3.4 **SUMMARY OF CYANIDE LEACH TEST RESULTS**

Feed Source	**F41** Gravity Concentrate	**F42** Ro/Sc Concentrate	**F43** Ro/Sc Concentrate	**F44** Ro/Sc Concentrate
Leach Feed Grade (g/t Au)	100.5	17.4	19.9	25.0
Au Recovery (%)				
6 hrs	85.5	75.7	85.8	74.5
24 hrs	98.1	94.9	90.7	86.9
48 hrs	97.9	87.1	93.6	85.3
Ag Recovery (%)				
6 hrs	87.4	56.6	87.0	60.4
24 hrs	99.4	64.4	76.2	58.9
48 hrs	98.5	73.5	79.4	60.9
Net Reagent Consumption (kg/t)				
Cyanide	3.30	4.99	3.77	5.85
Lime	0.24	0.33	0.35	0.65
pH				
Start	10.7	10.8	10.7	11.0
End	11.7	12.2	11.8	11.6

	F41	F42	F43	F44
Feed Source	**Gravity Concentrate**	**Ro/Sc Concentrate**	**Ro/Sc Concentrate**	**Ro/Sc Concentrate**
D.O. Level (ppm)				
Start	10.5	9.5	9.3	8.9
End	8.7	8.1	9.0	9.0

Gold leaching kinetics for the flotation concentrate leach tests were uniformly slower than expected, considering that the gold is mostly free or partially liberated, and fine in size. A single analysis of particle size of the flotation concentrate indicated a size of 86% passing 38 um, which is considerably finer than would normally be encountered in the plant. This may be attributed to either a fine crystal structure of the pyrite, or overgrinding in the laboratory mill. It is also uncertain if the concentrate has been reground prior to leaching.

The main cause for the slow kinetics is suspected to be coating by gypsum on gold surfaces, which acts as a diffusion layer, retarding the cyanide leach reaction. This gypsum is produced through the reaction between the lime added for pH modification and sulphate produced by the oxidation of sulphide in the pulp. It is likely therefore that if sodium hydroxide had been used, as is the intended practice in the plant to ensure compatibility with direct electrowinning, gypsum formation would be minimal and leach kinetics should improve considerably.

Kinetics were also seen to be slow for the gravity gold concentrate leach test as well, which is attributed to the gypsum coating problem discussed above, and the physical size of the coarser gold particles which take longer to dissolve. In the leach reactor intended for the modular plant, however, the internal baffles are effective in holding back coarse gold particles so that they receive extended leach residence time compared with the finer gold particles, hence maximising leach recovery.

Experience with other intensive leach circuits where the gold is not encapsulated in gangue or in solid solution with sulphides has been that the reaction should be mostly completed with 8 hours, versus the 24 to 48 hours indicated from the current test series. In the next series of tests, it is therefore recommended that caustic be used in place of lime for pH control.

In addition to this, operating at high pH levels can retard leach kinetics. Although a target pH of 10.5 was sought, terminal pH was 11.6 to 12.2 for the tests, which is excessive.

Cyanide consumptions of 4 to 6 kg/t were reported. However, these are net consumptions only, and assume that cyanide would be recovered from the leach liquor. In the plant, much of the cyanide will be destroyed in the electrowinning process, the rest being returned to the leach reactor for reuse. Therefore, correcting for, say, 50% loss of cyanide in final leach liquor, consumptions rise to the range of 6.5 to 8.3 kg/t leached. Assuming a mass split to leaching of 14%, consumption per tonne of new feed is 0.9 to 1.2 kg/t, which is in line with the value of 1.1 kg/t of new feed adopted for design.

3.5 THICKENING AND FILTRATION

Limited static testing on flotation tails material was conducted. No work has been undertaken on flotation concentrate or concentrate leach residue due to insufficient material being available at this time.

Thickening

Results are as flows:

Specific settling rate = 0.13 m2/t.d

Underflow density = 60% solids

Flocculant addition = 4 g/t Percol 351

Slurry pH = 10.0

Lime addition = 13 g/t

Initial pulp density = 30.6% solids w/w

Supernatant clarity = good

The settling rate achieved is lower than expected for this type of ore and for the coarse particle size of 80% -150 um adopted. Normally a higher flocculant addition in the region of 50 g/t is necessary to achieve sufficient flocculation for a high rate thickening application, versus the 4 g/t addition used which is more in line with conventional thickening.

It is also noted that lime has been added to modify the pH to 10. Lime is a good coagulant and promotes flocculation of fine and colloidal material. However, the use of pH modifiers is not consistent with the intended process route, where thickener overflow will be recycled to the process water tank and reused for repulping new feed. Hence, the net result would be that process water would become alkaline, which is expected to have a deleterious effect on gold and sulphide flotation. In practice, tails thickening would need to be undertaken at natural pH, probably pH 8, and an alternative coagulant can be added, such as polyacrylamide or aluminium sulphate, which will not interfere with the pH of the overflow solution.

On a positive note, the underflow density achieved was quite high at 60% solids w/w, which allows a high proportion of process water to be recovered from flotation tails.

The preliminary result is encouraging, and additional work involving vendors can be undertaken in the feasibility study to firm up the required thickener size and process parameters. It should be noted, however, that testwork in this area is no longer considered as essential as tails thickening has been deleted from the current flowsheet. Unless water conservation becomes an issue, it is unlikely that it will be evaluated any further in the feasibility study.

Filtration Results

Results are as follows:

Initial pulp density = 66% solids w/w

Slurry pH = 10.1

Filtration area used = 200 cm^2

Cake thickness = 1.5 cm

Final cake moisture = 11.0%

Filtrate clarity = good

Filtration time = 50 secs

Dry mass of cake = 463g

Based on these results, a filtration rate of 1.56 t/m2.h is calculated, which represents a material that is very easy to filter. This value would need to be firmed up by vendors using dynamic test methods during the feasibility study, but the initial result suggests that filtering the flotation tailings is viable. As with the thickening tests, filtration of tailings is no longer considered relevant, as it has been omitted from the flowsheet.

Flotation concentrate was not filtered due to insufficient sample being available for testing.

3.6 CYANIDE DETOXIFICATION

A single cyanide detoxification test using hydrogen peroxide as the destruction agent was performed on leach liquor from the concentrate leach tests. The outcome of the test was unsatisfactory as unacceptably high levels of complexed metal cyanide species, in particular with copper and iron, were still present in solution, even after adding peroxide at 10 times the stoichiometric dosage. WAD cyanide destruction was achieved to a reasonably low level however.

To achieve acceptably low total and WAD cyanide levels, which is currently less than 1 ppm and 0.5 ppm respectively according to World Bank guidelines, the use of Caro's Acid (a stoichiometric mix of hydrogen peroxide and sulphuric acid) or the INCO method are required. If the use of cyanide is to be incorporated in the design for the feasibility study, this will need to be tested comprehensively to meet the required standards.

4 PROCESS DESIGN CRITERIA

Process design criteria for the Doris North Trial Operation Scoping Study were developed by interpreting supplied testwork reports for the Doris project and applying suitable process parameters from Bateman's design database where test values were not available. The projected plant feed grade and daily plant throughput were specified by Miramar Mining Corporation for the HBJV.

The plant design is based on the scope of work detailed in Section 3 and the design criteria. Mechanical, civil, structural and electrical designs allow for a 10-year plant life and conform to the appropriate Australian and industry standards. Provision for future plant capacity expansion has not been made.

Design criteria are listed in Appendix A. These criteria were derived from several sources as detailed in the document and came primarily from:

- Final Report on Preliminary Metallurgical Testwork, Doris Gold Project, (prepared for BHP Minerals International Inc. by International Metallurgical and Environmental Inc., 1998).
- Test Work Reports from PRA.
- Discussions and advice from the client.
- Bateman Engineering in-house data or recommendation.
- Vendor data.
- Calculations.
- Assumptions requiring further confirmation from other sources.

5 EQUIPMENT LIST

A block flow diagram and mass balance for the proposed plant design have been provided in Appendix B. These flow diagrams have been used with aspects of the design criteria to size the major process equipment items. An equipment list has also been developed for the option and is presented in Appendix C.

6 PROCESS DESCRIPTION

6.1 CRUSHING

Process flow diagram 300-B-DF-001 in Appendix D shows this circuit schematically.

Run of mine (ROM) ore is delivered from stockpiles by FEL to the ROM bin on an 18 hours per day basis. The ROM bin, vibrating feeder and jaw crusher are an integral modular unit built on the same sub-frame. A static grizzly screen to prevent oversize from entering the crushing circuit is located on top of the bin. A rock breaker can be used for any material not passing through the 600 x 600-mm openings. Grizzly undersize at –75 mm drops directly onto the discharge conveyor, whilst oversize is fed to the jaw crusher, set at 110 mm CSS, also discharging onto the conveyor.

To minimise dust generation from loading the bin with ore, and to separate the loading operation from the heated crushing plant dome, the ROM ore receival and primary crushing module are to be located inside a dedicated supported chamber that is exposed to the elements at the ROM bin end. The discharge conveyor passes through skirts into the main crushing dome. This conveyor arrangement includes tramp iron magnet to remove any scrap steel and a weightometer to monitor crushing production.

Conveyor discharge drops onto the product screen, configured with 38 mm apertures in the upper deck and 13 mm apertures in the lower deck, both in rubber construction. Screen oversize drops directly into the cone crusher, which discharges onto the first of two conveyors that recycles material back to the screen feed conveyor. Screen undersize at –13 mm is fed to a stacking conveyor which can be raised or lowered depending on the status of the stockpile height, thus minimising dust generation.

Insertable dust extractors are fitted to both crusher discharges, and suppression sprays are fitted to minimise dust emissions on fine ore product discharge to the stockpile.

6.2 MILLING, GRAVITY & ROUGHER FLOTATION

Process flow diagram 300-B-DF-002 in Appendix D shows this section of the circuit.

Fine ore is back-loaded from the surge stockpile by FEL into the reclaim hopper located over the ball mill feed conveyor. The ball mill, a shell supported hydraulic drive unit, will discharge ground slurry into the mill discharge sump. The duty gravity/cyclone feed pump (with one standby) pump slurry through a continuous in-line pressure jig to recover free coarse and medium sized gold particles. The jig handles the entire mill discharge stream, thus ensuring early capture of nuggety or flaky gold before it is broken up into finer particles or trapped in the circulating load. Hutch water is applied to assist the separation process. Jig concentrate gravity flows to the intensive cyanide leach reactor (ILR) feed hopper, whilst jig tails under pressure feed the cyclone cluster.

Cyclone underflow will gravitate to a distribution box where the split of circulating load returning to the ball mill can be roughly controlled between 0 and 100%. The design allows for 100% of the slurry to gravitate into a single flash flotation cell to recover the remaining coarse gold, free fine gold and fast floating sulphides, principally pyrite. Flotation reagents are added from head tanks to flash cell feed, these being activator (copper sulphate), promoter (3418A), collector (PAX) and frother (MIBC). Flash flotation tails discharges from the bottom of the unit and launders back into ball mill feed. Flash flotation concentrate launders into the regrind mill discharge sump.

The milling and gravity area has a floor sump and pump for spillage and clean up.

6.3 SCAVENGER FLOTATION

Process flow diagram 300-B-DF-003 depicts the scavenger flotation section of the plant in Appendix D.

Cyclone overflow is classified to P_{80} = 125 microns and flows directly to the scavenger flotation feed conditioning tank, where additional flotation reagents are added via the head tanks. The tank is agitated and has a residence time of 5 minutes. Slurry discharges from the tank and gravity launders into the first of four stepped tank cells, with a minimum total residence time of 30 minutes. Each cell is fitted with froth crowder rings to maximise recovery of lower grade froth expected in this part of the circuit. Scavenger tails launders into the final tails hopper, whilst combined scavenger concentrate is pumped via a vertical froth pump over to the concentrate regrind mill discharge sump.

The scavenger flotation area has a floor sump and pump for spillage and clean up.

Dedicated flotation blowers provide low-pressure air to the flash flotation cell and the scavenger flotation cells.

Cross-cut samplers have been included on scavenger flotation feed and tails streams to provide the means of monitoring metallurgical performance of this circuit. All other streams are considered to be of sufficiently low flow rate to allow hand sampling for metallurgical balance purposes.

6.4 CONCENTRATE REGRIND & INTENSIVE CYANIDE LEACHING

This circuit is shown schematically in process flow diagram 300-B-DF-004 in Appendix D.

The reground flotation concentrate and gravity concentrate meet at the feed settling cone of the ILR unit, where they are dewatered to 75% w/w solids pulp density. Settling cone overflow water drops into the floor sump and is pumped across to the ball mill discharge hopper, along with belt filter and general spillage. Depending on water volume and the nature of the spillage, this could also be pumped to the final tails hopper. Underflow feeds the ILR unit, which is a rotating drum of 8 hours residence time fitted with baffles and lifters to provide adequate mixing and to minimise short-circuiting. Cyanide addition is made to the feed chute to the unit in addition to recycled spent electrolyte from electrowinning.

Slurry discharges into a small sump and is pumped up to the residue settling cone. Leach liquor overflows from the unit and launders to the rich electrolyte tank located next to the gold room. Decant underflow feeds a small belt filter fitted with three stages of counter-current washing to maximise gold recovery whilst applying minimum wash water dilution (estimated to be 1 tonne wash water per tonne of contained cake moisture). Filtrate is pumped to the rich electrolyte tank. Belt filter discharge at 85% solids discharges into a launder and is repulped by spent electrolyte bleed solution before laundering into the cyanide detoxification reactor.

6.5 GOLDROOM

Process flow diagram 300-B-DF-005 in Appendix D shows the goldroom schematically.

Liquor containing gold produced from the intensive cyanide leach circuit is stored in the rich electrolyte tank. Solution is pumped to two electrowinning cells, configured in series, to recover gold. The majority of gold is extracted from the first cell, whilst the second cell serves to scavenge remaining gold values from the electrolyte thus ensuring high gold recovery per pass. The resulting barren electrolyte solution is split roughly 60:40 between a recycle to ILR feed and the rest to leach residue cake repulping ahead of cyanide detoxification.

The electrowinning cells contain steel wool cathodes to remove the gold from the electrolyte. Loaded cathodes are removed periodically from the cells using a hoist and replaced with fresh cathodes. The loaded cathodes are washed and dried in a calcining oven where steel is oxidised. The calcine is smelted in the barring furnace with a mixture of pre-weighed fluxes. Molten gold is poured into doré moulds, weighed and stored in the safe awaiting shipment.

Fumes from smelting and electrowinning are controlled through the installation of an extraction system.

6.6 CYANIDE DETOXIFICATION AND TAILINGS HANDLING

Process flow diagram 300-B-DF-006 in Appendix D shows this circuit schematically.

Bleed barren electrolyte from the goldroom is used to repulp cyanide leach residue, and is contacted in a small agitated reactor with Caro's Acid, a stoichiometric mix of sulphuric acid and hydrogen peroxide. Free cyanide and WAD cyanide complexes in solution are rapidly destroyed and the overflow from the tank is gravity discharged into the final tails sump. The combined flotation and leach tailings are pumped via a pair of insulated pipes to a containment dam located some 3 km away. Lined emergency ponds are provided for to allow automatic discharge of tailings in the event of a burst pipe further down the line, or transient excessive cyanide content in tailings thus ensuring the tailings in the main containment dam are not contaminated with cyanide.

6.7 REAGENTS AND PLANT SERVICES

Reagents (300-B-DF-007)

Collector

Potassium amyl xanthate (PAX) is added to flash and scavenger flotation areas to provide strong hydrophobic collector ability for floating sulphides and free gold. It is usually non-selective, and useful for bulk concentrate production to maximise recovery. It is received in drums (100kg) and mixed in batches in an agitated mix tank to 10% strength using a drum tipper and hoist. Xanthate solution is transferred to a storage tank and pumped to a header tank and dosed via dosing valves into the flotation circuits, with header tank overflow returning back to the distribution tank.

Frother

Methyl iso-buytl carbinol (MIBC) is added to assist with froth formation which in turn facilitates sulphides and fine gold recovery. MIBC is a general purpose economical frother commonly used in gold flotation operations. It is received on site in 200L drums, and is pumped up to a header tank located in the flotation area and dosed neat to the flotation circuits with dosing valves.

Promoter

Aerophine 3418A promoter is added to enhance native gold and silver recovery, and combines well with the strong collecting power of PAX, although it can work against pyrite flotation efficiency. Although it is water soluble, given the small dosing rate, it will be pumped neat to a header tank located in the scavenger flotation area and dosed neat into the flotation circuit with dosing valves.

Activator

Copper sulphate is added to activate sulphides, in particular pyrite, and generally assists in speeding up kinetics. It will be mixed manually in a mixing tank to 10% solution strength, transferred to a storage tank and pumped up to a head tank for dosing into flotation areas, with tank overflow returning to the storage tank.

Sodium Cyanide

Sodium cyanide is received in bulk bags and stored for use in a reagent compound. Using a lift truck, hoist and bag breaker, cyanide is mixed with water in the cyanide-mixing tank. This solution is transferred to the cyanide storage tank for distribution to the ILR circuit. Two dosing pumps have been allowed for given the absence of a head tank feeding the ILR unit.

Sodium Hydroxide

Sodium hydroxide is used to adjust pH ahead of cyanide leaching, and to maintain electrowinning at a pH of 12.5 for optimal conductivity. It will be mixed manually in a mixing tank, transferred to a storage tank and dosed to the ILR feed chute.

An alkaline area spillage sump and pump, common to all alkaline reagent mixing operations, has been included to transfer spillage to the tailings hopper.

Caro's Acid Production

Sulphuric acid and hydrogen peroxide in 1 tonne bulka boxes will be dosed in accurate proportions through a Caro's Acid reactor box, a teflon block with a tortuous path through it to provide rapid high shear mixing. The two reagents mix together to make Caro's Acid (H_2SO_5), which is delivered under pressure to the cyanide detoxification reactor via stainless steel braided teflon lines, thus avoiding any batch makeup of corrosive chemicals by operators.

Plant Services (300-B-DF-008, 009)

Raw Water

Water supply for the plant is to be taken from a barren lake located 2.5 km from the proposed plant site. A high head borehole pump located in a decant well in the lake, accessed by a jetty or causeway, will allow all year round drawing of water from the lake as the intake to the pump will be located below any ice cap that forms. The water is pumped via an insulated pipeline to the process water tank, with a takeoff to potable water treatment.

Process Water

Raw water is delivered to the process water tank, activated by a float valve. Duty and standby pumps deliver process water to the plant for use in all process areas.

Potable Water

A dedicated plant (by others) treats raw water for use as potable water. This water is reticulated throughout the site for safety showers and general purpose.

Seal Water and High Pressure Water

Makeup for this tank is from the same raw water supply. High pressure water pumps (duty and standby) deliver water to hose down points and water suppression applications.

Gland seal water is delivered to slurry and belt filter vacuum pumps using water from the high pressure water tank. The gland seal water circuit has duty and stand-by pumps.

Plant and Instrument Air

Compressors will provide high-pressure air for instrumentation and general use. Duty and standby compressors maintain air pressure to an air receiver. Air from the receiver is then reticulated to the plant as plant air. The instrument air system consists of duty and standby high pressure compressors with a common filter and air drier feeding the plant instrumentation.

Low Pressure Air

Two low-pressure blowers, duty and standby, will supply air for the flash and scavenger flotation cells.

7 CAPITAL COST ESTIMATE

7.1 QUALIFICATIONS

The following qualifications are important to note:

7.1.1 MECHANICAL EQUIPMENT

In the time available, Bateman re-priced as much as possible of the mechanical equipment. Wherever no new price could be obtained Bateman carried forward the costs from the previous submission. Dust extraction at dry transfer points and dry processing areas was allowed for but the dust loading at these points is pure speculation.

7.1.2 CIVILS

The calculation is based on the stated fact that this plant will be built on a rock outcrop, which will be levelled and suitably compacted by the Clients' mining contractor. This eliminates the need to consider the effects of disturbing of the permafrost zone.

It is important to draw the Client's attention to the fact that, without a site visit and the opportunity of consulting with geo-technical experts in the area, only a very basic view of requirements for civil works in the area is possible. It is only allowed for bund walls and floors in the areas indicated on the layout drawing. A rate of C$1,200 per m^3 of concrete was used. No cast foundations or cast-in hold down bolts were allowed anywhere. It is also important to note that no surface concrete floors, walkways or foundations are envisaged other than those areas within the bund walls under the various processes.

Acting on advice from Erik Bruggink of Bateman Engineering it is not deemed necessary to allow for acid-proofing of concrete surfaces. It is sufficient to insert a layer of plastic sheeting under the concrete bed to prevent any possible leaching of chemicals into the soil.

7.1.3 INSTRUMENTATION

In the absence of any specifications we copied the instrumentation description and costs from a recently completed proposal. This is inclusive of PLC and SCADA. The following is a brief description of the instrumentation system proposed:

Control and Instrumentation Scope of Work

The scope of the control and instrumentation work for the proposed Hope Bay 600 tpd Modular Gold Plant shall include the detailed design, procurement works testing where applicable, delivery FOB Hope Bay installation/erection, supervision, cold/hot commissioning of the complete control and instrumentation system and hand over to the client for plant operation.

Specifications and Standards

The control and instrumentation system design shall be based on the prevailing ISA, and the latest South African Standard Specifications and Codes of Practice where applicable.

System Design

The design will be based on pneumatically actuated control valves and direct acting solenoid valves. Variable speed control of motors will be utilised for variation of process slurry flows.

Configuration of the system will be as follows: One control room housing the PLC and SCADA server. The control room PLC connected directly to I/O racks in the individual plant sections via a Profibus-DP network. Motor control is via Simocode intelligent motor protection and control devices connected to the PLC via a Profibus-DP field bus network.

The control room will be housed in an air-conditioned container

The PLC power supplies will be backed up by UPS.

The control & field installation shall consist of:

- Hot dip galvanised ladder type racking.
- 300/500 grade PVC PVC SWA PVC instrument power cable.
- 150/300V grade Dekabon type armour instrument signal cable.
- IP 65 (equivalent to NEMA 4) field junction and marshalling boxes.
- IP 65 field devices such as transmitters and instruments.

Exclusions

- Public address and telecom systems.
- Fire protection.
- Plant & Instrumentation air reticulation.

7.1.4 ELECTRICAL

The cost of the electrical installations includes trial assembly and testing ex-works, area lighting inside the sprung steel dome, special cold weather cables and site erection. TECK low temperature capability cable will be shipped to South Africa for incorporation in the plant. Since power is understood to be generated on site by means of diesel driven gen-sets, no transformers are required. Emergency lighting will be provided by self-contained battery back-ups in strategically located light fittings. A containerised MCC is included in the pricing.

The location of the diesel power generator module has not been identified and neither has any allowance been made for the heat exchanging and heat reticulation system.

7.1.5 PLATEWORK AND LINERS

Bateman have calculated the masses of plate work and liners required for the option.

7.1.6 STRUCTURAL STEELWORK AND 'SPRUNG STEELDOMES'

The structural steelwork quantity was derived from a previous similar design, and amounts to 64 tons.

The revised layout for option "A" significantly reduced the size of the main Sprung Steel building with a resultant reduction in price. The crushing/screening/stockpile building was left as before.

7.1.7 PIPING AND VALVES

The monetary value of this item was factored. Since the piping is mainly small bore plastic piping and the main automated valves are included under instrumentation, this figure is small and not considered to be a significant risk. Insulated piping for water supply and tails lines form a separate item in the cost estimate.

7.1.8 BUILDINGS

An allowance has been made for a containerised office during commissioning, which can be refitted later for other use by operations after demobilisation.

7.1.9 TRANSPORTATION

Transportation is factored at 15% of DFC (excluding the Sprung Steel structures for which transport and erection are allowed separately). Concrete has also been excluded from the transport allowance as an installed rate has been used.

7.1.10 OPERATING SPARES

These are at 4% of supply costs for mechanical, electrical and instrumentation.

7.1.11 CONTINGENCY

A 12% contingency has been allowed for additional minor items.

7.2 CAPITAL COST ESTIMATE

7.2.1 GENERAL

The objective of the study was to develop a ±25% capital cost estimate based upon available testwork information, client supplied criteria and assumptions derived from in-house experience. The methodology adopted is similar to the previous study. Documentation developed during the study used as a basis for the estimate is:

- Process Design Criteria.
- Equipment List.
- Flowsheets.
- Plant General Arrangements (in preliminary sketch form for internal capital estimating use).
- Plant Layout Drawing.

The above deliverables were produced in sufficient detail to achieve a cost for the process plant at the required accuracy.

Due consideration was given to the location and climate but site topography and ground conditions are assumed to be of hard rock composition suitable for standard foundations.

All values are expressed in Canadian dollars with a base date of 30thth November 2001. An exchange rate of 1.20 A$:CAN$ was used to convert Australian rates.

Capital costs for the project have been based on the purchase of all-new equipment and materials. The use of second-hand equipment may be considered once the project development commences.

Table 7.1 tabulates the estimate by commodity. Appendix E contains details of erection and assembly factors applied to base costs to arrive at total costs by commodity.

Table 7.1 **PROJECT CAPITAL COST SUMMARY**

DESCRIPTION	TOTAL COST
Direct Field Costs	
Civils	270
Mechanical Equipment including conveyors & tanks	3,374
Platework & Liners included in 002	
Structural Steelwork	456
Piping & Valves excl tailings & overland pipes	469
buildings, container office - allowance	104
Electrical including PLC, MCC	640
Instrumentation	587
Tails Lines and Water Supply	873
Desom Ventilation	403
Mech Eqt, Plw, elec, struct, & Instrum. Erect mobilise	17
First fill - allowance	96
Electrical mobilise	16
Instrumentation mobilise	4
Trial assemble, Strip plant and load into containers	83
Transportation - CIF to Hope Bay - 15% of FOB value	1,007
Commissioning Spares - allowance 1% of mech, elect, 67% inst.	40
Commissioning labour	44
Vendor assist during Constr & Comm-Allow 1%	36
12 month's Op Spares - allow 4% of mech & elect, 67% inst.	161
DIRECT FIELD COSTS	**8,687**
Sprung Steel Dome	1,914
Transportation to Hope Bay	44
TOTAL DIRECT FIELD COSTS	**10,645**
Home Office & Indirect Field Costs	
Home Office Resources Site Resources Commissioning Resources Home Office Sundries Site Sundries Commissioning Sundries -	1,620
External consultants/testwork - allowance	163
Site Establishment including air fares etc	407
Sprung Steel Dome	44

DESCRIPTION	TOTAL COST
	2,233
TOTAL NET COST	**12,878**
<u>Other Costs</u> -	
Interest & Surety Bond	0
Escalation	0
Fee - 10% of Total DFC	1,064
Fee - "Technical know-how" 15% of Tot HO costs	335
Insurance - CAR & marine - allowance	133
Contingency @ 12% of TNC	1,545
TOTAL OTHER COSTS	**3,078**
OVERALL PROJECT COST	**15,957**
TOTAL EXCLUDING GST	**15,957**
GRAND TOTAL PROJECT COST	**15,957**

8 OPERATING COST ESTIMATE

The operating cost estimate has been derived from test work data, information supplied by the client and from Bateman's in-house database of similar duties. The methodology adopted is very similar to that used for the previous Hope Bay scoping study. The estimate uses quoted prices current for 4Q 2001. All costs are presented in Canadian dollars.

8.1 SUMMARY OF OPERATING COSTS

Table 8.1 presents a summary of operating costs derived for the selected process plant option to treat Doris North ore at a rate of 600 tonnes per day.

Table 8.1 **SUMMARY OF OPERATING COSTS**

Item	$/annum
Reagents	1,334,422
Power	1,370,855
Liners	150,000
Labour	3,248,623
Hired Services	216,000
Mobile Equipment	301,632
Maintenance	500,000
Laboratory	100,000
Building Heating	128,100
Total	**7,349,632**
Cost per tonne	
Cost per oz produced	

Note that the cost per ounce is calculated based on 125,217 tr oz per year production, and cost per tonne is based upon a production rate of 219,000 tpa.

8.2 ESTIMATE METHODOLOGY

8.2.1 LABOUR

The annual labour cost of personnel includes flat annualised salaries and includes an allowance for superannuation and statutory overheads (workers' compensation, insurance and training). Labour rates exclude company overheads such as recruiting, travel, housing and service charges from head office. No provisions are included in labour costs for lost time due to industrial disputes and redundancy considerations.

Drawing on the client's experience from other projects in the region, the allowance for staff personnel on costs is a base of 36% plus FIFO costs on a 2weeks on/2 weeks off basis, and daily living allowance. For award based personnel, the daily allowance and FIFO cost is built into hourly rates, based on a 12 hours operating shift. A working year of 183 days has been applied for all employees.

Manning levels were established to meet the production levels of the operation, in consultation with HBJV. HBJV provided rates for all operating and maintenance personnel. The shift arrangements for operating personnel are based on a regime of 4-crews working 12-hours shifts. A summary of labour requirements is detailed in Table 8.2.

Table 8.2 **LABOUR COST SUMMARY**

Staff	Number	Salary Base ($pa)	Salary Inc. Oncosts ($pa)	Sub-Total ($pa)
Operating + Support				
Mill Superintendent	1	80,000	119,924	119,924
General Foreman	2	70,000	106,324	212,648
Plant Metallurgist	1	70,000	106,324	106,324
Chemist	2	55,000	85,924	171,848
Loader Drivers	4	42,734	69,230	276,921
Crusher Operators	4	36,498	60,512	242,048
Milling/Gravity Operators	4	39,462	64,026	256,103
Scav. Float/Leach/Filtration Operators	4	51,145	82,209	328,834
Gold Room Operators	2	48,861	77,751	155,501
Met Technician	1	45,589	74,786	74,786
Assayers	2	40,275	66,288	132,575
General Labourers	4	36,498	60,512	242,048
Sub-Total	**31**			**2,319,560**
Maintenance				
Maintenance Superintendent	2	80,000	119,924	239,848
Fitters	2	53,626	81,660	163,319
B/maker-Welder	2	53,626	81,660	163,319

Staff	Number	Salary Base ($pa)	Salary Inc. Oncosts ($pa)	Sub-Total ($pa)
Electrician/Instrument Technician	2	53,626	81,660	163,319
Labourer	2	36,498	58,799	117,598
Planner	1	53,626	81,660	81,660
Sub-Total	**11**			**929,063**
Total Labour	**42**			**3,248,623**

8.2.2 CRUSHER AND MILL LINERS

Schedules for crusher and mill liners were derived from Bateman's database for similar applications. Assumptions are as follows:

Jaw crusher liners – 1.5 sets per year at $20,000 per set

Cone crusher liners – 2 sets per year at $15,000 per set

Mill rubber liners – 1 set per year at $40,000 per set

Mill rubber lifters – 2 sets per year at $25,000 per set

8.2.3 MAINTENANCE CONSUMABLES

Maintenance expenses comprise those costs associated with the consumption of equipment spares and other supplies utilised in carrying out the maintenance functions for the project but exclude staff labour.

The amounts for maintenance consumables were estimated as 5% of total direct costs, which is reasonable for a new plant of this type. The total maintenance consumables cost as calculated at $500,000 or $2.28/t milled. A total maintenance cost of $4.70/t was determined including labour.

8.2.4 POWER

- The total connected load for the project was determined from the equipment list and used in conjunction with appropriate factors for average and peak demand and the costs of generation to provide the power operating costs.
- Some power consumption data such as in the mill area was derived from first principles (Bond work indices and design criteria).
- Power consumption in other areas was determined by factoring installed power from the equipment list.
- The rate for power consumption was provided by HBJV of $0.16/kWh. This rate was then used to determine totals.

A summary is presented in Table 8.3.

Table 8.3 **Power Cost Summary**

	Installed Power (kW)	Drawn Power (kW)	Avail. (hr)	Consumption (MWH/yr)	Cost ($/yr)
ROM Ore Crushing	274	219	5,585	1,223	195,698
Milling, Gravity and Classification	645	500	8,234	4,117	658,720
Scavenger Flotation	60	48	8,234	395	63,237
Regrind, Leaching and Filtration	109	83	8,234	683	109,348
Goldroom	65	51	8,234	420	67,189
Tailings and Detox	181	72	8,234	593	94,856
Reagents	9	7	8,234	58	9,222
Services	283	131	8,234	1,079	172,585
Total	**1,626**	**1,111**		**8,940**	**1,370,855**

8.2.5 HIRED SERVICES

Allowance has been made for bringing in external assistance for items such as weightometer calibration, environmental and water issues, metallurgical consultants, metallurgical testing, external assay checks and instrument calibration. A breakdown of these costs is provided as Table 8.4.

Table 8.4 **Hired Services Summary**

Category	Cost ($/annum)
Instrument Calibration	20,000
Met Consultants	25,000
Met Testing	40,000
Conveyor Belt Repairs	12,000
Water Consultants	25,000
Water Assays	6,000
Tailings Management	30,000
Tailings Rehabilitation	50,000
External Assay Checks	8,000
Total	**216,000**

8.2.6 PLANT VEHICLES RUNNING COSTS

A flat running cost estimate has been made for operating the mill feed FEL and bobcat on an annual hours basis, and the mill vehicles on a flat rate:

FEL – 8234 hrs/annum at $30 per hour
Bobcat – 730 hrs/annum at $20 per hour
Light vehicles (2) – $20,000 each per annum

8.2.7 REAGENTS & CONSUMABLES

- Reagents and consumables were determined based on the design criteria.
- Mill balls were calculated using Bond method based on an assumed abrasion index for quartz reef ore in greenstone host rock.
- A complete schedule of metallurgical plant reagent costs based on a typical operating year was developed and priced.
- Costs for reagents and consumables were based on supplier quotations ex-major cities, then transported by road and rail to Hay River, followed by transport to Hope Bay by barge via the McKenzie River-sea route. A number of reagent costs were supplied by HBJV, using current supply costs for Yellowknife operations plus additional transport costs to Hope Bay.
- Import duties and provincial taxes have been excluded from the cost estimate.

Table 8.5 below summarises these items and their costs.

Table 8.5 **Reagent & Consumable Cost Summary**

Reagent	Unit	Consumption		Landed Cost	Cost (CAN$)	
		(per tonne)	(annual)	($/unit)	($/t ore)	(annual)
Cyanide	kg	1.10	240,900	2.49	2.739	599,841
Caustic	kg	0.22	48,180	1.68	0.370	80,942
Copper Sulphate	kg	0.12	25,842	2.20	0.260	56,852
Frother	kg	0.05	21,024	3.45	0.331	72,533
Promoter - 3418A	kg	0.02	3,942	5.53	0.099	21,789
Collector - PAX	kg	0.10	21,024	4.17	0.400	87,670
Hydrogen Peroxide	kg	0.12	26,280	1.49	0.178	39,026
Sulphuric Acid	kg	0.21	45,990	0.94	0.196	43,001
Grinding Balls	kg	1.20	262,800	1.16	1.392	304,848
Diesel	litre	0.07	15,600	0.94	0.067	14,586
Smelting Fluxes	kg	0.03	6,423	1.37	0.040	8,810
Steel Wool Cathodes	kg	0.004	824	5.49	0.021	4,523
TOTAL					**6.09**	**1,334,422**

8.2.8 LABORATORY

Laboratory costs were estimated and a total cost of $100,000 was assumed.

8.2.9 WATER

Water requirements have been included in the operating cost schedule, and assume a pumping distance of 2.5 km from the lake supply to the plant. An estimate of approximately 72 m3/h has been calculated for raw water makeup purposes, determined from the mass balance.

8.3 QUALIFICATIONS & CLARIFICATIONS

Costs were estimated for a treatment rate of 219,000tpa of ore delivered to the ROM bin. Exclusions from the operating estimate are:

- Costs for areas outside of the battery limits including power supply, tailings dams, roads, communications, infrastructure;
- mining costs including mine maintenance;
- ore handling to the ROM pad;
- geology;
- site overheads and administration;
- head office costs;
- gold dore transportation and refining costs;

.

Appendix A

DESIGN CRITERIA

CLIENT:	Hope Bay Joint Venture
PROJECT:	Hope Bay Engineering Study
JOB NUMBER:	MAP102
CASE:	Final Option for Study - Gravity/Flotation/Leach Plant, 600 tpd
DATE:	January 9, 2002
REVISION:	A

SOURCE OF DATA

Bateman estimate, assumption or recommendation	1
Bateman database	2
I.M.E. report, Doris Gold Project (for BHP)	3
Public domain	4
Calculated	5
Vendor advice	6
Centre for Minerals Technology report, Feb 1997, Boston Gold Project	7
Lakefield Progress Report No. 1, July 1998, Boston Gold Project	8
Client advice	9
PRA Test Report	10

1.0 SITE DATA	**Unit**	**Value**	**Source**
General			
Location		Hope Bay Area, Nunavut Territory, Canada	9
Site Elevation	m	50	1
Site Barometric Pressure	mBar	10.49	5
Temperatures			
Minimum	degrees C	-55	9
Maximum	degrees C	20	9
Rainfall			
Minimum	mm	tba	9
Maximum	mm	tba	9
Annual	mm	tba	9
Evaporation Rates			
Minimum	mm	tba	9
Maximum	mm	tba	9
Annual	mm	tba	9

2.0 FEED CHARACTERISTICS	**Value**

Typical Head Analysis (average)			
Au	ppm	19.0	9
Ag	ppm	3	10
Total S	%	0.4	3
Cu	%	none	
Physical Properties			
Description		Quartz reef	
Abrasion Index		0.45	2
Bond Ball Mill Work Index Determination			
P80 Size	um	108	10
Work Index	kWh/t	17.5	10
Specific Gravity			
ROM Feed		2.70	2
Rougher Gravity Cons		3.60	2
Cleaner Gravity Concentrate		4.00	2
Flotation Concentrate		3.60	2
ROM Ore Bulk Density	t/m3	1.60	2
ROM Size Distribution			
Maximum	mm	600	1
Nominal P80	mm	250	1
Nominal P50	mm	100	1
Water Analysis		not available	
3.0 PRODUCTION CRITERIA			
Plant Throughput	t/a	219,000	9
Crushing			
Days per Annum		365	2
Days per Week		7	2
Operating Hours	/day	18.0	2
Available Hours	/day	15.3	5
Design Availability	%	85	2
Operating Hours	hrs/a	5585	5
Throughput	t/h	39.2	5
Other Areas			
Days per Annum		365	2
Days per Week		7	2
Operating Hours	/day	24	2
Available Hours	/day	22.6	5
Design Availability	%	94.0	2
Operating Hours	hrs/a	8234	5
Throughput	t/h	26.6	5

Gold Recoveries			
Gold to rougher gravity cons	%	60.0	10
Gold to rougher flotation cons	%	22.2	10
Gold to scavenger flotation cons	%	14.8	10
Gold to leaching	%	97.0	10
Leach recovery	%	98.0	10
Overall recovery	%	95.1	5
4.0 CRUSHING			
Annual Throughput, t/a		219,000	9
Production Rate, t/h		39.2	5
ROM Bin			
Live Capacity	mins	2	1
Live Volume	m3	0.8	5
Dead Volume	%	15	1
Total Volume	m3	0.9	5
Primary Crushing			
Ore Delivery		FEL	1
Feed Rate	t/h	39.2	5
Feed Moisture, average	% w/w	5.0	1
Crusher Type		Jaw	6
Feeder Type		vibrating feeder	6
Crusher CSS	mm	110	6
Crusher Product, 80% Passing Size	mm	100	6
Product Screening			
Feed Top Size	mm	200	6
Circulating Load	% of new feed	150	6
Feed Rate	tph	98.0	5
Screen Type		two deck, inclined, vibrating	6
Screen Aperture			
- upper	mm	38.0	6
- lower	mm	13.0	6
Panel Type		rubber	6
Product Size, 80% passing	mm	10.0	6
Product Rate	tph	39.2	5
Secondary Crushing			
Feed Rate	t/h	58.8	5
Solids Content	% w/w	98.0	6
Crusher Type		Cone	6
Crusher CSS	mm	15	6
Crusher Product, 80% Passing Size	mm	13	6

Conveyor Duties			
Jaw Crusher d/c	tph	39.2	5
Screen Feed	tph	98.0	5
Fine Ore Transfer	tph	39.2	5
Cone Crusher Feed	tph	58.8	5
Fine Ore Stacking	tph	39.2	5
Mill Feed	tph	26.6	5
Particle Top Size			
Jaw Crusher d/c	mm	200	6
Screen Feed	mm	200	6
Fine Ore Transfer	mm	13	6
Cone Crusher Feed	mm	200	6
Fine Ore Stacking	mm	13	6
Mill Feed	mm	13	6

5.0 GRINDING, CLASSIFICATION & ROUGHER GOLD RECOVERY

Ball Mill			
Type		overflow ball	
Feedrate	t/h	26.60	5
Mill Feed Size, 100% passing	mm	13.0	6
Mill Feed Size, 80% passing	mm	10.0	6
Mill Product Size, 80% passing	P80 um	150	10
Milling Density	%w/w	70	1
Ball Mill Work Index	kWh/t	17.5	10
Rod Mill Work Index	kWh/t	19.3	1
EF Factors		1.19	5
Specific Milling Power at Pinion	kWh/t	15.12	5
Grinding Media			
Media Type		balls	1
Makeup Top Size	mm	90	5
Media Load			
Nominal	%	30	1
Design	%	40	1
Consumption Rate, estimate	kg/t	1.20	1
Mill Data			
Liner Type		rubber	1
Mill Size		2.8m D x 4.6m EGL	6
Mill Motor	kW Installed	500	6
Nominal	kW at Motor Input	432	5
Design	kW at Motor Input	500	6
Design	kW at pinion	402	5
Media Addition Method		to mill feed chute	1
Storage		drums/kibble	1
Dilution Water			
Mill Feed	m3/h	0.8	5

Mill Discharge	m3/h	10.8	5
Rougher Gravity Separation			
Gravity Separator Type		In-Line Pressure Jig	1
Number of Units		IPJ2400	6
Feed Source		mill discharge	1
Proportion of Stream Treated	% of total	100	1
Feed Solids Rate	tph	98.1	5
Water in Feed	m3/h	52.8	5
Feed Dilution	m3/h	10.8	5
Feed Pulp Density	% w/w	65.0	5
Fluidisation Water	t water per t solids	0.2	6
	m3/h	19.6	5
	% split to cons	70	6
Mass Pull to Concentrate	% of new feed	5.0	6
Concentrate Solids Rate	tph	1.33	5
Tails Solids Rate	tph	96.8	5
Gold Recovery to Concentrate	% of new feed	60.0	3
Concentrate Grade	g/t Au	228.0	5
Tails Solids Content	% w/w	60.7	5
Concentrate Solids Content	% w/w	12.0	5
Concentrate Water	m3/h	9.8	5
Tails Water	m3/h	62.7	5
Concentrate P80 Size, estimate	um	250	2
Cyclone Classification Circuit			
Cyclone Feed			
Feed Solids	t/h	96.8	5
Water Flowrate	m3/h	62.7	5
Feed Density	%w/w	60.7	5
Slurry Flowrate	m3/h	98.6	5
Circulating Load	%	300	1
Cyclone Overflow			
Overflow Solids	t/h	24.2	5
Water Flowrate	m3/h	34.5	5
Overflow Density	%w/w	41.2	1
Slurry Flowrate	m3/h	43.4	5
Cyclone Underflow			
Underflow Solids	t/h	72.6	5
Water Flowrate	m3/h	28.2	5
Underflow Density	%w/w	72.0	1
Slurry Flowrate	m3/h	55.1	5
Cyclone Diameter	mm	380	1
Number of Clusters		1	1
Number Operating/Cluster		1	5
Number Installed /Cluster		2	5
Operating Pressure	kPa	70	1

Rougher Flotation			
Flotation Device Type		"Flash Flotation" Unit Cell	1
Number Installed		1	6
Feed Source		Cyclone Underflow	1
Feed Solids Rate	tph	72.6	5
Water in Feed	m3/h	35.8	5
Dilution Required	m3/h	7.5	5
Feed Pulp Density	% w/w	67.0	6
Spray Water	t water per t solids	0.1	6
	tph	7.3	5
Mass Pull to Concentrate	% of new feed	4.0	6
Concentrate Solids Rate	tph	1.06	5
Tails Solids Rate	tph	71.54	5
Gold Recovery to Concentrate	% of new feed	22.2	10
Concentrate Grade - calculated	g/t Au	105	5
Concentrate Solids Content	% w/w	25.0	6
Concentrate Water	m3/h	3.19	5
Tails Solids Content	% w/w	64.2	5
Tails Water	m3/h	39.8	5
Air Requirement	Nm3/h	300	6
Reagents			
Collector - PAX	g/t treated	25	10
Frother - MIBC	g/t treated	30	10
Activator - CuSO4	g/t treated	33	3
Promoter - 3418A	g/t treated	5	3

6.0 SCAVENGER FLOTATION

Scavenger Flotation Feed Conditioning			
Volumetric Flow Rate	m3/h	43.4	5
Feed Source		cyclone overflow	1
Conditioning Time	mins	5	3
Conditioning Tank - freeboard	mm	300	1
Conditioning Tank Volume - live	m3	3.62	5
D/C Pulp Density	% solids w/w	35	1
Feed Dilution	m3/h	10.5	5
Scavenger Flotation			
Flotation Cell Type		Tank Cell	1
Number Installed		4	6
Available Volume in Cells	%	80	6
Size of Cells - minimum active volume	m3	8	5
Feed Source		conditioned cyclone overflow	1
Residence Time			
Laboratory	mins	15	10
Plant	mins	30	2
Feed Solids Rate	tph	24.2	5

Volumetric Flow Rate	m3/h	53.9	5
Feed Grade	g/t Au	3.7	5
Water in Feed	tph	34.5	5
Feed Pulp Density	% w/w	35.0	1
Launder Water	t water per t cons	1.0	1
	tph	0.5	5
Mass Pull to Concentrate	% of new feed	2.0	1
Concentrate Solids Rate	tph	0.53	5
Tails Solids Rate	tph	23.67	5
Gold Recovery to Concentrate	% of new feed	14.8	5
Concentrate Grade	g/t Au	141	5
Tails Grade	g/t Au	0.64	5
Tails Solids Content	% w/w	34.8	5
Concentrate Solids Content	% w/w	25.0	1
Concentrate Water	m3/h	1.60	5
Tails Water	m3/h	44.4	5
Concentrate P80 Size, estimate	um	100	2
Minimum Cell Size	m3	8.4	5
Blower Air - total	Nm3/h	1848	6
Reagents			
Collector - PAX	g/t treated	30	10
Frother - MIBC	g/t treated	15	10
Activator - CuSO4	g/t treated	30	3
Promoter - 3418A	g/t treated	5	3

7.0 CONCENTRATE REGRINDING

Cyclone Classification Circuit			
Cyclone Feed			
Feed Solids	t/h	6.4	5
Water Flowrate	m3/h	8.0	5
Feed Density	%w/w	44.4	5
Slurry Flowrate	m3/h	10.3	5
Circulating Load	%	300	1
Cyclone Overflow			
Overflow Solids	t/h	1.60	5
Water Flowrate	m3/h	6.1	5
Overflow Density	%w/w	20.7	5
Slurry Flowrate	m3/h	6.7	5
Cyclone Underflow			
Underflow Solids	t/h	4.8	5
Water Flowrate	m3/h	1.9	5
Underflow Density	%w/w	72.0	1
Slurry Flowrate	m3/h	3.6	5
Cyclone Diameter	mm	150	1
Number of Clusters		1	1
Number Operating/Cluster		1	5
Number Installed /Cluster		2	5

Operating Pressure	kPa	70	1
Concentrate Regrind			
Feed Rate,t/h	t/h	1.60	5
Concentrate P80 Size, estimate	P80, microns	192	2
Product size	P80, microns	45	10
Work Index	kWh/t	17.0	2
Specific Power at Pinion	kWh/t	18.3	5
Mill Density	%w/w	60.0	6
Media Type		steel shot	6
Media Load	%	100	6
Media Makeup Size	mm	6	6
Media Consumption Rate	kg/t milled	0.94	6
Mill Charge - estimate	tonnes	tba	6
Liner Type		rubber	6
Mill Motor	kW Installed	37	6
	kW Drawn	30	5

8.0 INTENSE CYANIDE LEACHING

Leach Feed Dewatering			
Feed Source		gravity + flotation concentrates	1
Feed Solids Rate	tph	2.93	5
Feed Water	m3/h	15.9	5
Feed Density	% w/w	15.6	5
Dewatering Unit		Static Cone	6
Underflow Density	% w/w	75	6
Decant Water	m3/h	14.9	5
Intense Cyanide Leaching			
Leaching Type		In-line Leach Reactor (ILR)	1
Leach Feed			
Solids Rate	tph	2.93	5
Solution Rate	m3/h	0.98	5
Volumetric Rate	m3/h	2.06	5
Head Grade	g/t Au	167.5	5
Dilution Source		spent electrolyte	1
Dilution Rate	m3/h	3.41	5
Dilution Tenor	ppm Au	1.62	5
Leach Density	% w/w	40.0	6
Cyanide Consumption	kg/t feed	10.0	6
	kg/h	29.3	5
Cyanide Strength	% w/w	20	1
Cyanide Solution Addition Rate	kg/h	134.6	5
Sodium Hydroxide Consumption	kg/t feed	2.00	6
Sodium Hydroxide Strength	% w/w	20	5
Caustic Solution Addition Rate	kg/h	29.26	5
Reactor Residence Time	hrs	8.0	6

Reactor Live Volume Req'd	m3	43.8	5
Voidage	%	40	6
Total Reactor Volume	m3	73.0	5
Gold Recovery	%	98.0	3
Solution Tenor	ppm Au	114.1	5
Solids Assay	g/t Au	3.4	5
Leach Residue Dewatering			
Discharge Solids Rate	tph	2.93	5
Discharge Pulp Density	% w/w	40.0	6
Discharge Volumetric Rate	m3/h	5.47	5
Discharge Solution Rate	m3/h	4.39	5
Dewatering Unit		Static Cone	6
Underflow Density	% w/w	60	6
Overflow Solution Rate	m3/h	2.44	5
Underflow Solution Rate	m3/h	1.95	5
Underflow Volumetric Flow	m3/h	3.03	5
Leach Residue Filtration			
Type of Filter		vacuum belt	1
Filter Operation		continuous	1
Feed Pulp Density	% w/w solids	60	6
Solution in Feed	tph	1.95	5
Specific Filtration Rate	t/m2.h	0.50	1
Required Filtration Area	m2	5.9	5
Number of Wash Stages		3	5
Wash Ratio	t water to t solution	1.0	1
Wash Efficiency	%	>99	1
Cake Solids	% w/w solids	85	1
Wash Water Requirement	tph	1.95	5
Filtrate Tenor	ppm Au	57.1	5
Solution Content in Filter Cake	m3/h	0.52	5
Filtrate Solution Flowrate	m3/h	3.38	5
Rich Electrolyte			
Filtrate Solution Flowrate	m3/h	5.82	5
Solution Tenor	ppm Au	81.0	5

9.0 ELECTROWINNING

Rich Electrolyte Tank			
Tank Residence Time	hrs	2.0	1
Live Volume	m3	11.6	5
Freeboard	mm	300	1
Height:Diameter Ratio		1.2	1
Required pH		12.5	1

Electrowinning

Feed Rate	m3/h	5.82	2
Pass Efficiency per Cell	%	98	2
Gold Deposition Rate	g/h	462.0	5
	g/day	11087	5
	g/week	77611	5
Gold:Cathode Loading Ratio		3.0	2
Number of Cells in Parallel		1	2
Number of Cells in Series		1	2
Cathodes per Cell		9	2
Anodes per Cell		10	2
Spent Electrolyte Tank			
Tank Residence Time	hrs	2.0	1
Live Volume	m3	11.6	5
Freeboard	mm	300	1
Height:Diameter Ratio		1.2	1
Spent Electrolyte Tenor	ppm Au	1.62	5
Solution Recycle to ILR	%	58.6	5
	m3/h	3.41	5
Solution Bleed to Cyanide Detox	%	41.4	5
	m3/h	2.41	5

10.0 DORE SMELTING

Cathode Calcining			
Wool:Recovered Metal Ratio		0.17	2
Steel Wool Consumption	kg/week	16	5
Weight Increase Factor After Calcining		1.43	5
Cathode Mass			
Gold Content (assumes 24 hrs availability)	kg/day	11.53	5
Gold Purity - assumed	%	80	2
Gross Cathode Mass - includes calcined wool	kg/week	124	5
Flux:Cathode Ratio		1.0	2
Flux Requirement	kg/week	124	5
Smelting			
Furnace Type		Tilting diesel fired	1
Smelting Temperature - max	deg C	1150	2
Smelting Time - including warmup	h	6	2
Smelts per Week		2	2
Ingot Size	ozs	500	2
Crucible Capacity	L	A200	2
Heater Source		Diesel	2
Dore Production			
Fine Gold Content	kg/week	76.1	5
Assumed Impurities	%	20	1

Dore Production	kg/week	95.1	5
Ingots Per Week Produced		6	5

11.0 CYANIDE DETOXIFICATION

Feed Source		repulped leach residue	1
Feed Solution Flow Rate	m3/h	2.93	5
Solids in Feed	tph	2.93	2
Volumetric Flow Rate	m3/h	4.01	2
Free and WAD Cyanide in Feed			
Average	ppm	350	1
Design	ppm	500	1
Free Cyanide in Tails			
Average	ppm	0.5	2
Design	ppm	1.0	2
Cyanide Flowrate			
Average	kg/h	1.022	5
Design	kg/h	1.46	5
Caro's Acid			
Stoichiometric Dose Rate	kg/kg CN^-	4.38	2
Stoichiometric Factor		1.10	2
Average	kg/h	4.9	5
Design	kg/h	6.4	5
Reaction Time	mins	2	2
Peroxide			
Concentration	%w/w	60.0	4
Average @ concentration noted	kg/h	2.4	5
Design @ concentration noted	kg/h	3.2	5
Sulphuric Acid			
Stoichiometric Factor		1.20	2
Average	kg/h	5.1	5
Max	kg/h	5.5	5

12.0 TAILINGS DISPOSAL

Feed Source		Flotation tails + detox d/c	
Solids Rate	t/h	26.6	5
Feed Density	%w/w	36.0	5
Volumetric Flow Rate	m3/h	57.1	5
Sump Residence Time	mins	1	9
Sump Minimum Live Volume	m3	1.0	2
Tailings Disposal Method		pump to storage dam	9

13.0 WATER BALANCE

Water In			
Mill Feed	m3/h	1.4	5

Reagents Allowance	m3/h	0.2	5
Total	m3/h	1.6	5
Water Out			
Final Tails	m3/h	47.3	5
Net Water Consumption	**m3/h**	**45.7**	5
Process Water Pumping			
Mill Feed	m3/h	0.8	5
Mill d/c	m3/h	10.8	5
Gravity Concentration	m3/h	19.6	5
Rougher Flotation: feed dilution + spray water	m3/h	14.8	5
Scavenger Flotation: feed dilution + launder water	m3/h	11.5	5
Regrind Mill	m3/h	1.3	5
Cleanup - peak demand	m3/h	10.0	5
Concentrate Belt Filter	m3/h	2.0	5
Reagents - peak demand	m3/h	2.8	5
Total	**m3/h**	**73.6**	**5**

14.0 REAGENTS + CONSUMABLES

Grinding Media - Ball Mill			
Media Type		steel balls	1
Consumption			
unit	kg/t new feed	1.20	2
daily (24 hr operation)	t/day	0.77	5
annual (inc. availability)	t/a	262.8	5
Media Size	mm	90	5
On Site Storage	d	365	1
Grinding Media - Regrind Mill			
Media Type		steel shot	1
Consumption			
unit	kg/t new feed	0.06	2
daily (24 hr operation)	t/day	0.04	5
annual (inc. availability)	t/a	12.4	5
Media Size	mm	6	5
On Site Storage	d	365	1
Sulphuric Acid			
Liquid SG		1.834	4
pH		<1	4
Concentration	%w/w	98	4
Consumption			
unit	kg/t	0.21	5

daily (24 hr operation)	t/day	0.13	5
annual (inc. availability)	t/a	45.3	5
Transport Form		Liquid	4
Transport Packaging		Bulka boxes	4
Delivery to Process Plant		drum pump	1
On Site Storage	d	365	1
Sodium Cyanide			
pH		alkaline	4
Net Consumption			
unit	kg/t new feed	1.10	5
daily (24 hr operation)	t/day	0.70	5
annual (inc. availability)	t/a	240.9	5
Mixed Concentration	%w/w	20	1
Addition Rate	l/h	117	5
Mixed Consumption (24 hr operation)	m3/day	2.81	5
Liquid SG		1.15	4
Mixing Tank Capacity	m3	2.8	5
Storage Tank Capacity	m3	3.7	5
Transport Form		pellets	4
Transport Packaging		bulka boxes, 1 tonne	4
Delivery to Process Plant		distribution pumps	1
Boxes per mix		1	1
On Site Storage	d	365	1
Hydrogen Peroxide			
Liquid SG		1.19	4
pH		mildly acidic	4
Concentration	%w/w	60.0	4
Consumption			
unit	kg/t	0.12	5
daily (24 hr operation)	t/day	0.08	5
annual (inc. availability)	t/a	26.2	5
Transport Form		Liquid	4
Transport Packaging		Bulka boxes	4
Delivery to Process Plant		metering pump	4
On Site Storage	d	365	1
Sodium Hydroxide			
pH		alkaline	4
Net Consumption			
unit	kg/t new feed	0.22	5
daily (24 hr operation)	t/day	0.14	5
annual (inc. availability)	t/a	48.2	5
Mixed Concentration	%w/w	20	1
Liquid SG		1.2	4
Addition Rate	l/h	23	5
Mixed Consumption (24 hr operation)	m3/day	0.56	5

Mixing Tank Capacity	m3	0.56	5
Storage Tank Capacity	m3	0.73	5
Transport Form		pellets	4
Transport Packaging		25 kg bags	4
Delivery to Process Plant		distribution pumps	1
Bags per mix		3	1
On Site Storage	d	365	1
Diesel (Cathode Smelting)			
Consumption			
unit	l/h	25	2
hours per campaign	h	6	2
campaigns per week		2	2
annual	m3/a	15.6	5
Liquid SG		0.9	4
Transport Form		Liquid	4
Receival Method		metered from day tank	4
Storage Capacity	days	14	2
Storage Tank Volume	m3	0.6	5
Smelting Fluxes			
Requirement per week	kg/week	124	5
Flux Makeup (typical)			
Anhydrous Borax	%	20	2
Silica	%	42	2
Sodium Nitrate	%	30	2
Soda Ash	%	8	2
Total	%	100	2
Annual Requirement (including availability)			
Anhydrous Borax	t/a	1.28	5
Silica	t/a	2.70	5
Sodium Nitrate	t/a	1.93	5
Soda Ash	t/a	0.51	5
Total	t/a	6.423	5
Storage Capacity	days	365	2
Steel Wool Cathodes			
Type		Grade 1 ribbon	2
Requirement	kg/week	15.8	5
Annual Requirement	kg/a	824.1	5
Storage Capacity	days	365	2
Flotation Collector			
Type		Potassium Amyl Xanthate	3
pH		Alkaline	4
Net Consumption			
unit	g/t new feed	96	5
daily (24 hr operation)	kg/d	61.0	5

annual (inc. availability)	t/a	20.9	5
Mixed Concentration	%w/w	10.0	2
Addition Rate	l/h	22.9	5
Mixed Consumption (24 hr operation)	m3/day	0.55	5
Mixing Tank Capacity	m3	0.5	5
Storage Tank Capacity	m3	0.7	5
Deliver to Process Plant		distribution pumps	2
Transport Form		Powder	4
Transport Packaging		Drum, 220 kg	4
Drums/mix		2.0	5
On Site Storage	d	365	1
Frother			
Type		MIBC	3
Bulk Density	t/m3	0.80	4
Consumption	g/t new feed	96	5
unit	l/day	76.2	5
annual	m3/a	26.2	5
Delivery to Process Plant		metering pump	2
Drum Capacity	L	300	4
	days	3.9	5
Transport Form		Liquid	4
Transport Packaging		Drum	4
On Site Storage	d	365	1
Flotation Promoter			
Type		A3418A	3
pH		Alkaline	4
Form		liquid	4
SG		1.1	4
Net Consumption			
unit	g/t new feed	18	5
daily (24 hr operation)	kg/d	11.6	5
	l/d	10.6	5
annual (inc. availability)	t/a	4.0	5
Delivery to Process Plant		metering pump	2
Transport Packaging		200 litre drums	4
On Site Storage	d	365	1
Flotation Activator			
Type		Copper Sulphate	3
pH		Alkaline	4
Net Consumption			
unit	g/t new feed	118	5
daily (24 hr operation)	kg/d	76	5
annual (inc. availability)	t/a	25.9	5
Mixed Concentration	%w/w	10.0	2
Addition Rate	l/h	28.3	5

Mixed Consumption (24 hr operation)	m3/day	0.68	5
Mixing Tank Capacity	m3	0.7	5
Storage Tank Capacity	m3	0.9	5
Delivery to Process Plant		distribution pumps	2
Transport Form		Powder	4
Transport Packaging		25 kg bags	4
Bags/mix		3	5
On Site Storage	d	365	1

15.0 SERVICES + UTILITIES

Compressed Air			
HP Plant Air			
Flowrate	Nm3/h	400	2
Operating Pressure	kPa	700	2
No Units		2	2
No Operating		1	2
LP Plant Air			
Flowrate	Nm3/h	300	2
Operating Pressure	kPa	70	2
No Units		Takeoff from HP Circuit	2
Flotation Air			
Blower Type		centrifugal with letdown	2
Flowrate	m3/h	2,685	5
Operating Pressure	kPa	50	2
No Units		2	2
No Operating		1	2
Instrument Air		with dryer	2
Flowrate	Nm3/h	10	2
Operating Pressure	kPa	600	2
No Units		2	2
Raw Water			
Source		lake supply	9
Supply method		submersible pump in decant	1
Plant Requirements			
- continuous	m3/h	46	2
- peak demand	m3/h	90	1
LP Process Water			
Source		raw water	9
Storage Type		Tank	2
Live Storage Volume	m3	72	5
Surge Residence Time	h	1.0	2
Plant Requirements	m3/h	72	5

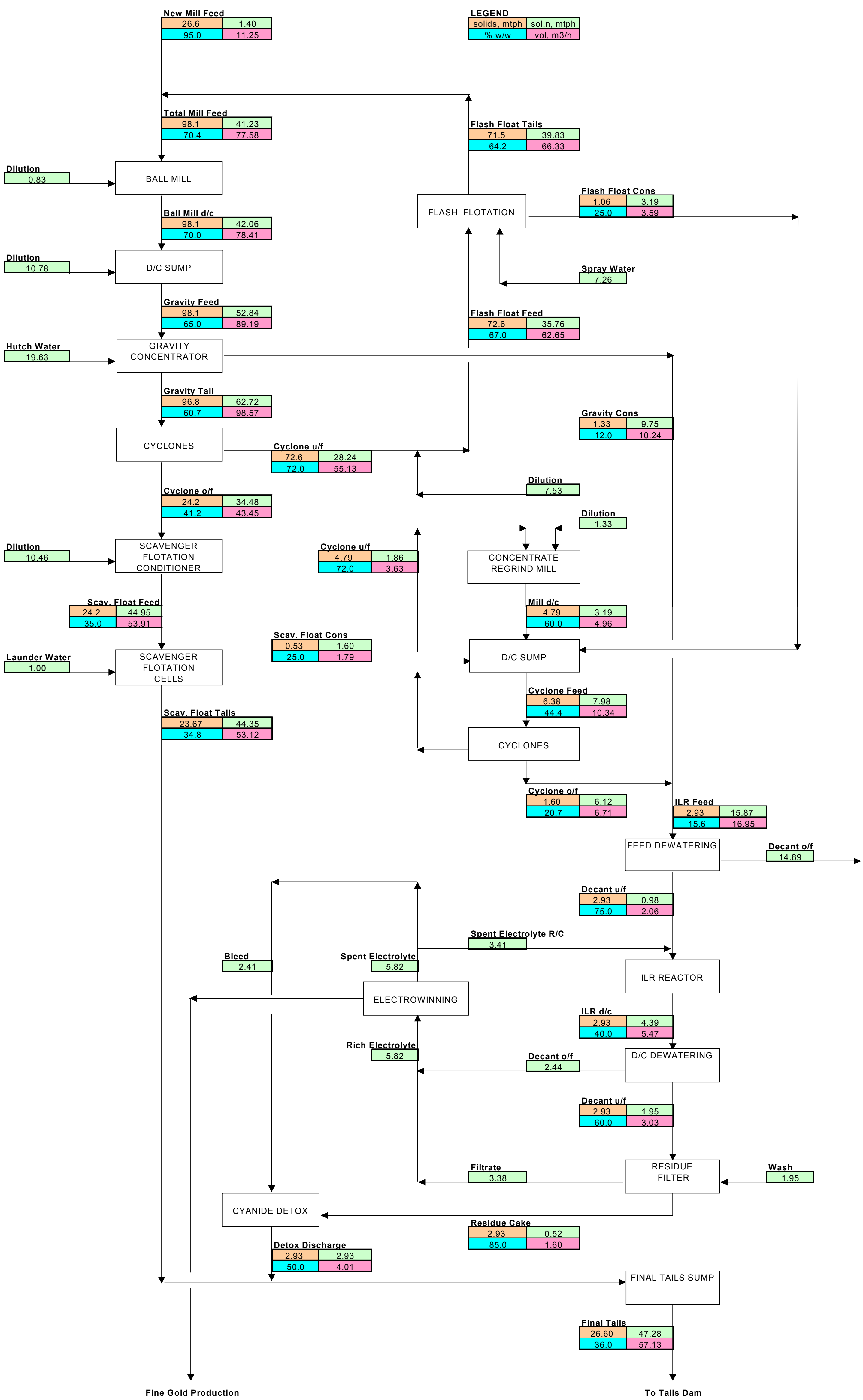
HP Process Water			
Source		raw water	2
Storage Type		Tank	2
Live Storage Volume	m3	10	2
Surge Residence Time	h	1.0	2
Plant Requirements	m3/h	10	2
Potable Water			
Source		tba	
Treatment		UV	2
Storage Volume	m3	5	2
Consumption	m3/h	2	2

Appendix B

BLOCK FLOWSHEET AND MASS BALANCE

MODULAR PLANT BLOCK MASS BALANCE

CLIENT:	Hope Bay Joint Venture
PROJECT:	Hope Bay Engineering Study
JOB NUMBER:	MAP102
CASE:	Final Option for Study - Gravity/Flotation/Leach Plant, 600 tpd
DATE:	January 31, 2002
REVISION:	A



NET WATER DEMAND =	**45.7 m3/h**

Appendix C

EQUIPMENT LIST

MECHANICAL EQUIPMENT LIST

CLIENT :Hope Bay Joint Venture

PROJECT : M3918

PROJECT :Hope Bay Scoping Study

PLANT TYPE :Modular Gravity / Flotation Plant, 600 tpd - no tails dewatering, water supplied included

REVISION :A

DATE :31-Jan-02

IDENTIFICATION							POWER			
AREA	ITEM	Tag No.	DESCRIPTION	CAPACITY	Size	UNIT QTY.	Each kW	Installed kW	Draw Factor	Drawn kW
			Area 110: ROM Ore Crushing							
110	CP	01	Modular Crushing Plant	60 tph		1	250.0	250.0	0.80	200.0
110	CV	01	Secondary Crusher Feed Conveyor		18m x 600mm wide	1	5.5	5.5	0.80	4.4
110	CV	02	Cone Crusher Recycle Conveyor # 1		20m x 600mm wide	1	5.5	5.5	0.80	4.4
110	CV	03	Cone Crusher Recycle Conveyor # 2		20m x 600mm wide	1	5.5	5.5	0.80	4.4
110	CV	04	Stacking Conveyor		30m x 600mm wide	1	7.5	7.5	0.80	6.0
110	MD	01	Metal Detector			1				
110	MH	01	Manual Hoist	2 ton		1				
					Totals	**7**		**274**		**219**

IDENTIFICATION										
AREA	ITEM	Tag No.	DESCRIPTION	CAPACITY	Size	UNIT QTY.	POWER Each KW	Installed kW	Draw Factor	Drawn kW
			Area 120: Milling, Classification, Gravity Separation + Rougher Flotation							
120	BM	05	Ball Mill with Hydraulic Drive	44.3 ton		1	500.0	500.0	0.86	432.0
120	BN	01	Reclaim Feed Bin	2.5m3		1				
120	BN	02	Ball Charging Kibble	1 ton		1				
120	CV	01	Mill Feed Conveyor	32tph	25m 600mm wide	1	3.3	3.3	0.80	2.6
120	CY	01	Cyclones	120m3/h	380mm dia.	2				
120	DB	01	Underflow Distribution Box	1m3		1				
120	FC	01	Flash Flotation Cell	80tph	SK 80	1	11.0	11.0	0.80	8.8
120	GC	01	Rougher Gravity Concentrator	100tph	IPJ2400	1	2.2	2.2	0.80	1.8
120	MH	01	Hoist - manual	2 ton		1				
120	PP	01	Ball Mill D/C Sump Pumps	107m3/h	4/3-AH	2	60.0	120.0	0.80	48.0
120	PP	02	Mill Area Spillage Pump	30m3/h	65 QV SP	1	7.5	7.5	0.80	6.0
120	SM	01	Ball Mill D/C Sump	2m3		1				
120	SS	01	Milling Area Safety Shower			1				
120	VB	01	Vibrating Feeder	32tph		1	1.1	1.1	0.80	0.8
120	WT	01	Weightometer	32tph		1				
					Totals	**17**		**645**		**500**

IDENTIFICATION										
AREA	ITEM	Tag No.	DESCRIPTION	CAPACITY	Size	UNIT QTY.	POWER Each kW	Installed kW	Draw Factor	Drawn kW
			Area 125: Scavenger Flotation							
125	TK	01	Scavenging Conditioning Tank	4 m3	1.7 dia x 2.05 high	1				
125	AG	01	Scavenging Conditioning Tank Agitator		Mixer Model 1080	1	1.5	1.5	0.80	1.2
125	TK	03	Frother Head Tank + Lid	20 litre		1				
125	TK	04	Activator Head Tank + Lid	100 litre		1				
125	TK	05	Collector Head Tank + Lid	100 litre		1				
125	TK	06	Promotor Head Tank + Lid	20 litre		1				
125	FC	01	Scavenger Flotation Tank Cells	9m3		4	11.0	44.0	0.80	35.2
125	PP	01	Flotation Area Spillage Sump Pump	30m3/h	65 QV SP	1	7.5	7.5	0.80	6.0
125	PP	02	Scavenger Flotation Concentrate Pump	2.2m3/h	3/4" froth	1	5.5	5.5	0.80	4.4
125	SS	01	Floation Area Safety Shower			1				
125	SM	01	Samplers			3	0.4	1.1	0.80	0.9
					Totals	**16**		**60**		**48**

IDENTIFICATION

AREA	ITEM	Tag No.	DESCRIPTION	CAPACITY	Size	UNIT QTY.	POWER Each kW	Installed kW	Draw Factor	Drawn kW
			Area 130: Concentrate Regrind, Leaching + Filtration							
130	RM	01	Concentrate Regrind Mill	3.5 tph	VTM 40 WB	1	37.0	37.0	0.81	30.0
130	CC	01	Regrind Circuit Cyclone	12.4 m3/h	100mm dia	1				
130	PP	01	Regrind Cyclone Feed Pump	12.4 m3/h	3/4" froth pump	2	5.5	11.0	0.80	4.4
130	SM	01	Regrind Mill d/c Sump	2.0m3		1				
130	BN	01	Media Charging Kibble	100 kg		1				
130	LR	01	In-Line Leach Reactor	5.0 tph	ILR5000	1	40.0	40.0	0.80	32.0
130	BF	01	Vacuum Belt Filter	3.5 tph	9m3 effective area	1	15.0	15.0	0.80	12.0
130	DL	01	Filter Discharge Launder		inc with Belt Filter	1				
130	PP	02	Filtration Area Spillage Pump	20m3	40 PV SP	1	5.5	5.5	0.80	4.4
					Totals	**10**		**109**		**83**

IDENTIFICATION

AREA	ITEM	Tag No.	DESCRIPTION	CAPACITY	Size	UNIT QTY.	POWER Each kW	Installed kW	Draw Factor	Drawn kW
			Area 140: Goldroom							
140	PC	01	Primary Electrowinning Cell		900mm x 900mm	1	18.0	18.0	0.80	14.4
140	SC	01	Scavenger Electrowinning Cell		900mm x 900mm	1	18.0	18.0	0.80	14.4
140	TK	01	Rich Electrolyte Tank with Lid	11.6 .m3	2.4 dia x 2.9 high	1				
140	TK	02	Spent Electrolyte Tank with Lid	11.6 .m3	2.4 dia x 2.9 high	1				
140	TK	03	Electrowinning Feed Box	0.1 m3	0.4 dia x 0.6 high	1				
140	CO	01	Calcining Oven		200 litre	1	14.0	15.0	0.80	11.2
140	PP	01	Goldroom Area Spillage Pump	20 m3/h	40 PV SP	1	5.5	5.5	0.80	4.4
140	WU	01	Cathode Washdown Unit			1				
140	WH	01	Cathode Wash Hopper		1m3	1				
140	CF	01	Cathode Sludge Filter			1				
140	PT	01	Cathode Preparation Table			1				
140	WS	01	Weighing Scales	0 - 40 kg	Model HL206-61	1				
140	SM	01	Smelting Furnace		A200 crucible size	1				
140	MB	01	Flux Mixing Barrel	1 m3		1				
140	SF	01	Safe			1				
140	DM	01	Dore Moulds		1000 oz	1				
140	EH	01	Smelting Exhaust Hood and Fan			1	3.3	3.3	0.80	2.6
140	EH	02	E/W Exhaust Hood and Fan			1	3.3	3.3	0.80	2.6
140	SS	01	Goldroom Safety Shower			1				
140	PP	02	E/W Feed Pump	4.1 m3/h	Helical Rotor - C61M	1	1.1	1.1	0.80	0.9

140	PP	03	Spent Electrolyte Pump	4.1 m3/h	Helical Rotor - C61M	1	1.1	1.1	0.80	0.9
140	MH	01	Hoist	250 kg		1				
140	VD	01	Vault Door			1				
					Totals	**23**		**65**		**51**

IDENTIFICATION										
AREA	**ITEM**	**Tag No.**	**DESCRIPTION**	**CAPACITY**	**Size**	**UNIT QTY.**	**POWER Each kW**	**Installed KW**	**Draw Factor**	**Drawn kW**
			Area 150: Cyanide Detox + Tailings							
150	PP	03	Final Tails Pumps - 1st stage	69 m3/h	3/2-AH-CC	2	45.0	90.0	0.8	36.0
150	PP	04	Final Tails Pumps - 2nd stage	69 m3/h	3/2-AH-CC	2	45.0	90.0	0.8	36.0
150	DR	01	Cyanide Detox Reactor with Lid	1m3	1.1 dia x 1.3 high	1				
150	AG	01	Cyanide Detox Reactor Agitator		Mixer Model 1030	1	0.55	0.55	0.8	0.44
150	AR	01	Caro's Acid Reactor	15 l/h		1				
150	SU	01	Final Tails Sump	2m3		1				
					Totals	**8**		**181**		**72**
IDENTIFICATION										
						UNIT	**POWER**			

AREA	ITEM	Tag No.	DESCRIPTION	CAPACITY	Size	QTY.	Each kW	Installed kW	Draw Factor	Drawn KW
			Area 180: Reagents							
180	AG	01	Collector Mixing Tank Agitator		Mixer Model 1040	1	0.37	0.37	0.80	0.30
180	AG	02	Copper Sulphate Mixing Tank Agitator		Mixer Model 1040	1	0.37	0.37	0.80	0.30
180	AG	03	Caustic Mixing Tank Agitator		Mixer Model 1040	1	0.37	0.37	0.80	0.30
180	AG	04	Sodium Cyanide Mixing Tank Agitator		Mixer Model 1040	1	0.37	0.37	0.80	0.30
180	TK	01	Collector Mixing Tank	0.8m3		1				
180	TK	02	Copper Sulphate Mixing Tank	0.8m3		1				
180	TK	03	Caustic Mixing Tank	0.6m3		1				
180	TK	04	Sodium Cyanide Mixing Tank	2.8m3		1				
180	TK	05	Collector Circulation Tank	1.0m3		1				
180	TK	06	Copper Sulphate Circulation Tank	1.0m3		1				
180	TK	07	Caustic Circulation Tank	0.8m3		1				
180	TK	08	Sodium Cyanide Circulation Tank	3.7m3		1				
180	PP	01	Collector Dosing Pump	120 l/h	SP10	1	0.18	0.18	0.80	0.14
180	PP	02	Copper Sulphate Dosing Pump	120 l/h	SP10	1	0.18	0.18	0.80	0.14
180	PP	03	Caustic Dosing Pumps	50 l/h	SP10	2	0.15	0.30	0.80	0.12
180	PP	04	Sodium Cyanide Dosing Pumps	250 l/h	SP10	2	0.18	0.36	0.80	0.14
180	PP	05	Peroxide Drum Delivery Pump	12 l/h	SP10	1	0.15	0.15	0.80	0.12
180	PP	06	Sulphuric Acid Drum Delivery Pump	20 l/h	SP10	1	0.15	0.15	0.80	0.12
180	PP	07	Promoter Drum Delivery Pump	20 l/h	SP10	1	0.18	0.18	0.80	0.14
180	PP	08	Frother Drum Delivery Pump	20 l/h	SP10	1	0.18	0.18	0.80	0.14

180	PP	09	LPG Delivery Pump	50 l/h	SP10	1	0.18	0.18	0.80	0.14
180	PP	10	Alkaline Reagents Area Spillage Pump	20 m3/h	40 PV SP	1	5.50	5.50	0.80	4.40
180	MH	01	Reagents Hoist	2 ton		1				
180	DT	01	Collector Drum Tipper		200 litre drums	1				
					Totals	**26**		**8.8**		**6.8**

IDENTIFICATION							
						UNIT	**POWER**

AREA	ITEM	Tag No.	DESCRIPTION	CAPACITY	Size	QTY.	Each kW	Installed kW	Draw Factor	Drawn kW
190	TK	01	Process Water Tank	72 m3	4.5 dia x 4.9 high	1				
190	TK	02	High Pressure Water Tank	20 m3	2.3 dia x 2.7 high	1				
190	TK	03	Potable Water Tank	5 m3	1.8 dia x 2.3 high	1				
190	XM	01	Raw Water Decant Tower		2 m dia x 10m high	1				
190	PP	01	LP Pressure Water Pumps	86m3/h	3/2-AH	2	15.0	30.0	0.8	12.0
190	PP	02	HP Pressure Water Pumps	12m3/h	1.5/1-AH	2	5.5	11.0	0.8	4.4
190	PP	03	Gland Seal Water Pumps	12m3/h	1.5/1-AH	2	5.5	11.0	0.8	4.4
190	PP	04	Potable Water Pumps	12m3/h	1.5/1-AH	2	5.5	11.0	0.8	4.4
190	PP	05	Raw Water Supply Pump	90m3/h	100 mm dia, multi-stage	1	45.0	45.0	0.8	36.0
190	FB	01	Flotation Blowers	50 kPa	URAI 33	2	5.5	11.0	0.8	4.4
190	CM	01	Plant Air Compressors	600 kPa	SSR XF60	2	45.0	90.0	0.8	36.0
190	CM	02	Instrument Air Compressors	600 kPa	SSR XFE-50	2	37.0	74.0	0.8	29.6
190	AR	01	Plant Air Receiver		R-4 1000L	1				
190	AR	02	Instrument Air Receiver		R-5 1350L	1				
190	AD	01	Instrument Air Dryer		TS-110	1				
					Totals	**22**		**283**		**131**
					Grand Totals	**129**		**1,625**		**1,112**

Appendix D

PROCESS FLOW DIAGRAMS

Appendix E

CAPITAL COST ESTIMATE

APPENDIX D
Process Research Associated Report

Metallurgical Study
Doris Deposit
Hope Bay Project

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Attention: **Mr. Dean McDonald**

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Managed by Peter Tse
General Manager

Date: January 14, 2002 <DRAFT FOR COMMENT AND REVIEW>

TABLE OF CONTENTS

1.0 SUMMARY

Laboratory studies were performed on a number of mineral samples obtained from the Doris Deposit, at the Hope Bay Gold Project. The samples were obtained from three areas, consisting of the Doris Central - Stringer Zone (CSZ), Doris Central – Lakeshore Vein (CLV), and Doris North.

The use of gravity recovery followed by cyanidation of gravity tailing or cyanidation of flotation concentrate provided for a promising treatment procedure;

- The gravity concentrate typically recovered 25% to 50% of the gold present, depending on the composite sample tested and grind conditions used.
- The primary grind can be relatively coarse (80% passing 149 microns), which will impact the size of the mill as well as the power required. Gold recovery improved at finer grind sizes and this may be justified pending economic evaluation.
- Overall gold recoveries using gravity and cyanidation ranged from 89% to 98.5% depending on the composite sample tested and conditions used.
- The gold recovery to the flotation rougher concentrate is good and only this concentrate needs to be reground prior to cyanidation, rather than the whole ore.
- The overall recovery of the gold by gravity and cyanidation of reground flotation concentrate ranged from 93% to 98%.

The test program indicates that the Doris material responds well to conventional gravity, flotation and cyanidation procedures for recovery of gold.

2.0 INTRODUCTION

Process Research Associates Ltd. (PRA) was commissioned by Miramar Mining Corporation to undertake laboratory metallurgical studies on samples from the Hope Bay deposit located in the Nunavut Territory, Canada. The objective of the test work was to identify a preliminary process flow sheet using gravity, flotation and cyanidation procedures to recover the precious metals from the Doris ore zone.

This report summaries the metallurgical test procedures and results of the program.

3.0 PROCEDURES

3.1 Sample Preparation

The samples for the Doris test program were received in August 2001. The samples came from the mine exploration site for composition and for metallurgical testing. The drill core samples were jaw crushed to –10 mesh before compositing according to client instructions. After compositing, a sub-sample was taken out and pulverized for head assaying. The remainder of the sample was riffled into either 1kg or 2kg batches for metallurgical testing. The sample inventory log sheets, which include the individual sample identification numbers and sample weights are provided in Appendix.

A number of test grinds were performed in a laboratory stainless rod mill on composite samples to establish a suitable time to achieve a desired particle distribution for the test program.

3.2 Analytical Procedures

3.2.1 Fire Assay

The Au and Ag analysis was performed by using a standard fire assay procedure. A weighed sample was mixed with litharge and the required soda ash and borax fluxes to produce a fluid slag at 1000^{o}C. After cooling, the lead button was separated from the glassy slag and re-melted in a cupel, which absorbed the oxidized base metals. The remaining precious metals bead was weighed, dissolved in acid and analyzed by Atomic Absorption (AA) spectrophotometry.

3.2.2 Sulfur Analyses

The total sulphur concentration was determined by a wet chemical technique. The sample was oxidized by digesting it on a hot plate in a mixture of potassium bromide, bromine and nitric acid, until the excess bromine had been driven off. The solution was evaporated to dryness, re-dissolved in hydrochloric acid and re-evaporated to dryness. This step was repeated before a final dissolution in a 10% HCl solution. The sulphur was precipitated as barium sulphate, filtered, burned to an ash, and weighed.

3.3 Grinding

Test grinds were conducted to determine the grind time required to achieve target size of K80 in a laboratory stainless steel rods mill at 65% w/v solid content.

Screen analyses were carried out in a standard Rotap, with 8" diameter stacked test sieves in ascending mesh sizes. The sample was initially wet screened at 37 microns. The +37 micron fraction is then dry screened through a series of stacked test sieves. Each fraction was collected and weighed for calculating the individual percent retained on the screen.

3.4 Gravity Concentration

The ground sample was repulped to 20% solids and subjected to Falcon SB40 concentrator in typically one pass at a centrifugal force of 200G; with the back water pressure set at 1 psi. The Falcon concentrate was panned, the pan concentrate was assayed and the pan tail and Falcon tail combined for either cyanide leaching or flotation.

3.5 Batch Flotation

The batch flotation tests were conducted in a Denver D12 laboratory flotation machine. A 2 kg gravity tailing ore sample was used in each test. The cell size was chosen to make a typical flotation pulp density of 30-35% solids by weight. The impeller speed was set at 1800 RPM and the air flow was controlled manually to maintain the froth level. Potassium amyl xanthate (PAX) was used as the collector for most of the flotation tests. The flotation was conducted at natural pH with one stage rougher and three stages of scavenger and combined into a bulk concentrate. The detailed procedures and conditions were recorded for each individual flotation test and are attached in the Appendix.

3.6 Cyanidation

The gravity tailing, flotation concentrate and flotation tailing were each cyanide leached at 40% solids, typically for 48 hours. A target pH 10.5, and minimum NaCN concentration of 1 g/L was maintained throughout the test. Intermittent solution samples were taken for kinetic determination of gold extraction. At termination of testing the slurry was filtered and the cake washed with hot NaCN solution, followed with two displacements hot water washes. Mass and material balances were performed for all the tests.

4.0 RESULTS AND DISCUSSION

4.1 Sample Preparation and Characterization

The samples were jaw crushed to –10 mesh and blended into five composites. The composition information and head assay results are tabulated in Table 4.1 and Table 4.2, respectively.

Table 4.1 – Doris Composites

Doris CSZ	Doris CLV	Doris North
TDD129S	TDD129LV	TDM97LV
TDD131S	TDD131LV	TDM98LV
TDD135S	TDD135LV	TDM100LV
TDD138S	TDD368LV	TDM105DH
TDD368S	TDD376LV	
TDD376S	TDD387LV	
TDD387S	TDD388ALV	
TDD388AS	TDD389LV	
TDD389S	TDD390ALV	
TDD390AS		
TDD392S		

Table 4.2 – Doris Composites Head Assays

Sample ID	Au g/t	S_T %	As %	Cu %	Fe %
Doris CSZ	13.4	2.87	<0.0005	0.009	7.2
Doris CLV	9.60	1.36	<0.0005	0.007	2.7
Doris North	7.60	0.46	0.0007	0.008	1.3

4.2 Bond Ball Mill Index

A Bond Ball Mill Work Index (W.I.) was conducted with a Bico Mill using standard procedures with a 149 um sieve size. The results are summarized in Table 4.3, with detailed procedures and results provided in the Appendix.

Table 4.3 – Ball Mill Work Index

Test No.	Zone	W.I., kWh/tonne
BI3	Doris North	17.5
BI4	Doris CSZ	15.7
BI7	Doris CLV	15.3

4.3 Gravity Concentration – Cyanidation

The gold recovery using a combination of gravity procedures and cyanide leaching process was conducted to determine the benefit of gravity concentration on gold recovery prior to cyanide leaching

The composites were tested at three different primary grind sizes, of 80% passing 140 microns, 74 microns and 44 microns respectively. The combination of gravity concentration and cyanidation achieved excellent overall gold recovery exceeding 97% at the finest primary grind size. The gravity (pan concentrate) recovery ranged from 28% at the coarser grind size to 49% at the finer grind size. The cyanide leach circuit extracted over 95% of the Au on the gravity tail at finer grind size after leaching for 48 hours. The detailed procedures and results are provided in the Appendix. The summaries of the test results are tabulated in Table 4.4 and Figures 4.1 to 4.3.

Table 4.4 – Summary of Gravity and Cyanidation Test Results

Test No	Sample ID	Grind P80=um	% Recovery			Reagent Consumption, kg/t	
			Gravity	Cyanide	Total	*NaCN	*Ca $(OH)_2$
C15	Doris CSZ	149	27.5	61.5	89.0	2.63	0.17
C16		69	52.6	44.8	97.4	2.45	0.17
C17		45	45.3	53.0	98.3	2.95	0.17
C24	Doris CLV	140	36.7	58.1	94.9	0.63	0.13
C25		73	45.2	52.1	97.3	0.75	0.14
C26		48	42.6	55.9	98.5	0.77	0.18
C27	Doris North	145	32.5	61.3	93.8	0.60	0.12
C28		99	36.1	59.0	95.1	0.69	0.10
C29		45	35.8	61.9	97.7	0.74	0.16

*the cyanide recovery and reagent consumption was calculated at 48 hours retention time.

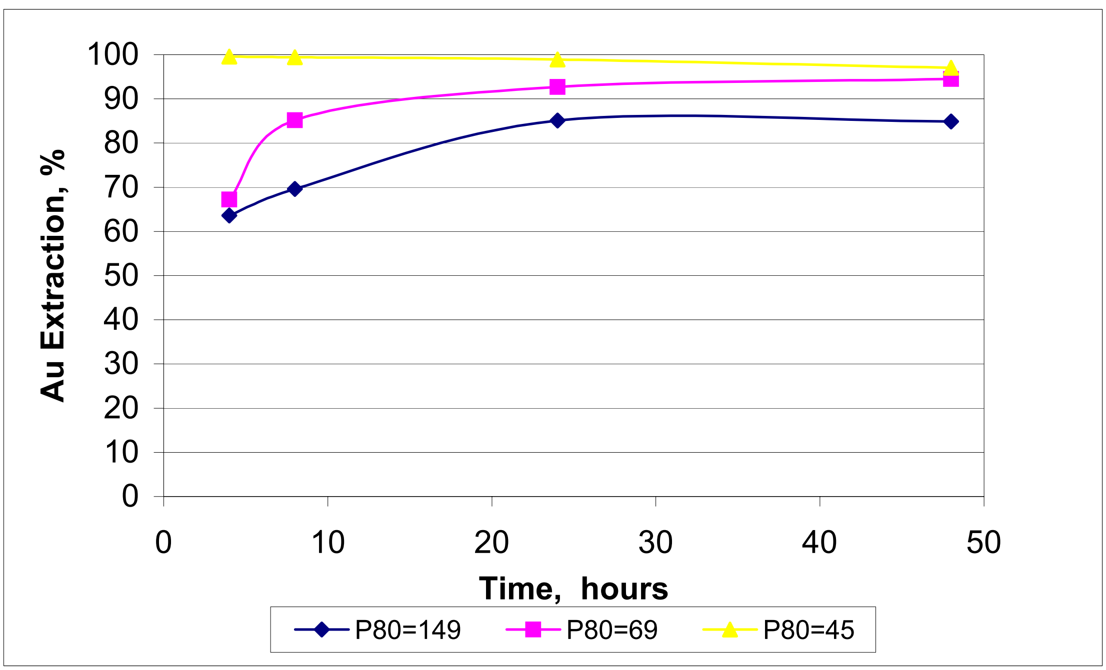

Figure 4.1 – Cyanide Leach Kinetics on Doris CSZ

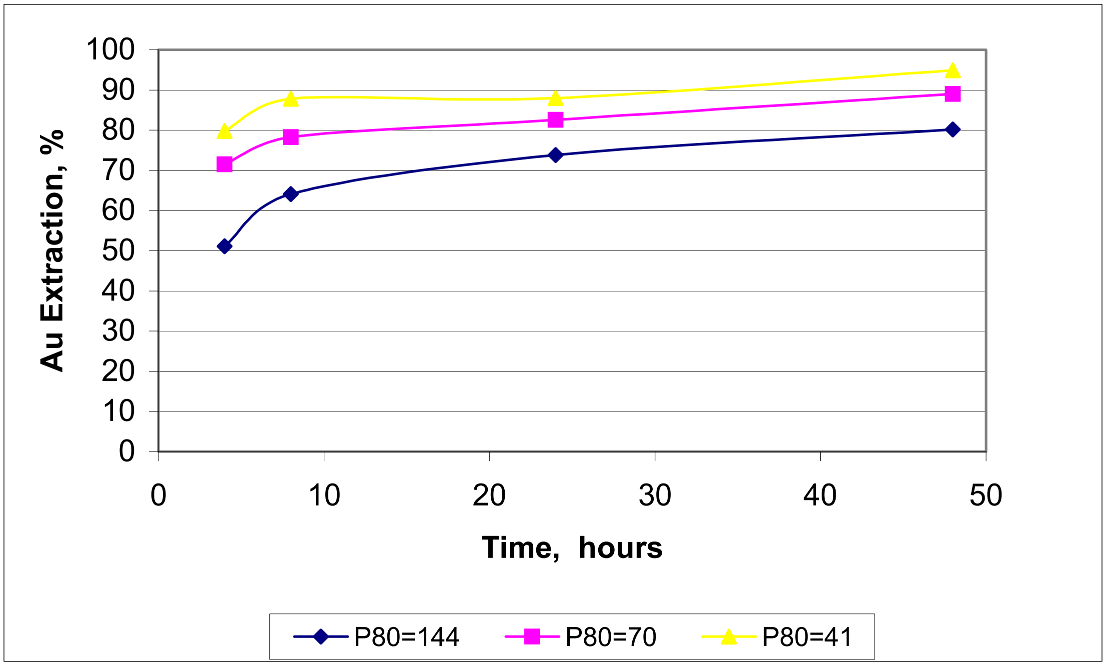

Figure 4.2 – Cyanide Leach Kinetics Doris CLV

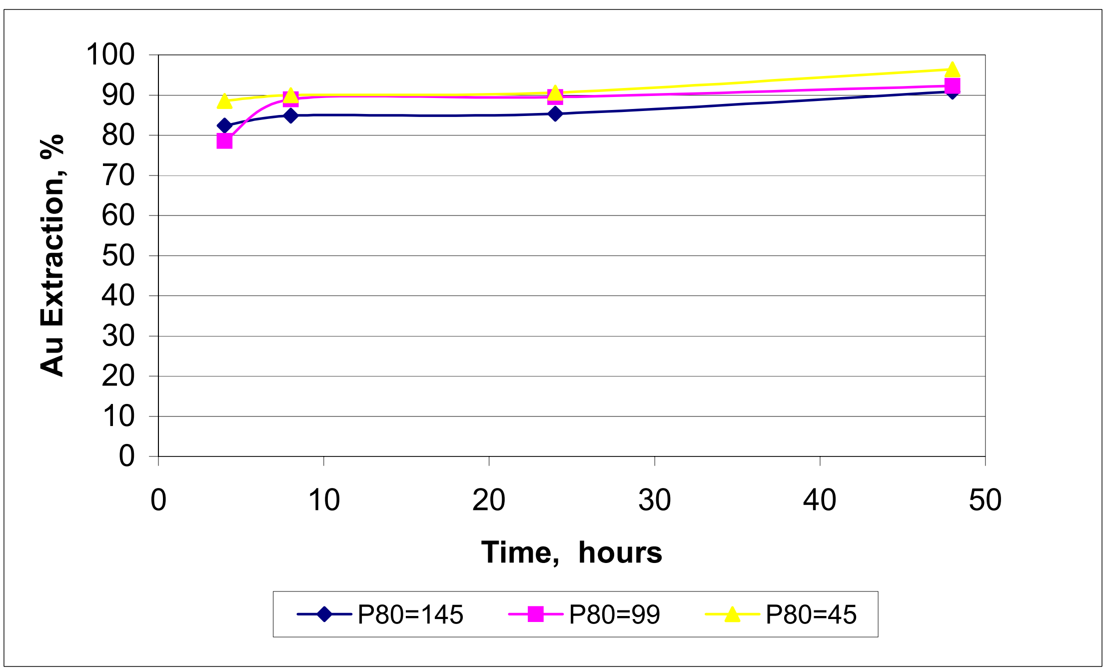

Figure 4.3 – Cyanide Leach Kinetics on Doris North

The data shows that the leaching kinetics increased with a finer grind size, and that optimum gold extraction appeared after approximately 24 hours leach retention time. The NaCN consumption will be lower at 24 hours, as compared to 48 hours of leaching.

4.4 Batch (Open Circuit) Flotation

A series of rougher flotation tests were conducted on the Doris zone composites to determine the amenability of the ore to the flotation process. All the flotation tests were conducted on the gravity tailing using procedures established on earlier studies conducted for other samples obtained from the Hope Bay Project.

The tests (F20 to F25) on the Doris composites used only PAX as collector and were conducted at two different primary grind sizes. Prior to flotation, the ground samples were subjected to gravity concentration using Falcon® SB40 concentrator. The finer primary grind size marginally improved the overall gold recovery. The test results are summarized in Table 4.5 and 4.6. The detailed procedure and results are provided in the Appendix.

Table 4.5 – Rougher Flotation Test Summary

Test No	Sample ID	Grind Size P80=um	Weight Rec. %	Flotation Concentrate Grade		Flotation Recovery	
				Au, g/t	S_T, %	Au, %	S_T, %
F20	Doris CSZ	135	14.2	46.8	21.6	89.8	98.4
F21		67	12.7	51.0	23.0	91.0	98.2
F22	Doris CLV	144	6.7	88.2	20.2	94.0	98.7
F23		74	7.6	101	18.2	96.5	99.3
F24	Doris North	143	6.1	83.4	8.22	97.1	98.1
F25		80	6.7	74.2	6.81	97.8	98.0

Table 4.6 – Overall Test Summary

Test No	Sample ID	Grind Size P80=um	Final Tail Au Grade G/t	% Au Distribution		
				Gravity	Flotation	Total
F20	Doris	135	0.88	29.2	63.6	92.8
F21	CSZ	67	0.73	38.5	56.0	94.5
F22	Doris CLV	144	0.41	32.3	63.6	95.9
F23		74	0.30	40.5	57.5	97.9
F24	Doris	143	0.16	29.0	69.0	97.9
F25	North	80	0.12	25.8	72.5	98.4

The test results show that all the samples tested were amenable to gravity-flotation procedure. The overall gold recovery ranged from 93% to 98%.

4.5 Gravity-Flotation-Cyanidation

The Doris composite samples were subjected to gravity-flotation-cyanidation procedures to determine the total gold (Au) extraction at a target primary grind size of 80% passing 149 microns. The test procedure is presented schematically in Figure 4.4. The detailed procedure is in the Appendix.

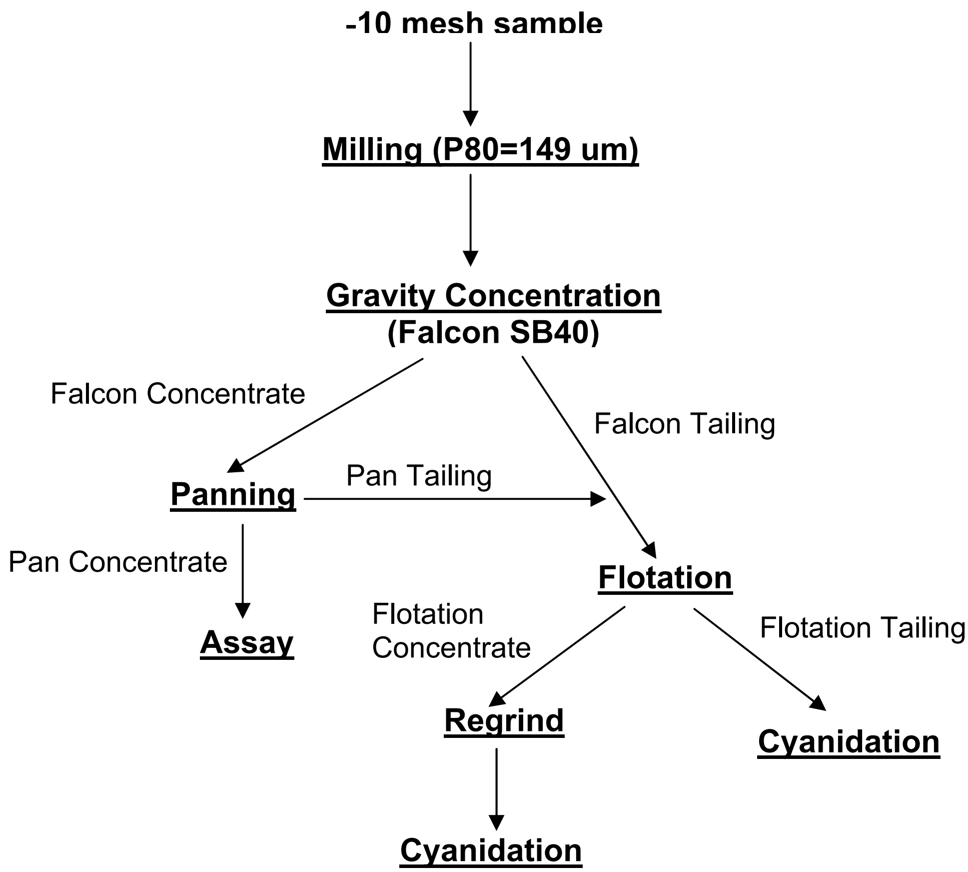

Figure 4.4 – Gravity-Flotation-Cyanidation Test Procedure

The combined gravity and cyanidation performed on the whole ore achieved greater than 97% gold recoveries for composites Doris North, CSZ, and CLV. The combination of gravity-flotation-cyanidation procedure achieved excellent results as summarized in Table 4.7. The cyanide leach kinetics is presented graphically in Figure 4.5 and 4.6. The detailed procedures and results are provided in the Appendix.

Table 4.7 – Gravity-Flotation-Cyanidation Total Au Recovery

Test No	Sample ID	% Au Recovery			
		Gravity	Cyanide C	Cyanide T	Total
F27	Doris North	32.9	63.8	2.4	99.1
F30	Doris CSZ	32.3	59.2	6.0	97.5
F31	Doris CLV	51.0	45.9	2.3	99.2

Cyanide C=Flotation Concentrate, Cyanide T=Flotation Tailing

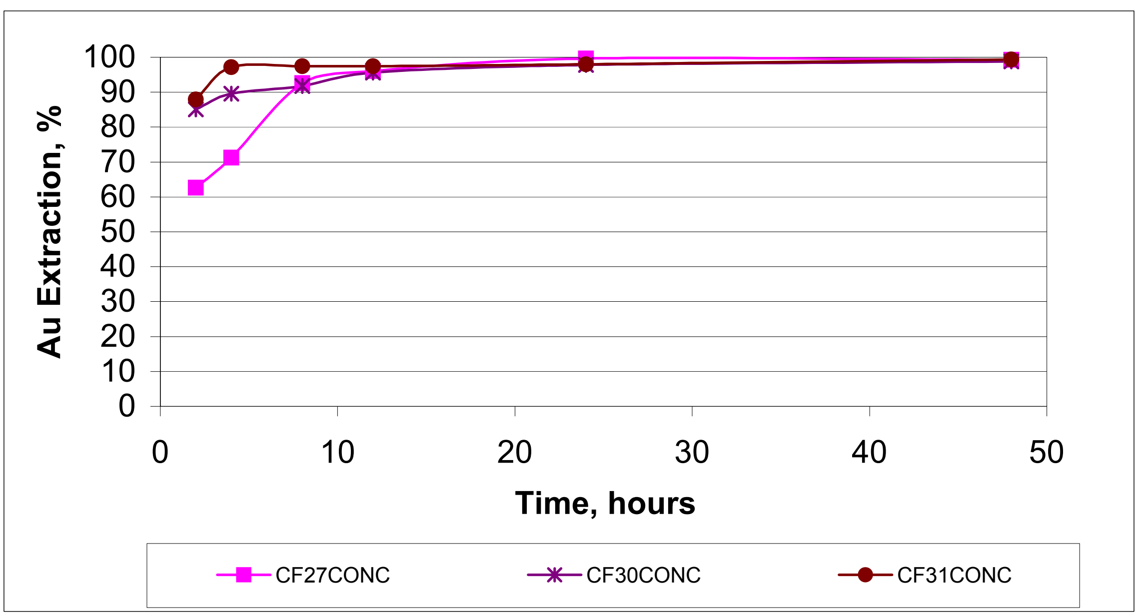

Figure 4.5 – Flotation Concentrate Cyanidation Kinetic

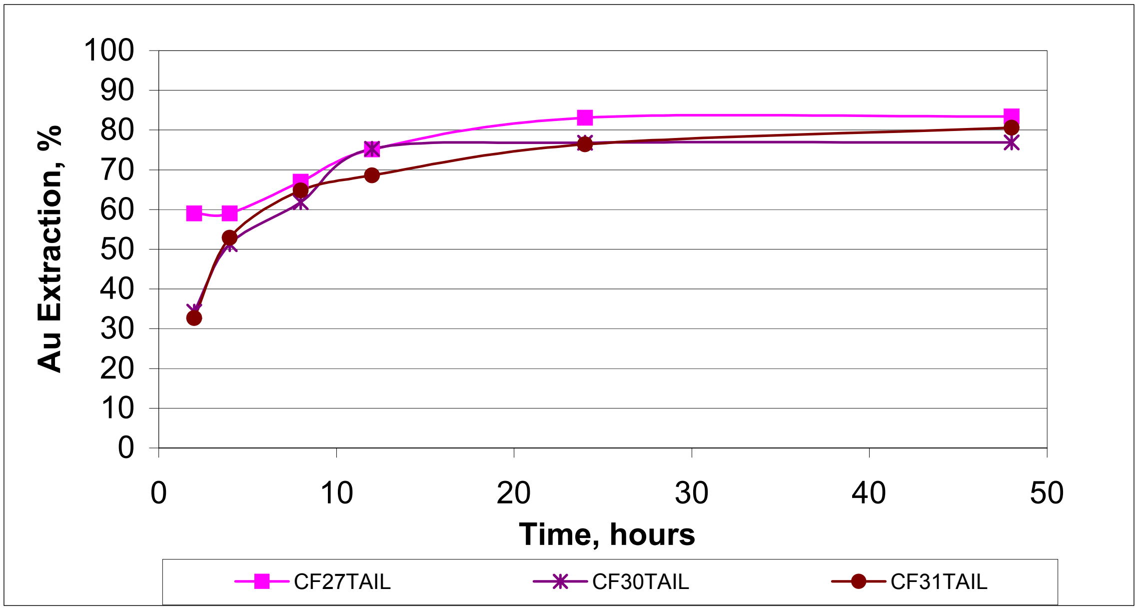

Figure 4.6 – Flotation Tail Cyanidation Kinetic

The leach kinetic data indicates that the Au extraction appeared to be complete within 24 hours cyanidation time, for both flotation tailing and flotation concentrate. The un-leached gold remaining in the cyanided tailing may be due to finely disseminated gold in sulfide minerals, or gold associated within silicates. The total NaCN consumption per tonne of original ore to gravity feed is summarized in Table 4.8.

Table 4.8 – NaCN Consumption at 24h Leaching Time

Composite ID	NaCN Consumption, kg/t of Ore at 24 hours
Doris North	0.99
Doris CSZ	1.68
Doris CLV	1.05

4.6 Flotation Optimization Suggested by Bateman Engineering

An eight kilogram Doris North composite was ground to target 80% passing 147 microns and subjected to two-pass Falcon gravity recovery procedure. The two gravity concentrates were combined and cyanide leached. The extraction was excellent at 97.9% Au and 98.5% Ag. The gravity tailing was split into 4 equal portions for the subsequent flotation tests.

The first flotation test F41, was similar to PRA procedure using PAX as the collector and floated at natural pH of 8.6. A kinetic flotation study was conducted and the test results are presented in Figure 4.7. The flotation recovery was 94.4% Au, 78.2% Ag and 97.1% total sulphur. The flotation kinetic data indicates that these metals were floated in 15 minutes.

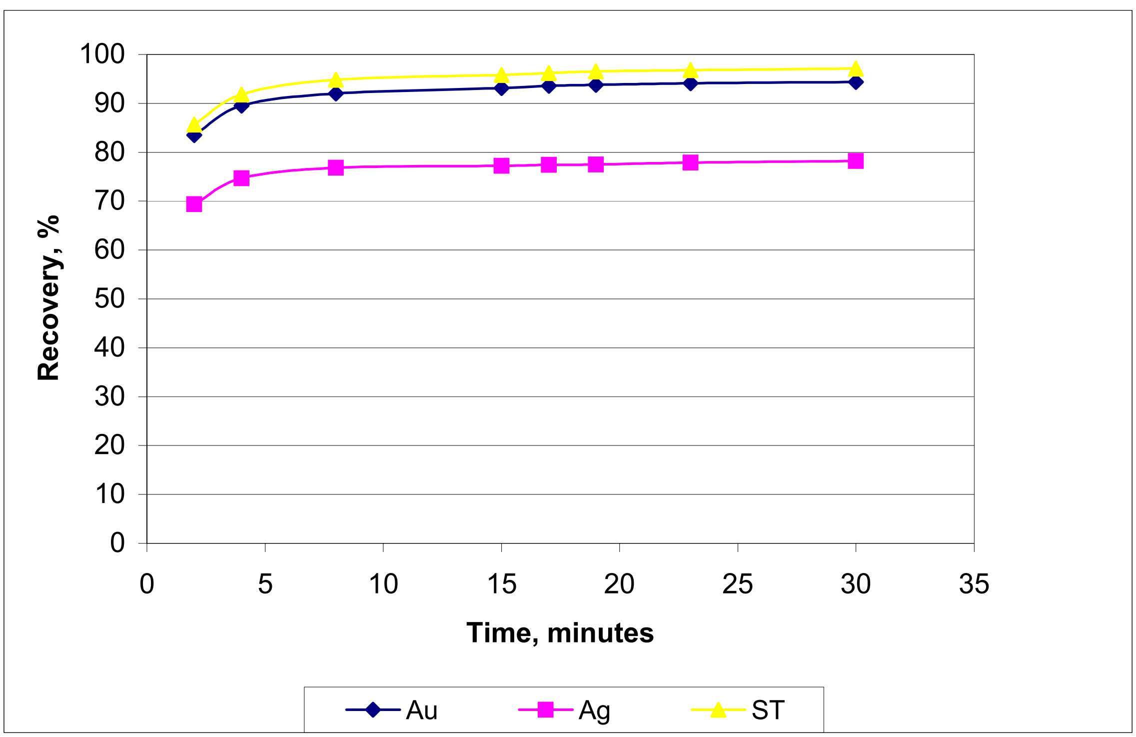

Figure 4.7 – Doris North Flotation Kinetics

A second flotation test F42 was conducted to study the response of copper sulfate addition. The results indicate that the copper sulfate did not have a significant effect on the gold recovery, as summarized in Table 4.9, below. The Au and Ag extraction from the flotation concentrate by cyanidation was 87.1% and 73.5%, respectively.

The third flotation test F43 using sodium isopropyl xanthate as a collector and with copper sulfate resulted in slightly decreased Au and Ag flotation recovery. The flotation tailing losses was higher at 0.23g/t Au and 0.20g/t Ag. The Au and Ag extraction by cyanidation of the concentrate was 93.6% and 79.6%, respectively.

A slime depressant CMC was tested in test F44 to evaluate if mass yield to the concentrate could be achieved. A marginal reduction of concentrate weight was achieved. The cyanide extraction from the flotation concentrate was 85.3% Au and 60.9% Ag. The results summarizing the optimization are presented in Table 4.9.

Table 4.9 – Flotation Optimization Tests F41 to F44 on Doris North

Test	Flot Con	Au %Recovery			Flotation Tail	Cyan Ext'n	
No	Weight, %	Gravity	Flotation	Total	Grade, g/t	Au,%	Ag,%
F41	8.9	69.9	28.4	98.3	0.12	-	-
F42	9.9	69.7	28.0	97.8	0.16	87.1	73.5
F43	8.0	71.1	25.6	96.7	0.23	93.6	79.6
F44	7.5	68.7	29.1	97.8	0.16	85.3	60.9

4.7 Filtration and Settling

A settling test STF41 was conducted on Doris North (test F41) flotation tail. An initial scoping tests show that flocculant alone did not achieve good supernatant clearity. The supernatant became clear when lime was added. Test STF41 achieved 66% solids in the thickener under flow after 24 hours settling. The procedure and detailed results are provided in the Appendix.

Filtration test FTF41 was performed on the STF41 thickener under flow using a 200 cm^2 Buchner funnel. The filtration time was 50 seconds to form a cake thickness of 1.5 cm. The cake moisture was determined to be 11.0%. According to Bateman Engineering instruction, a filtration test was also performed on three cyanide final slurries CF42, CF43 and CF44 produced from cyanidation of the flotation concentrate. The % moisture in each cake (after repulping and filtering) was 32.8%, 8.7% and 27.7%, respectively. The procedure and detailed results are provided in the Appendix.

4.8 Environmental

4.8.1 Acid Base Accounting

Acid base accounting (ABA) was conducted on the Doris North (test F41) flotation tail to determine the neutralization potential (NP). The test was performed according to the Sobek standard procedure. The net NP was determined to be –24.3 kg CaCO3 equivalent per tonne of sample. This indicates that the flotation tailing should be subjected to kinetic tests to better determine if there is acid producing potential.

4.8.2 Cyanide Destruction

The cyanide destruction tests CFH2O2-15 and CFH202-30 were conducted on solutions originating from Doris North material. The solutions originated from tests CF42, CF43 and CF44 filtrate, which contained 2.60g/L NaCN. A 50% H2O2 (hydrogen peroxide) solution was added to two filtrate samples at a rate of 15g/L and 30g/L and agitated for 24 hours. The resulting solutions were then analyzed for weak acid soluble (wad) cyanide, total cyanide, Cu and Fe. The test results are summarized in Table 4.10.

Table 4.10 – Doris North Cyanide Destruction Results

Test No	H2O2 dosage	CN_{wad}	CN_{total}	Cu	Fe
	50%, g/L	mg/L	mg/L	mg/L	mg/L
CFH2O2-15	15	172	176	31.8	17.7
CFH2O2-30	30	1.85	40	8.79	16.0

The results indicate hydrogen peroxide was effective at reducing some cyanide complexes.

5.0 RECOMMENDATIONS

Based on a finalized process flow sheet, additional metallurgical work is recommended to allow the treatment circuit to be developed to a feasibility level of accuracy. Further environmental studies also appear to be warranted, depending on regulatory permitting requirements.

APPENDIX E
Mineral Resources Estimates

APPENDIX E
Mineral Resources Estimates

Hope Bay Mineral Resources Estimates (Dec. 31, 2001) Tabulated By Category					
Category, Deposit & Zone	**Cut-off (Au g/t)**	**Capping (Au g/t)**	**Tonnes (000's)**	**Gold Grade (g/t)**	**Contained Gold (000's ozs)**
Measured					
Boston					
- B2	5	50-175	232	16.3	121
- B3					
- B4					
Boston Sub-total			**232**	**16.3**	**121**
Doris					
- Hinge					
- North					
- Central					
- Pillars					
Doris Sub-total					
Madrid					
- Naartok					
- Suluk					
- South Patch					
- Perrin, Matrim					
- Pillars					
Madrid Sub-total					
Total Measured			**232**	**16.3**	**121**

Hope Bay Mineral Resources Estimates (Dec. 31, 2001) Tabulated By Category					
Category, Deposit & Zone	**Cut-off (Au g/t)**	**Capping (Au g/t)**	**Tonnes (000's)**	**Gold Grade (g/t)**	**Contained Gold (000's ozs)**
Indicated					
Boston					
- B2	5	50-175	1,069	15.6	535
- B3	7	30-50	86	11.1	31
- B4					
Boston Sub-total			**1,155**	**15.2**	**566**
Doris					
- Hinge	5	200	215	29.0	201
- North (flanks)	5	25-150	254	25.9	212
- Central	7	10-150	418	14.9	201
- Pillars					
Doris Sub-total			**887**	**21.5**	**614**
Madrid					
- Naartok	7	100	558	12.8	230
- Suluk					
- South Patch					
- Perrin, Matrim	5	30-40	532	7.8	133
- Pillars					
Madrid Sub-total			**1,090**	**10.3**	**363**
Total Indicated			**3,132**	**15.3**	**1,542**

Hope Bay Mineral Resources Estimates (Dec. 31, 2001) Tabulated By Category					
Category, Deposit & Zone	**Cut-off (Au g/t)**	**Capping (Au g/t)**	**Tonnes (000's)**	**Gold Grade (g/t)**	**Contained Gold (000's ozs)**
Measured + Indicated					
Boston					
- B2	5	50-175	1,300	15.7	656
- B3	7	30-50	86	11.1	31
- B4					
Boston Sub-total			**1,386**	**15.4**	**687**
Doris					
- Hinge	5	200	215	29.1	201
- North	5	25-150	254	25.9	212
- Central	7	10-150	418	15.0	201
- Pillars					
Doris Sub-total			**887**	**21.5**	**614**
Madrid					
- Naartok	7	100	558	12.8	230
- Suluk					
- South Patch					
- Perrin, Matrim	5	30-40	532	7.8	133
- Pillars					
Madrid Sub-total			**1,090**	**10.3**	**363**
Total Measured + Indicated			**3,363**	**15.4**	**1,664**

Hope Bay Mineral Resources Estimates (Dec. 31, 2001) Tabulated By Category					
Category, Deposit & Zone	**Cut-off (Au g/t)**	**Capping (Au g/t)**	**Tonnes (000's)**	**Gold Grade (g/t)**	**Contained Gold (000's ozs)**
<u>Additional Inferred</u>					
Boston					
- B2	5	50-175	1,595	10.3	527
- B3	7	30-50	696	12.1	271
- B4	7	40	283	11.4	103
Boston Sub-total			**2,574**	**10.9**	**901**
Doris					
- Hinge	5	200	79	37.0	94
- North	5	25-150	1,222	12.8	501
- Central	7	10-150	114	16.0	59
- Pillars	5 - 7	25-150	263	18.6	158
Doris Sub-total			**1,679**	**15.0**	**811**
Madrid					
- Naartok	7	100	312	11.9	120
- Suluk	7	50-90	1,302	12.1	508
- South Patch	7	100	75	36.2	88
- Perrin, Matrim	5	30-40	594	7.5	143
- Pillars	5 - 7	30-100	176	13.3	76
Madrid Sub-total			**2,460**	**11.8**	**935**
Total Additional Inferred			**6,713**	**12.3**	**2,648**

APPENDIX F
Summary of Existing Leases

APPENDIX F
Summary of Existing Leases

Crown Mineral Claims

Claim Name	Tag #	Acres	NTS	Record Date	Current Anniversary
AMAROK1	F27801	2,169.30	77A/13,76O/15	Jun 3,1993	Jun 3,2003
AMAROK2	F27802	180.80	76O/15	Jun 3,1993	Jun 3,2003
AMAROK3	F27803	2,436.00	76O/15	Jun 3,1993	Jun 3,2003
AMAROK4	F27804	387.40	76O/16	Jun 3,1993	Jun 3,2003
AMAROK5	F27805	2,169.30	76O/15,16	Jun 3,1993	Jun 3,2003
AMAROK6	F27807	2,530.85	76O/15,16	Jun 3,1993	Jun 3,2003
AMAROK7	F27806	180.80	76O/15	Jun 3,1993	Jun 3,2003
AMAROK8	F27808	154.95	76O/15	Jun 3,1993	Jun 3,2003
AMAROK9	F44725	619.80	76O/16	Jul 4,1995	Jul 4,2005
AMAROK10	F44724	2,582.50	76O/16	Jul 4,1995	Jun 3,2005
AMAROK11	F44723	1,647.10	76O/16	Jul 4,1995	Jul 4,2003
AMAROK12	F56177	1,022.43	76O/16	Sep 5,1995	Sep 5,2002
AMAROK13	F56178	735.10	76O/16	Sep 5,1995	Sep 5,2003
BOSTON8	Z02735	1,084.65	76O/09	Dec 15,1992	Dec 15,2002
BOSTON9	Z02736	1,446.20	76O/09	Dec 15,1992	Dec 15,2002
BOSTON10	Z02737	2,582.50	76O/09	Dec 15,1992	Dec 15,2002
BOSTON12	RA04550	413.20	76O/09	Dec 15,1992	Dec 15,2001
BOSTON13	RA04552	1,807.75	76O/09	Dec 15,1992	Dec 15,2002
BOSTON14	F39511	1,652.80	76O/09	Jun 3,1993	Jun 3,2003
BOSTON16	RA04551	464.85	76O/09	Jun 3,1993	Jun 3,2003
BOSTON18	F72164	464.85	76O/09	Aug 28,2001	Aug 28,2003
BOSTON19	F72165	2,066.00	76O/09	Aug 28,2001	Aug 28,2003
BOSTON20	F72163	1,239.60	76O/09,08	Aug 28,2001	Aug 28,2003
BD1	F65148	1,102.52	76O/09,10	Jun 3,1998	Jun 3,2003
BD2	F65149	1,865.46	76O/09,10	Jun 3,1998	Jun 3,2003
BUFFALO1	Z00203	2,582.50	76O/09	Jun 3,1993	Jun 3,2002
BUFFALO2	F38421	1,962.70	76O/09	Jun 3,1993	Jun 3,2003
BUFFALO3	Z00204	1,549.50	76O/09	Jun 3,1993	Jun 3,2002
BUFFALO4	F39503	2,302.15	76O/09,10	Jun 3,1993	Jun 3,2002
BUFFALO5	F39501	2,582.50	76O/09,10	Jun 3,1993	Jun 3,2003
CHICAGO1	F38425	2,185.00	76O/10	Jun 3,1993	Jun 3,2003
CHICAGO2	F27799	1,308.00	76O/10	Jun 3,1993	Jun 3,2003
CHICAGO4	F38424	2,582.50	76O/10	Jun 3,1993	Jun 3,2003
CHICAGO5	F54311	2,582.50	76O/10	Oct 31,1996	Oct 31,2006
ENGINE1	F56175	1,915.56	77A/03	Jul 25,1995	Jul 25,2002
ENGINE2	F56176	604.75	77A/03	Jul 25,1995	Jul 25,2005
ENGINE3	F46662	50.98	77A/03	May 27,1998	May 27,2008
ENGINE4	F46663	245.30	77A/03	May 27,1998	May 27,2003

Claim Name	Tag #	Acres	NTS	Record Date	Current Anniversary
HEKU1	F70303	2582.50	76O/10	Nov 3,2000	Nov 3,2010
HEKU2	F70302	2066.00	76O/10	Nov 3,2000	Nov 3,2002
HEKU3	F70423	2324.25	76O/10	Nov 3,2000	Nov 3,2002
HEKU4	F70424	2272.60	76O/10	Nov 3,2000	Nov 3,2002
HEKU5	F72172	1033.00	76O/10	Aug 28,2001	Aug 28,2003
PJ1	F58064	555.97	76O/09	Oct 7,1996	Oct 7,2002
PJ2	F54312	2,475.02	76O/09,16	Oct 7,1996	Oct 7,2002
PJ3	F54313	2,582.50	76O/09,16	Oct 7,1996	Oct 7,2002
PJ4	F54314	2,582.50	76O/09	Oct 7,1996	Oct 7,2003
PJ5	F54315	1,807.75	76O/09	Oct 7,1996	Oct 7,2002
PJ6	F54316	2,582.50	76O/09	Oct 7,1996	Oct 7,2003
PJ7	F46644	2,582.50	76O/09	May 29,1997	May 29,2003
QUITO1	Z00208	1,342.90	76O/15	Jun 3,1993	Jun 3,2002
QUITO2	Z00207	2,117.65	76O/15	Jun 3,1993	Jun 3,2002
QUITO3	Z00206	1,884.14	76O/15	Jun 3,1993	Jun 3,2003
QUITO4	Z00205	1,962.70	76O/15	Jun 3,1993	Jun 3,2002
TOTAL	**54**	**88,215.13**			

19 Mining Leases and Leases Pending

Lease Name	Tenure #	Surveyed Acres	NTS	Record Date	Current Anniversary
BOSTON1	F18751	2,488.20	76O/09	pending	July. 2002
BOSTON2	F18752	2,568.77	76O/09	pending	July. 2002
BOSTON3	F18753	2,507.00	76O/09	pending	July. 2002
BOSTON4	F18754	2,420.93	76O/09	pending	July. 2002
BOSTON5	F19271	2,431.04	76O/09	pending	Oct. 2002
BOSTON6	F18222	1,518.00	76O/09	pending	Oct. 2002
BOSTON7	F18219	1,388.00	76O/09	pending	Oct. 2002
HAVANA	F19280	2,472.00	76O/15,16	pending	Oct. 2002
KAMIK 1	ML3923	2,671.10	76O/15	Jul 24, 2000	Jul 24,2002
KAMIK 2	ML3924	2,462.10	76O/15	Jul 24, 2000	Jul 24,2002
KOIG1	ML3545	2,873.80	77A/03	Apr 17,1997	Apr 17,2002
KOIG2	ML3547	1,086.00	77A/03	Apr 17,1997	Apr 17,2002
KOIG3	ML3549	1,472.00	77A/03	Apr 17,1997	Apr 17,2002
KOIG4	ML3550	983.00	77A/03	Apr 17,1997	Apr 17,2002
KOIG6	ML3544	2,731.00	76O/16	Apr 17,1997	Apr 17,2002
WOG2	ML3546	2,595.00	77A/03	Apr 17,1997	Apr 17,2002
WOG3	ML3548	1,704.00	77A/03	Apr 17,1997	Apr 17,2002
MADRID 1	F18218	2,355.00	77A/03	pending	Oct. 2002
MADRID 2	F18220	1,179.00	77A/03	pending	Oct. 2002
Total	**19**	**39,905.94**			

Seven Inuit Exploration Agreements

Agreement Name	*Agreement #*	*Effective Date*	*Size (hectares)*	*Anniversary Date*
AKUNGANI 1	BB57-00-01	Aug.1, 2000	9,095	Aug.1, 2000
AKUNGANI 2	BB57-00-02	Aug.1, 2000	8,670	Aug.1, 2000
AKUNGANI 3	BB57-00-03	Aug.1, 2000	9,570	Aug.1, 2000
AIMAOKATUK 1	BB57-00-04	Aug.1, 2000	5,305	Aug.1, 2000
TOK 1	BB60-00-01	Aug.1, 2000	6,378	Aug.1, 2000
TOK 2	BB60-00-02	Aug.1, 2000	5,811	Aug.1, 2000
TOK 3	BB60-00-03	Aug.1, 2000	11,147	Aug.1, 2000
Total	**7 agreements**		**55,976**	

APPENDIX G
Economic Model

TABLE 1

HOPE BAY PROJECT - DORIS NORTH								
LIFE-OF-MINE PLAN			*2003*	*2004*	*2005*	*2006*	*2007*	*TOTAL*
SUMMARY RESULTS:								
Cash Operating Cost per Ounce	**$Cdn**		**$ -**	**$ 212**	**$ 197**	**$ 154**	**$ -**	**$ 179**
	$US		**$ -**	**$ 135**	**$ 126**	**$ 98**	**$ -**	**$ 114**
All-in Cash Operating Cost per Oz	**$Cdn**		**$ -**	**$ 1,218**	**$ 203**	**$ 142**	**$ -**	**$ 277**
	$US		**$ -**	**$ 776**	**$ 129**	**$ 91**	**$ -**	**$ 177**
Direct Operating Cost Per Tonne	**$Cdn**		**$ -**	**$ 67**	**$ 107**	**$ 139**	**$ -**	**$ 105**
	$US		**$ -**	**$ 43**	**$ 68**	**$ 88**	**$ -**	**$ 67**
MINE PRODUCTION								
Doris Hinge - North	Tonnes		-	119,100	219,000	124,500	-	462600
Ore Milled	Tonnes		-	55,200	219,000	197,400	-	471600
Grade	gpt		-	14.00	18.46	19.74	-	18.48
Recovery	%		0.0%	97.0%	97.0%	97.0%	0.0%	97.0%
Total Gold Recovered	**Oz**		**-**	**24,103**	**126,105**	**121,516**	**-**	**271,724**
Market Prices:								
Gold (Spot) $US		$280	280.00	280.00	280.00	280.00	280.00	280.00
Exchange Rate $US:$C		1.570	0.637	0.637	0.637	0.637	0.637	0.64
Sales Revenues:								
Gold (Spot)	$Cdn		-	10,595,788	55,435,580	53,418,615	-	119,449,983
Total Sales Revenue:	$Cdn		-	10,595,788	55,435,580	53,418,615	-	119,449,983
Cost of Goods Sold								
Mine Operations	$Cdn		-	4,916,347	10,826,895	6,225,799	-	21,969,040
Processing Operations			-	2,017,103	8,066,554	7,294,367	-	17,378,024
Surface Maintenance			-	45,100	180,400	165,367	-	390,867
Administration			-	970,186	4,374,014	3,612,763	-	8,956,962
Royalties		1.8%	-	190,724	997,840	961,535	-	2,150,100
Other / Amortization			313,731	4,071,945	11,639,647	11,476,646	(833,322)	26,668,646
Total Property Costs			313,731	12,211,405	36,085,350	29,736,475	(833,322)	77,513,639
Net Income	$Cdn		(313,731)	(1,615,617)	19,350,230	23,682,140	833,322	41,936,344
CASH FLOW								
Net Income	$Cdn		(313,731)	(1,615,617)	19,350,230	23,682,140	833,322	41,936,344
Non-cash			313,731	3,421,945	11,639,647	11,309,967	-	26,685,290
PP&E Capital			(3,119,000)	(21,400,590)	(2,165,700)	-	-	(26,685,290)
Reclamation/Cash Bonds			-	(1,150,000)	-	-	4,000,000	2,850,000
NET CASH FLOW	**$Cdn**		**(3,119,000)**	**(20,744,262)**	**28,824,176**	**34,992,107**	**4,833,322**	**44,786,344**
CUMULATIVE NET CASH	$Cdn		(3,119,000)	(23,863,262)	4,960,914	39,953,022	44,786,344	
NET PRESENT VALUE		0.4%	(3,004,304)	(19,439,200)	25,657,307	30,114,096	3,886,802	37,214,701
CUMULATIVE NPV		5.0%	(3,004,304)	(22,443,503)	3,213,803	33,327,899	37,214,701	
IRR		85.2%						

TABLE 2

HOPE BAY PROJECT - DORIS NORTH							
LIFE-OF-MINE PLAN		*2003*	*2004*	*2005*	*2006*	*2007*	*TOTAL*
PRODUCTION - Doris Hinge North							
Room & Pillar	33 Total		119,100	219,000	124,500	-	462,600
Total Ore Tonnes Mined			119,100	219,000	124,500	-	462,600
PRODUCTION GRADE							
Doris Hinge North	gpt		14.497	19.900	19.831	0.000	18.490
CONTAINED OUNCES MINED							
Doris Hinge North							
Longhole	33 Total		55,511	140,116	79,377	-	275,004
Total Contained Oz Mined			55,511	140,116	79,377	-	275,004
MILL PROCESSING							
TOTAL ORE PROCESSED	Tonnes		55,200	219,000	197,400	-	471,600
Grade	gpt		14.00	18.46	19.74	-	18.48
Contained ounces			24,849	130,005	125,275	-	280,128
Recovery %			97.0%	97.0%	97.0%	0.0%	97.0%
Recovered ounces			24,103	126,105	121,516	-	271,724
TOTAL GOLD PRODUCED			24,103	126,105	121,516	-	271,724
TOTAL SILVER PRODUCED	0%		-	-	-	-	-

TABLE 3

HOPE BAY PROJECT - DORIS NORTH							
LIFE-OF-MINE PLAN		*2003*	*2004*	*2005*	*2006*	*2007*	*TOTAL*
CAPITAL							
Process Plant							
Direct Field Cost	8687290	-	8,687,290	-	-		8,687,290
Sprung Structure	1957676.948	-	1,957,677	-	-		1,957,677
Indirects	2233390.59	-	2,233,391	-	-		2,233,391
Contingencies etc.	3078241.57	-	3,078,242	-	-		3,078,242
Site Prep & Open Pit Mining							
Contractor Mob/Demob	2138400	1,425,600	-	712,800	-		2,138,400
Contractor Standby Charges	315000	180,000	135,000				315,000
Site Prep	2231200	-	2,231,200	-	-		2,231,200
Underground							
Contractor Mob/Demob	308280	-	308,280	-	-		308,280
Hinge Portal	39600	-	39,600	-	-		39,600
Hinge Development	681000	-	454,000	227,000	-		681,000
Lakeshore Development	1037500	-	-	1,037,500	-		1,037,500
Miscellaneous							
Surface Equipment	750000	-	750,000	-	-		750,000
Site Evaluation & Eng.	250000	250,000					250,000
Fuel Farm Lease-Purchase	565200	188,400	188,400	188,400	-		565,200
Move Boston Camp	100000	-	100,000	-	-		100,000
New Kitchen	75000	75,000	-	-	-		75,000
Computer Hardware/Software	1000000	1,000,000	-	-	-		1,000,000
Start up Labour & Misc G&A	1237510.76	-	1,237,511	-	-		1,237,511
SUBTOTAL CAPITAL PP&E		3,119,000	21,400,590	2,165,700	-	-	26,685,290
CAPITALIZED DEVELOPMENT							
Deferred development		-	3,107,250	-	-	-	3,107,250
		-	-	-	-	-	-
Subtotal		-	3,107,250	-	-	-	3,107,250
SUBTOTAL CAPITALIZED DEVEL		-	3,107,250	-	-	-	3,107,250
TOTAL CAPITAL		3,119,000	24,507,840	2,165,700	-	-	29,792,540

TABLE 4

HOPE BAY PROJECT - DORIS NORTH				
LIFE-OF-MINE PLAN	*2004*	*2005*	*2006*	*TOTAL*
OPERATING COSTS				
MINE SERVICES				
Engineering	42,583	255,430	167,867	465,880
Geology - Production	38,832	232,927	152,998	424,757
Geology - Drilling	19,739	118,113	67,146	204,998
Administration Underground	24,618	147,666	96,994	269,278
Underground Services	2,000	12,000	8,000	22,000
Trucking	63,318	378,870	215,385	657,573
Power (dewatering, misc)	45,005	269,410	157,461	471,876
UG Ventilation	5,000	30,000	20,000	55,000
Electric Power	45,005	269,410	157,461	471,876
OPEN PIT MINE PRODUCTION	3,107,250	-	-	3,107,250
MINE PRODUCTION				
Room & Pillar	1,519,998	9,095,070	5,170,485	15,785,553
UG Electrical	3,000	18,000	12,000	33,000
PROCESSING				
Mill Administration	499,241	1,996,962	1,830,549	4,326,751
Surface Loader	137,457	547,347	497,121	1,181,925
Maintenance	358,805	1,431,112	1,304,204	3,094,121
Electric Power	593,213	2,356,633	2,130,060	5,079,906
Grinding Balls	76,838	304,848	274,781	656,467
Liners	37,808	150,000	135,205	323,014
Solutions & Reagent	292	1,169	1,072	2,533
Cyanide	151,193	599,841	540,679	1,291,712
Caustic	20,402	80,942	72,959	174,303
Copper Sulphate	14,330	56,852	51,245	122,427
Frother	18,282	72,533	65,379	156,194
Promoter - 3418A	5,492	21,789	19,640	46,922
Collector - PAX	22,098	87,670	79,023	188,791
Hydrogen Peroxide	9,837	39,026	35,177	84,039
Sulphuric Acid	10,839	43,001	38,759	92,599
Refinery	9,832	39,098	35,413	84,342
Assay	51,145	237,730	183,102	471,977
GENERAL & ADMIN				
Plant Buildings	13,075	52,300	47,942	113,317
Diesel	32,025	128,100	117,425	277,550
General & Administration	45,150	180,600	165,550	391,300
Camp food costs	210,588	835,485	764,526	1,810,599
Employee transport	199,746	1,195,200	679,463	2,074,409
Outside refining	84,361	441,366	425,307	951,035
Insurance	87,500	350,000	320,833	758,333
Accounting/IS/Materials	211,072	844,286	773,929	1,829,286
Safety/Security/Enviro	131,769	527,077	483,154	1,142,000
TOTAL DIRECT COSTS	**7,948,736**	**23,447,863**	**17,298,295**	**48,694,894**

*Base case

TABLE 5: MARKET PRICE AND EXCHANGE RATE NET CASH FLOW (undiscounted)								
			Exchange Rate					
			1.530	1.550	1.570	1.590	1.610	1.630
	$	250	29,550,167	30,884,333	32,218,499	33,552,665	34,886,831	36,220,997
	$	260	33,632,715	35,020,248	36,407,781	37,795,313	39,182,846	40,570,379
Market	$	270	37,715,263	39,156,163	40,597,062	42,037,962	43,478,861	44,919,760
Price	$	280	41,797,812	43,292,078	44,786,344	46,280,610	47,774,876	49,269,142
$US	$	290	45,880,360	47,427,993	48,975,625	50,523,258	52,070,891	53,618,523
	$	300	49,962,908	51,563,907	53,164,907	54,765,906	56,366,905	57,967,905
	$	310	54,045,456	55,699,822	57,354,188	59,008,554	60,662,920	62,317,286

TABLE 6: GRADE AND RECOVERY NET CASH FLOW (undiscounted)							
		RECOVERY					
		0.930	0.940	0.950	0.960	0.970	0.980
	-15%	23,561,877	24,584,720	25,607,562	26,630,405	27,653,248	28,676,091
	-10%	29,037,402	30,119,122	31,200,841	32,282,560	33,364,280	34,445,999
Grade	-5%	34,512,928	35,653,524	36,794,120	37,934,716	39,075,312	40,215,908
% increase/	0%	39,988,453	41,187,926	42,387,398	43,586,871	44,786,344	45,985,816
(decrease)	5%	45,463,978	46,722,328	47,980,677	49,239,026	50,497,376	51,755,725
	10%	50,939,504	52,256,730	53,573,956	54,891,182	56,208,407	57,525,633
	15%	56,415,029	57,791,132	59,167,234	60,543,337	61,919,439	63,295,542

TABLE 7: OPERATING AND CAPITAL COSTS NET CASH FLOW (undiscounted)							
		OPERATING COSTS % increase / (decrease)					
		-10%	-5%	0.000	5%	10%	15%
	-15%	53,611,377	51,176,632	48,741,887	46,307,142	43,872,398	41,437,653
	-10%	52,292,862	49,858,117	47,423,373	44,988,628	42,553,883	40,119,139
CAPITAL	-5%	50,974,348	48,539,603	46,104,858	43,670,113	41,235,369	38,800,624
% increase/	0%	49,655,833	47,221,088	44,786,344	42,351,599	39,916,854	37,482,110
(decrease)	5%	48,337,319	45,902,574	43,467,829	41,033,085	38,598,340	36,163,595
	10%	47,018,804	44,584,059	42,149,315	39,714,570	37,279,825	34,845,081
	15%	45,700,290	43,265,545	40,830,800	38,396,056	35,961,311	33,526,566

APPENDIX H
Certificates of Consent

CERTIFICATE AND CONSENT

To Accompany the Hope Bay Project –Preliminary Assessment, Doris North Trial Operation, Nunavut, Canada

I, **Christopher H. Page**, residing at 102 Deep Dene Road, North Vancouver, British Columbia do hereby certify that:

1) I am a Corporate Consultant with the firm of Steffen Robertson and Kirsten (Canada) Inc. (SRK) with an office at Suite 800, 580 Hornby Street, Vancouver, CANADA

2) I am a graduate of the University of Leeds with a BSc. in Mining Engineering in 1967, Ph.D from Leeds University in 1971, and have practiced my profession continuously since 1971.

3) I am a member of the CIM; and a Professional Engineer registered with the Association of Professional Engineers and Geoscientists of the province of British Columbia, North West Territories and Ontario.

4) I have not received, nor do I expect to receive, any interest, directly or indirectly, in the Hope Bay Project or securities of the Hope Bay Joint Venture (HBJV) partners.

5) I am not aware of any material fact or material change with respect to the subject matter of the technical report, which is not reflected in the technical report, the omission to disclose which makes the technical report misleading.

6) I, as a qualified person, am independent of the issuer as defined in Section 1.5 of National Instrument 43-101.

7) I have not had any prior involvement with the property that is subject to the technical report.

8) I have read National Instrument 43-101 and Form 43-101F1 and the technical report (a preliminary assessment) has been prepared in compliance with this Instrument and Form 43-101F1.

9) Steffen Robertson and Kirsten (Canada) Inc. was retained by HBJV to prepare a preliminary assessment report on the Hope Bay Project in accordance with National Instrument 43-101. The following report is based on SRK's review of existing project files prepared for or by HBJV, estimates of mineral resources prepared by HBJV, estimates of mining manpower, mining costs, and production schedule prepared by contractor Nuna Logistics, and in-house data and estimates prepared by SRK Consulting. I have not personally visited the project site.

10) I have reviewed the report. I am qualified to report on the mining sections of the report, but not with respect to the resources.

11) I hereby consent to use of this report and our name in the preparation of a prospectus for submission to any Provincial regulatory authority.

Vancouver, BC, Canada
February 5, 2002

Christopher H. Page, P.Eng.
Corporate Consultant

CERTIFICATE AND CONSENT

To Accompany the Hope Bay Project –Preliminary Assessment, Doris North Trial Operation, Nunavut, Canada

I, **Ken S. Reipas**, residing at 43 Deverell Street, Whitby, Ontario do hereby certify that:

1) I am a Principal Mining Engineer with the firm of Steffen Robertson and Kirsten (Canada) Inc. (SRK) with an office at Suite 602, 357 Bay Street, Toronto, CANADA.

2) I am a graduate of Queen's University with a B.Sc. in Mining Engineering 1981, and have practiced my profession continuously since 1981,

3) I am a Professional Engineer registered with the Association of Professional Engineers of Ontario,

4) I have not received, nor do I expect to receive, any interest, directly or indirectly, in the Hope Bay Project or securities of the Hope Bay Joint Venture (HBJV) partners.

5) I am not aware of any material fact or material change with respect to the subject matter of the technical report, which is not reflected in the technical report, the omission to disclose which makes the technical report misleading.

6) I, as a qualified person, am independent of the issuer as defined in Section 1.5 of National Instrument 43-101.

7) I have not had any prior involvement with the property that is subject to the technical report.

8) I have read National Instrument 43-101 and Form 43-101F1 and the technical report (a preliminary assessment) has been prepared in compliance with this Instrument and Form 43-101F1.

9) Steffen Robertson and Kirsten (Canada) Inc. was retained by HBJV to prepare a preliminary assessment report on the Hope Bay Project in accordance with National Instrument 43-101. The following report is based on SRK's review of existing project files prepared for or by HBJV, estimates of mineral resources prepared by HBJV, estimates of mining manpower, mining costs, and production schedule prepared by contractor Nuna Logistics, and in-house data and estimates prepared by SRK Consulting. I have not personally visited the project site.

10) I was a co-author of sections 15.1, 15.2, 15.3, 15.4, 15.5, 15.6, and 15.7 of the report.

11) I hereby consent to use of this report and our name in the preparation of a prospectus for submission to any Provincial regulatory authority.

LICENSED PROFESSIONAL ENGINEER
K. S. REIPAS
PROVINCE OF ONTARIO

Toronto, Canada
February 4, 2002

Ken S. Reipas, P. Eng.
Principal Mining Engineer

CERTIFICATE AND CONSENT

To Accompany the Hope Bay Project –Preliminary Assessment, Doris North Trial Operation, Nunavut, Canada

I, **E. Maritz Rykaart**, residing at 15321-28 A Avenue, Surrey, British Columbia do hereby certify that:

1) I am a Senior Geo-Environmental Engineer with the firm of Steffen Robertson and Kirsten (Canada) Inc. (SRK) with an office at Suite 800, 580 Hornby Street, Vancouver, CANADA

2) I am a graduate of the Rand Afrikaans University with a B.Eng. in Civil Engineering in 1991, a M.Eng. in Civil Engineering in 1993 and a Ph.D from the University of Saskatchewan in 2001, and have practiced my profession continuously since 1993.

3) I am a Professional Engineer registered with the Engineering Council of South Africa, and a Engineer-in-Training with the Association of Professional Engineers and Geoscientists of Saskatchewan.

4) I have not received, nor do I expect to receive, any interest, directly or indirectly, in the Hope Bay Project or securities of the Hope Bay Joint Venture (HBJV) partners.

5) I am not aware of any material fact or material change with respect to the subject matter of the technical report, which is not reflected in the technical report, the omission to disclose which makes the technical report misleading.

6) I, as a qualified person, am independent of the issuer as defined in Section 1.5 of National Instrument 43-101.

7) I have not had any prior involvement with the property that is subject to the technical report.

8) I have read National Instrument 43-101 and Form 43-101F1 and the technical report (a preliminary assessment) has been prepared in compliance with this Instrument and Form 43-101F1.

9) Steffen Robertson and Kirsten (Canada) Inc. was retained by HBJV to prepare a preliminary assessment report on the Hope Bay Project in accordance with National Instrument 43-101. The following report is based on SRK's review of existing project files prepared for or by HBJV, estimates of mineral resources prepared by HBJV, estimates of mining manpower, mining costs, and production schedule prepared by contractor Nuna Logistics, and in-house data and estimates prepared by SRK Consulting. I have not personally visited the project site.

10) I was co-author of sections 3.1, 3.5, 3.6, 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, and 3.15 of this report.

11) I hereby consent to use of this report and our name in the preparation of a prospectus for submission to any Provincial regulatory authority.

Vancouver, BC, Canada
February 6, 2002

E. Maritz Rykaart, Ph.D.
Senior Geo-Environmental Engineer