Doris Camp – Windy Camp Access Road Technical Report

Hope Bay, Nunavut, Canada

Prepared for:

Hope Bay Mining Ltd.
Suite 300, 889 Harbourside Drive
North Vancouver, BC V7P 3S1
Canada

Prepared by:

SRK Consulting
Engineers and Scientists

SRK Project No. 1CH008.000

May 2008

Doris Camp - Windy Camp Access Road Technical Report

Hope Bay, Nunavut, Canada

Hope Bay Mining Ltd.

Suite 300 - 889 Harbourside Drive
North Vancouver, BC, Canada, V7P 3S1

SRK Consulting (Canada) Inc.
Suite 2200, 1066 West Hastings Street
Vancouver, B.C. V6E 3X2

Tel: 604.681.4196 Fax: 604.687.5532
E-mail: vancouver@srk.com Web site: www.srk.com

SRK Project Number 1CH008.000

May 2008

Author
Mark Vendrig, MSc.

Reviewed by
Maritz Rykaart, Ph.D., P.Eng.

Executive Summary

This document is the technical report in support of an all-weather access road between Doris Camp and Windy Camp in the Hope Bay belt. This project is proposed by Hope Bay Mining Limited (HBML), a wholly owned subsidiary of Newmont Mining Corporation. The proposed road is in two sections; Route 1 between Doris Camp and Windy Camp, approximately 10 km long and Route 2 between the Drill Shop and Route 1, approximately 1 km long. The best routeing for the roads was determined from an analysis of alternatives for each route, in order to minimise interaction with water bodies and terrestrial life.

HBML have reviewed activities in the Hope Bay belt and have determined that the proposed road is needed to improve efficiency of operations, make year round exploration possible, reduce the use of helicopters which are associated with environmental noise effects and vast fuel usage, and improve site wide medical evacuation ability. HBML believes the proposed access roads will improve operational, safety and environmental performance of activities at Hope Bay.

HBML is aware of the limited window of opportunity for construction and would like to make use of the 2008 construction period to complete the road. This technical report is based to a large extent on the data and information that was collected for the Doris North Project Environmental Impact Statement (EIS) and subsequent Class A Water Licence which was issued on September 19, 2007, and approved by the Minister of Indian and Northern Affairs Canada on November 5, 2007. This extrapolation of data is appropriate as the proposed road is contiguous with and occurs in almost identical environmental conditions to the Doris North Project which lies immediately to the North. In some instances specialist studies for the Doris North Project considered the areas that will be covered by the proposed road.

These specialist studies have revealed that there are no endangered or threatened plants or animal species occurring in the area and that the bedrock material proposed to be used for construction is not acid generating. There will, however, likely be interaction between the proposed road construction activities and potential archaeological sites, bird nesting sites and animal, particularly caribou movements. To this end, HBML is committed to implementing mitigatory measures which include engineering safe animal crossings in consultation with the Kitikmeot Inuit Association (KIA), to ensure that all construction activities are preceded by archaeological and nesting migratory bird surveys along the proposed road corridors.

The proposed road is routed along high ground to avoid streams, potentially wet areas and topographical lows. At the time this document was written it has not been possible to determine unequivocally if fish occur in the small streams that will be crossed, so HBML has adopted the precautionary principle and assumes all streams that will be crossed are fish bearing. Engineering designs have been prepared to provide clear-span structures over the stream channels so as not to interfere with the fish or stream banks. These structures will be supported on buttresses either side of and clear of the stream channel.

The rock for road construction will be derived from permitted and operating quarries at the Doris North Project. This material has been found through extensive testing for the EIS to be non acid generating. Adequate material is available in these permitted quarries. Potential quarries closer to the proposed road have

been identified. If they are required, HBML will file the needed applications under a separate cover with the KIA.

The proposed construction methods and operation of the road are not likely to require any federal permits, based on preliminary discussions with the Nunavut Water Board, Department of Fisheries and Oceans, and Transport Canada, but this is subject to their confirmation upon review of technical documents.

No residual environmental effects have been identified after mitigatory measures are applied and activities will be limited to the road footprint. HBML are committed to an ongoing programme of maintenance of roads to ensure that erosion and damage does not occur. HBML is also committed to removing clear-span structures on completion of road usage.

Construction and operation of the road will require the issuance of surface rights from the KIA. HBML will consult with KIA on the nature of the tenure to be issued. KIA and other interested and affected parties will also be consulted prior to construction to ensure that their issues and interests are understood and incorporated into the proposed road design.

Table of Contents

List of Figures

List of Appendices

1 Introduction

This document is the technical report in support of an all weather access road between Windy Camp and Doris Camp (the project). This project is proposed by Hope Bay Mining Limited (HBML), a wholly owned subsidiary of Newmont Mining Corporation.

This report is intended to provide a complete summary of the information relating to the proposed road that may be required by stakeholders, the landowner and Federal and Territorial regulatory agencies. The document is intended to be inclusive, with the detailed engineering reports, drawings and specifications attached as supporting documents. The focus is on transparently demonstrating that HBML has considered the proposed road development and is aware of its responsibilities in ensuring good environmental stewardship in all its activities at Hope Bay. To this end HBML and its Consultants have considered the data available, applied the Precautionary Principle and used conservative engineering designs to ensure that potential environmental effects are minimised. Where HBML and its Consultants have made assumptions in the designs or with regards to site conditions, these assumptions are clearly stated to ensure transparency.

1.1 Proposed Project Location

The proposed Doris Camp to Windy Camp access road project is located on the mainland in the West Kitikmeot region of Nunavut approximately 125 km southwest of Cambridge Bay and 75 km northeast of Umingmaktok (Figure 1 and Figure 2). The proposed road will begin immediately to the South of the approved Doris North Project for which an extensive Environmental Impact Statement (EIS) (Doris North EIS) was prepared and the required regulatory permits received. Windy Camp, which is operated under an active Nunavut Water Board Water Licence is the southernmost part of the proposed access road.

1.2 Project Summary

This proposed project is to develop all-weather access roads between:

- Doris Camp (Lat. 68.137°; Long. -106.616°) and Windy Camp (Lat. 68.060°; Long. -106.615°) (Route 1), and
- a link road between Route 1 (Lat. 68.078°; Long -106.614°) and the Patch Lake Drill Shop (Lat. 68.072°; Long. -106.590°) (Route 2).

Windy Camp and the Patch Lake Drill Shop are existing exploration infrastructure, and Doris Camp is part of the Doris North Project which is currently under construction. All these sites are currently accessed by air and winter road (Figure 3).

1.3 Motivation for the Proposed Project

HBML has assessed operational activities at Hope Bay and it is now apparent that current transport systems pose safety concerns, are inefficient, operationally limiting and consume resources unnecessarily. The proposed access Routes 1 and 2 will create the following benefits for HBML and the environment:

- extension of the operational exploration period to a year round activity,
- reductions in the use of helicopters, associated fuel usage, exhaust emissions and noise,
- minimisation of the footprint by restricting activities to a narrower corridor, and
- increase worker safety by having year round access to an airstrip.

To facilitate realising the proposed access road project in 2008, this technical report is based on the extensive set of data collected for the region during the Doris North EIS and Water Licence Application. HBML and its Consultants have extracted and extrapolated relevant data from these applications for use in this document. Where necessary, additional new studies were undertaken to support the proposed project.

2 Key Assumptions

Some assumptions and extrapolations have been made for this study using data derived from the approved Environmental Impact Statement (EIS) and approved Water Licence Application previously submitted for the Doris North Project by Miramar Hope Bay Ltd., as well as the reconnaissance activities and regional studies conducted in support of Phase 2 of that project. The Doris North Project lies immediately to the north of and is contiguous with the areas and access road routes proposed in this project, as illustrated in Figure 3. The extrapolations and assumptions are regarded as reasonable based on the following rationale. The sites:

- are directly adjoining, and the Doris North Project site is well studied,
- are in close proximity and bounded by the same natural lake features which are well studied,
- have homogeneity in the environment of the project areas, and
- have continuity of features between the project areas.

Key known data for the Doris North Project and proposed road corridor include:

- geology between the two sites is contiguous and similar,
- climate and geomorphological processes are the same,
- geochemistry is the same as the rocks are the same ,
- wildlife is the same,
- vegetation is the same,
- soil cover is the same, and
- permafrost is the same.

The key assumptions that have been made in preparing this application include the following:

- all streams are potentially fish bearing particularly in the lower reaches, and
- archaeological sites are likely to be encountered on the proposed road routing.

It is important to note that route alternatives analysis and final route selections have been based on high resolution aerial photographs taken in 2007 and site reconnaissance. Stream channel crossings have been evaluated using these aerial photographs and interpretation is limited to the detail apparent in those aerial photographs. Regional knowledge of stream channels, suggest that the conclusions drawn about stream channels in this report is extremely conservative.

The Precautionary Principle has been applied throughout the engineering design and this report. If there is for example inadequate information to unequivocally say a stream is not fish bearing then it has been assumed to be fish bearing and the design engineering reflects the conservative approach used.

3 Proposed Access Road Development

3.1 Selection of Best Alternatives

The current transport systems at Hope Bay are inefficient, operationally limiting and consuming resources unnecessarily. The proposed access Routes 1 and 2 will create the following benefits for HBML and the environment:

- extension of the operational exploration period to a year round activity,
- reductions in the use of helicopters, associated fuel usage, exhaust emissions and noise,
- minimisation of the footprint by restricting activities to a narrower corridor, and
- increase worker safety by having year round access to an airstrip.

Not proceeding with this proposed project (i.e. the no-go alternative) would result in the following:

- Operational exploration activity in the area will be limited to the current status, which is about 8 months per year. This significantly impacts the amount of annual exploration that HBML can carry out. Furthermore, this means that year round employment of technical and support staff is not possible.
- Exploration support relies solely on air transport. This requires substantial use of helicopters, which means increased fuel usage, exhaust emissions and noise.
- Windy Camp houses between 60 and 80 people at any given time. This camp does not have an all-weather airstrip, and is not linked to an all-weather airstrip via an all-weather road. If a medical evacuation is required during low-light conditions, when helicopters cannot fly, medical evacuation will not be possible.

Therefore, HBML does not consider the no-go alternative to be appropriate.

A detailed multi variable analysis has been conducted to assess various alternatives that have been proposed for the two routes presented in this report. The best alternative for each route has been selected based on the minimisation of the environmental footprint and by eliminating potential environmental concerns by careful routing to avoid key environmental features such as streams. The full analysis is presented in SRK (2008a), which is included as Appendix 1. The outcome of the alternatives analysis has identified two routes which form the basis of this report.

- Route 1: The proposed all-weather access road linking Doris Camp and Windy Camp.
- Route 2: The proposed all-weather access road linking Route 1 to the Patch Lake Drill shop.

Only these two routes are further discussed in this report. Figure 4 shows the proposed Routes 1 and 2.

3.2 Existing Environment

The proposed access road project is contiguous with the Doris North Project area, immediately to the north, as illustrated in Figure 3. The area has subsequently been extensively studied and the existing environment conditions, including physical, biological and socioeconomic aspects has been documented in the Environmental Impact Statement (EIS) and approved Water Licence Application previously submitted for the Doris North Project by Miramar Hope Bay Ltd. Additional reconnaissance activities and regional studies conducted in support of the access road project are presented in this report, including Appendix 1.

3.3 Quarries and Construction Materials

Figure 5 shows the regional geological mapping in the project area. This figure also shows the proposed road alignment, and the underlying regional mafic to ultramafic metavolcanic units. These geologic units host the magnesium (Mg) tholeite basalt rock outcrops of quarries 1 to 4 (quarry 1 is not on the figure as it is located 4 km to the north) which will be developed as part of the Doris North Project.

3.3.1 Potential for Encountering Acid Generating Rock

Extensive testing of samples collected at quarries 1 to 4, through drilling and surface sampling showed that the rock at these sites were ideal for use as construction material (SRK 2007). The samples tested show this material is not potentially acid generating and poses little risk of metal leaching. In addition, the samples tested had a significant excess of calcium and magnesium carbonate minerals, beyond the quantity required to neutralize any acidity that could be generated.

For the development of the access roads, quarries 2 and 4 are planned as the source of construction material.

The amount of material that is currently available for quarrying in these two quarries is 360,000 m^3. The estimated quantity of quarried rock material that will be required to construct the proposed access roads as described in this technical report is 201,000 m^3.

3.3.2 Geochemical Screening of Future Potential Quarry Locations

In the event that additional quarry locations are required for supply of construction rock for the proposed access roads they should be located in the same mafic to ultramafic volcanic stratigraphy as the rock found in the Doris North Project (Appendix 1). Mg-tholeite basalt outcrops are abundant along Route 1 and Route 2, and based on regional assessment, as shown in Figure 5, rock from any of these outcrops would be geochemically suitable as construction material. At this time several potential new quarry locations have been identified and will undergo geo-chemical evaluation as part of a process to identify additional quarries should the need arise. Prior to the start of construction HBML may identify specific new quarry locations within geochemically suitable rock units. At that

time HBML may approach the land owner and relevant regulators to obtain the relevant quarry development permit(s).

3.3.3 Quarry Operations

This section is provided demonstrate how the quarry operations will be undertaken.

The quarry outcrops are 15 to 20 m in height and will be drilled and blasted in benches. The rock produced will be hauled to where it is needed. The rock mass is competent, and conventional hard rock bench design parameters are envisioned, consisting of 3 to 5 m high benches blasted with 80 degree wall slopes. Bench setback will be between 3 to 5 m. These parameters will be adjusted as needed based on observed rock quality once quarry development starts.

During quarry development and operation, surface runoff (rain and snowmelt) management will consist of an upstream quarry berm to prevent runoff from outside of the quarry footprint from entering the area, as well as a downstream berm to contain surface runoff within the quarry footprint. The rock will be mined near to grade but not to a level below to avoid creating permanent ponds at closure. The quarry base will have a low spot or sump where this water can collect without affecting quarry operations. The sumps will be large enough to contain water until it meets standards acceptable for discharge to the environment. This water will contain any development sediment. By allowing it to settle out in a central location, the water can be clarified prior to release. HBML will have to meet the discharge criteria for the Doris North type A water licence to discharge from the permitted quarries.

3.4 Construction

Additional technical details pertaining to the design and construction of the proposed access road is provided in Appendix 1.

3.4.1 Construction Schedule

Wherever possible, roadways will be constructed in the winter to ensure the integrity of the permafrost, but summer construction may be required to realise the benefits of the proposed road development. Winter and summer construction techniques will be identical; however, summer construction will result in the use of more construction material as greater imbedding of material into the active zone will occur. It is recognized that if a program of summer construction is followed then careful screening of the site for nesting birds will be required and it maybe necessary to modify construction schedules to avoid the disturbance of nesting populations.

3.4.2 Typical Construction Methods

Regional information and thermal modeling completed for the Doris North Project (Appendix 1) confirm that the minimum fill thickness required for all-weather roads to ensure minimal thaw settlement and maintenance is 1.5 m. HBML will maintain this fill thickness for the proposed

all-weather roads. Some settlement of roads is expected, and will be addressed through an annual maintenance program.

Road width will initially be limited to the minimum working width, of 8 m and may be extended to 10 m in the future after concurrence by all appropriate stakeholders. For planning purposes and to allow preliminary quantity calculations SRK have assumed the roads will have an 8 m wide crown width (with angle of repose side slopes).

Construction of the all-weather road will entail the following components:

- Clearing of the snow and ice off the road alignment immediately prior to fill placement. At no time will disturbance of the tundra vegetation or soils be allowed outside of the road footprint. No permafrost disturbance will be allowed.
- Construction fill will be placed by end-dumping along an advancing road surface. After end-dumping, the fill will be levelled with a dozer and subsequently compacted.
- The three types of fill making up the roads will be placed consecutively, with a new fill type only placed after the preceding layer has been completed to the design grade and level.
- The contractor will construct temporary rock fill road turnouts to facilitate optimal construction progress at suitable locations identified during construction. These will be removed as construction advances.
- Stream crossings will be dealt with as described in subsequent sections of this document.
- Road turnouts and animal crossings will be constructed using the same methodology as that used for the road construction.
- Where necessary rock drains will be installed at topographic lows to ensure no standing water is created on or near the road (Figure 6).

3.4.3 Construction Equipment

Construction equipment to execute the project are on site, and will consist of the following:

- CAT 980 Loader (one): The Loader will be used to load construction fill material from stockpiles of quarry rock into haul trucks.
- CAT 730 Haul Truck (two) and CAT 773 Haul Truck (two): Haul trucks will be used to transport the construction fill material to the area of placement.
- CAT D8 Dozer (one): The Dozer will be used to level and spread the construction fill material to the required design grade and level after it has been dumped by the Haul trucks.
- CAT CS563 Packer (one): The Compactor is used to compact the levelled construction fill material.
- CAT 330 Excavator (one): The Excavator will be used to create stockpiles of quarry rock for loading by the Loader. The Excavator will also be used for placement of clear-span structures.

Due to the small scale of these structures, this machine will be able to complete all work without having to access the stream channel or the immediate stream banks.

- CAT 16H Grader (one): The Grader will be used to do the final shaping of the road, as well as carry out routine maintenance on the roads.

3.4.4 Typical Road Cross Section

The proposed road surface will have an 8 m crown width. Side slopes will be at angle of repose (about 1.2H:1V). Roadway drainage will be via 0.5% surface grading in both directions from the centreline of the roadway. The road will consist of a 0.2 m thick surfacing grade layer overlying a 0.3 m thick select grade layer. Both these will overlie a 1.0 m thick run-of-quarry layer (Figure 7).

3.4.5 Animal (Caribou) Crossings

HBML will install graded animal crossings at appropriate locations along the proposed all-weather roads. These crossings will typically consist of a gently sloped section with fine grained crushed rock (i.e. surfacing grade material) covering to allow animals to cross the roads with low risk of injury. Immediately following completion of the road construction HBML will work with the Kitikmeot Inuit Association (KIA), community Elders and representatives of the local hunters and trappers associations to determine the number and location of animal crossings required.

For project planning purposes HBML proposes to place animal crossings at road junctions, major bends and at regular intervals along stretches of road where no junctions are present. The animal crossings will entail flattening of the roadway shoulder to 5H:1V for a 10 m wide section on either side of the road (Figure 8). This flattened section will be clad in surfacing grade material to ensure a suitable surface for animals to travel on. Roadway signposts will be installed to warn traffic of the locations of these crossings. These signs will be similar to those used at the Diavik Diamond Mine, which give a color coded warning for the probability of encountering caribou on the road.

3.4.6 Proposed Stream Crossings

SRK has defined a stream in this report as a preferential flow path for surface freshet melt water and rain fall such that it may contain water seasonally or permanently and frequently links permanent water bodies. Some on-site review and reconnaissance flights have occurred relating to the four streams which will potentially be crossed on Route 1 and on Route 2 (Figure 9). These streams are located at the following latitude and longitude co-ordinates respectively; Stream 1: 68.118^{o}; -106.617^{o}, Stream 2: 68.107^{o}; -106.618^{o}, Stream 3: 68.099^{o}; -106.622^{o} and Stream 4: 68.075^{o}; -106.597^{o}.

A general assessment of fish habitat potential in the streams of the area was conducted (Heidi Swanson and Matt Kawei, (Miramar) 2007; as reported by Golder, 2008 (see Appendix 2)) and they were considered to have limited to no fish habitat potential. However, without conducting fish

sampling, it is not possible to unequivocally state that there are no fish present within the streams in question.

HBML are proposing an approach that assumes the streams are fish bearing and will engineer clear-span structures for stream crossings on both Route 1 and 2. These clear-span structures will conform to the Department of Fisheries and Oceans Operational Statements. During the coming summer field season HBML may verify, with appropriate studies, the fish bearing status of the streams, and if they are non fish bearing would propose to cross those streams with appropriately engineered systems suitable to the stream classification.

Stream flow hydrology for each of the four streams in question has been evaluated (see Appendix 1) and confirms that these streams generally have a peak flow of less than 0.03 m^3/s. Regional knowledge, as well as the small peak flows in these streams suggest that the bank-full width (i.e. the ordinary high water mark) of the streams are likely less than 1.0 m, and probably much smaller. Figure 9 demonstrates close-up aerial photography of each stream, confirming that the actual channel width is probably very small.

Construction of the clear-span structures will not impact the stream or stream banks. To demonstrate this, the following construction summary is provided:

- Clear-span structures will consist of conventional arch culverts (Figure 12) or clear-span bridge decks (Figure 11).
- If a clear-span bridge is selected it will have a solid deck to avoid material falling through and entering the stream.
- None of the proposed stream crossings will require a clear-span of more than 2.5 to 3 m.
- Clear-span structure abutments will be sized to ensure at least a 1 m offset from the bank-full width of the stream.
- The minimum freeboard height to the underside of the clear-span structure will be 1 m during a 24-hour duration storm event with a 1:100 year recurrence interval.
- All-weather road fill placement will advance towards the stream, but stop about 3 m from the bank-full width of the stream (see Figure 10).
- The culvert and its components will be installed by excavator (using a sling), standing on the end of the constructed road to ensure no disturbance of original ground or stream.
- When the culvert is in place, the excavator will place fill material into the gap between the culvert and the advancing road, before the normal road construction is allowed to proceed.
- Silt fences will be installed along both sides of the toe of the roadway to ensure that all surface runoff sediment is captured and not released into the streams. The silt fences will start 3 m before the abutment of the clear-span structure.

3.5 Logistics

The proposed Doris Camp - Windy Camp access road project will not require any additional temporary or permanent infrastructure such as a construction camp, fuel supply, landfill, water and waste water treatment facilities, etc. The existing infrastructure at Windy Camp and at the Doris North Project location sites will completely meet all the construction needs of the proposed access road project.

Construction crews will be accommodated at the Windy Camp until such time as the Doris North Project Camp has been completed. Both Doris- and Windy Camps are being operated under approved and active Nunavut Water Board Licences. Personnel and supplies to support the proposed access road project will be transported by air. An all-weather airstrip is currently under construction as part of the Doris North Project, and as soon as this 900 m long airstrip is complete it will be the main airstrip servicing the project. Transfer of personnel and supplies between the airstrip and the Camps will be via helicopter until such time as the all-weather roads are constructed. At that time a passenger bus will be used to transport personnel and crew cab trucks will be used for supplies. However, a winter airstrip may still be maintained on Windy Lake, and during the summer months float planes may continue to operate from Windy Lake.

Fuel to support the proposed access road project is already on site, contained in barges in Roberts Bay, as well as in the Patch Lake fuel tank farm. Re-fuelling of construction equipment will be done using a dedicated fuel truck supplied by the contractor. Re-fuelling will be done in accordance with standard operating procedures developed by HBML. There will be no additional fuel storage facilities required for this proposed access road project. The proposed project does not require the use of any chemicals and hazardous materials, with the exception of oils and antifreeze for the construction fleet. Regular maintenance of the construction fleet will however only be done at designated facilities at either the Windy- or Doris Camps and therefore no additional storage facilities are required.

3.6 Road Usage and Maintenance

The immediate use of the roads will be for light vehicle traffic, personnel transfer busses and fuel and supplies transport. The majority of road traffic along the all-weather access road will coincide with the movement of material and supplies during and immediately after each annual sealift, expected to occur in mid August of each year. Usage will also occur across all seasons in order to keep the exploration operations at Windy Camp functioning and serviced.

Road maintenance will be required weekly during the period of mid July through mid September, when supplies are brought to site by the annual sea lift. If the road is used less frequently, maintenance is expected to only be required monthly during the non-snow months. The all-weather road will be periodically maintained using a conventional road grader following standard road grading procedures for gravel topped roads, i.e.:

- roughen up the surface,

- re-shape the crown,
- remove any ruts or potholes, and
- fill in areas of settlement.

Periodically new topping gravel will be placed on the surface to fill in settlements, potholes or to reshape the road crown, as required. Stockpiles of crushed quarried rock will be maintained at the site quarries for this purpose.

If dust suppression is required this will only be done with water laid down from a truck mounted tank used solely for this purpose. The truck will be filled from the fresh water supply system at the Doris Camp site, with strict adherence to the Water Licence requirements for that site. No chemical suppressants are planned for or thought necessary.

3.7 Decommissioning and Reclamation

The all-weather access roads will remain in place after closure. Peripheral equipment such as signposting will be removed. Where rock drains or clear-span structures have been installed, the roadway will be breached, the element removed and the breached opening sloped and appropriately armoured with rock to ensure that natural drainage can pass through with no requirement for maintenance over the long term.

4 Interested and Affected Parties

4.1 Regulatory Requirements

Construction and operation of the road will require the issuance of surface rights from the KIA. In addition to the surface rights approval, a list of the acts, regulations, and guidelines that may apply to the proposed project activities is attached as Appendix 3.

4.1.1 Nunavut Waters and Nunavut Surface Rights Tribunal Act

Section 11 of the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* generally states that, "no person shall use, or permit the use of, waters in Nunavut except in accordance with the conditions of a license." Section 12 prohibits the deposit of waste without a licence. "Use" is defined as meaning a direct or indirect use of any kind, including but not limited to (a) any use of water power and geotechnical resources; (b) any diversion or obstruction of waters; (c) any alteration of the flow of waters; and (d) any alteration of the bed or banks of a river, stream, lake or other body of water, whether or not the body of water is seasonal.

It is HBML's assessment that the proposed Doris Camp - Windy Camp access road would not require a water licence during the construction or operations phases because the road will neither use water nor deposit waste into water. Specifically:

- there is no proposed deposition of waste into water;
- there is no direct or indirect "use" of water for any purpose;
- there is no diversion or obstruction of waters or any alteration of the flow of waters;
- there is no alteration of the bed or banks or existing channel/shoreline morphology of any seasonal or permanent river, stream, lake or other body of water;
- no structures will be placed in the water, on a temporary or permanent basis and there are no structures or activities that may cause a temporary or permanent barrier of movement of fish or flow of water; and
- there is no area of impact on water.

However, HBML will provide the information necessary to obtain the Nunavut Water Board's technical confirmation of this assessment.

4.1.2 Fisheries Act

As discussed with the Department of Fisheries and Oceans, water crossings would be constructed to incorporate the measures to protect any potential fish and fish habitat as outlined in the applicable Department of Fisheries and Oceans Operational Statements. Preliminary discussions with the Department of Fisheries and Oceans have indicated that no authorization under Section 35 of the

Fisheries Act is likely required, but technical materials will be forwarded to DFO to confirm this assessment.

4.1.3 Navigable Waters Protection Act

Section 5 of the *Navigable Waters Protection Act* requires approval of any work that is built or placed in, on, over, under, through or across any navigable water. HBML understands from Transport Canada policy materials that the administrative definition of "navigable waters" is as follows:

Navigable Waters include any body of water capable, in its natural state, of being navigated by floating vessels of any description for the purpose of transportation, recreation or commerce.

As the four small stream crossings in this case are low flow, less than one metre wide, and would be virtually impossible to navigate by floating vessels, it is HBML's assessment that the crossings do not cross "navigable waters". HBML will submit the necessary technical documents to Transport Canada to obtain their confirmation that the waters in question are not "navigable".

4.2 Land Tenure

It is understood, that the proposed Doris to Windy access road project will be constructed on Inuit owned Lands, Parcel BB-60 (Figure 13).

The Hope Bay mineral exploration property rights have been described in the EIS for the Doris North project as an area comprising 1,078 km^2 forming a contiguous block approximately 80 km long by 20 km wide. It is assumed that the Doris to Windy Camp access road will fall into this area known as Exploration Agreement BB60-00-01, Tok 1, held formerly between Miramar Hope Bay Ltd and NTI.

The existing and proposed land lease areas are shown in Figure 14.

4.3 Public Consultation

HBML understands the critical role of stakeholder engagement. HBML has conducted a range of communications and consultation activities with Inuit groups, communities, regulators and resource managers since 2002 in relation to the Doris North Project. Information about HBML and its activities has been shared with interested parties to attempt to identify key issues and concerns. To that end, in relation to the Windy Camp access road project HBML has engaged the Kitikmeot Inuit Association, Nunavut Water Board, Nunavut Impact Review Board, Department of Fisheries and Oceans and Transport Canada) to obtain their input on the project.

With respect to the Kitikmeot Inuit Association in particular, HBML has negotiated an Inuit Impact and Benefits Agreement in relation to the Doris North Project, and has committed in its application for surface use approval to generally follow its principles in relation to the Windy Camp access road.

5 Environmental Review

5.1 Baseline Environment

5.1.1 Protected Areas

There are no protected areas in, or adjacent to the Hope Bay belt. The closest designated land use restriction is the Queen Maud Gulf Bird Sanctuary, 40 km to the east.

5.1.2 Archaeology

The surveys conducted to date have not identified any archaeological sites along the proposed Route 1 and 2 corridors. Archaeological assessments in the Doris North Project area were undertaken by Point West Heritage Consulting Ltd. between 1995 and 2003. In five seasons of field investigations 127 archaeological sites were discovered in the Doris North site region, including:

- 45 are located on the Doris North Project area,
- six sites immediately adjacent to the Doris North study area,
- eleven of the known sites occur on the ridge between Doris and Tail Lakes,
- seven sites nearby the Doris North study area, and
- 27 sites proximal to Roberts Bay.

The land between Windy and Patch Lakes is of primary exploration focus. Much of this area has already been surveyed in past seasons (Prager 2005, 2006, 2007). In 2007, Miramar requested completion of intensive archaeological assessments within that area. The area was overflown by low and slow helicopter flights and bedrock outcrops, that had not been surveyed previously, were subjected to pedestrian survey using closely spaced transects, generally between 10 and 25 m. Towards the end of the 2007 season a preliminary map for a road proposed between Windy Camp and Doris North was developed. The broad corridor between Windy Camp and the drillers shop at the north end of Patch Lake was surveyed in 2006 (Prager 2007). Because this assessment was added late in the field program and there was some uncertainty as to the exact location of the route, an overview level of assessment was completed. The portion from the drillers' shop to Doris North was viewed by several low and slow passes with a helicopter and selected sections were examined on foot by transects spaced 10 to 30 m apart.

The archaeological remains in the broader region provide abundant evidence of Inuit land use over time. It is also possible that archaeological sites will be identified along the proposed road corridor. HBML is committed to safeguarding archaeological sites and will review the entire proposed route prior to commencing work. In the event that any archaeological sites are identified these will be safeguarded by either rerouting the proposed road or by using trained professionals to record and recover any materials that may be present.

5.1.3 Vegetation

None of the local plants identified during the course of previous baseline studies are designated as endangered or threatened (Doris North EIS).

Vegetation in the study area of proposed developments is characteristic of sub-arctic tundra vegetation. Three ecosystem units were described within the Doris North Project study area:

- ocean shoreline association,
- lowland ecosystems, and
- rock outcrop and upland ecosystems.

Several plant communities make up each of these ecosystems. Plant species identified (Doris North EIS) in the region included

- 19 shrubs,
- 92 herbs,
- 18 grasses,
- 32 sedges and rushes,
- 21 mosses, and
- 8 species and/or genera of lichen.

5.1.4 Animals

No species have been extirpated from the area and none are designated as endangered or threatened (Doris North EIS).

The Doris North project study area for wildlife covered the Hope Bay belt and 18 species of mammals were identified including:

- shrews,
- voles and lemmings,
- arctic hares,
- ground squirrels,
- weasels,
- wolves and foxes,
- wolverines,
- grizzly bears,
- caribou, and
- musk oxen.

Approximately half the species observed are year-round residents of the area while others such as caribou are migratory. Large carnivores such as foxes, wolverine, wolves and grizzly bears are present but are not year round residents as their annual ranges cover much greater territories than the Doris North Project area. The small mammal species present, including ground squirrels and Arctic hare, spend their entire life in a small area and so the local areas where they occur encompass their entire home ranges. Vole and lemming populations are cyclic affecting the abundance and productivity of both bird and mammal predators. Weasel populations will cycle in synchrony with vole and lemming populations.

Muskoxen are permanent and year-round residents in the area and are observed in varying numbers during all seasons, but tend to occur in low numbers during late summer and early winter.

The region is presently used by at least two caribou herds: the Dolphin-Union (Victoria Island) herd and the Ahiak (Queen Maude Gulf) herd. The proposed development is on the margins of the range over which the Ahiak herd calving grounds have been documented (Doris North EIS). Historically, the Bathurst herd has used the area, but this herd has not been observed in the area or adjacent ranges east of Bathurst Inlet since 1996 (Doris North EIS). Inuit traditional knowledge of caribou movements and distribution holds that the Bathurst herd and Ahiak herds are known to mix.

5.1.5 Birds

The Doris North study area did not appear to harbour concentrations of breeding migratory birds such as waterfowl, waterbirds and passerines during the breeding season. In addition, the area does not appear to be important for staging or resting by species that breed further north, during the spring or fall migration, and no “key” habitat has been identified in the regional study area (Doris North EIS). Bird studies in the region since 1994 include aerial surveys for waterfowl and ptarmigan, walking transects and point counts for passerines, and habitat specific surveys for raptors with annual follow-up inspections of all known raptor nest sites (Doris North EIS).

Study results indicate that raptors, such as the peregrine falcon, gyrfalcon, golden eagle and rough-legged hawk are relatively abundant in the region; 101 nest sites were recorded in the survey area from 1994 to 2003. Fifty percent of these nests are concentrated within 400 km^2 around Windy, Doris and Patch Lakes, presumably in response to the abundance of cliffs, dikes, and outcrops that constitute preferred nesting sites.

Shrub environments were found to be important nesting habitats for passerine species breeding in the area (Doris North EIS).

Lakes in the study area typically do not harbour more than a few pairs of waterfowl per lake, and the spring migration period tends to have the highest concentration of waterfowl, however, it appears that few species remain in the study area during the breeding period.

5.1.6 Fish and Streams

Streams and lakes in the Doris North project area and the proposed road corridor have been studied as part EIS and Water Licence Application submitted for the Doris North Project. Seven fish species occur in the Doris North Project area, including:

- arctic char,
- broad whitefish,
- cisco,
- lake trout,
- lake whitefish,
- least cisco, and
- ninespine stickleback.

Arctic char were the most common (61% of total catch), but were limited to the Roberts Lake system, and the lower section of Doris Outflow (below the falls); ninespine stickleback was second in abundance (23%) and was the most widely distributed species and encountered in each of the 14 streams sampled. Lake trout was third in abundance (13% of the total catch) and second in distribution (encountered in 10 of 14 streams). Juveniles and adults were present in the catch, suggesting that the larger streams provide both rearing and feeding habitat.

Stream habitat assessments were conducted at 17 stream sites for the Doris North Study. The associated lakes likely provide over-wintering habitat, which is lacking in streams due to shallow depths. Most of the small inflow tributaries that did not feature a lake or pond upstream were found to be either ephemeral, run-off from melt waters, or provided only marginal rearing and feeding habitat near their mouths (RL&L/Golder 2002; Doris North Project EIS).

5.2 Potential Environmental Issues

In assessing where the proposed activities are likely to create environmental issues as a result of interaction of environmental components with proposed road development or construction activities the following categories have been used to describe the level of likely interaction:

- High: Almost certain that an interaction will occur (65-100%)
- Moderate: A 30 – 64 % chance an interaction will occur
- Low: Unlikely that an interaction will occur (0-29%).

5.2.1 Archaeology

The surveys conducted to date have not identified any archaeological sites along the proposed Route 1 and 2 corridors. In surrounding areas archaeological sites have been found on the ridges.

As the routes chosen for the proposed roads follow the ridge line, it is possible that archaeological sites may exist in the proposed route corridors.

The likelihood of encountering archaeological sites on the proposed route is high.

5.2.2 Vegetation

There are no endangered or threatened species likely to be encountered in the proposed road routings, but vegetation loss or damage beyond the proposed construction footprint is undesirable. The construction technique will clear snow and ice but thereafter the road will be built vertically by end dumping and levelling.

The likelihood of activities causing vegetation disturbance is moderate.

5.2.3 Animals

There are no endangered or threatened species occurring at the site, but the construction activities will cause noise and may temporarily cause animals to avoid the site. During construction it is likely that both normal plane and helicopter operations and road construction will take place with a larger noise influence on the animals. After construction, it is probable that noise levels will be lower than those currently experienced as the number of flights will be reduced.

The road itself will pose a limited barrier to animals as the initial height is 1.5 m and will be sloped and animal crossings will be built.

The likelihood of noise affecting animals during construction is high.

The likelihood of noise affecting animals after construction is low.

The likelihood the road will pose a barrier to animals during and after construction is low.

5.2.4 Birds

The route that has been selected follows the drainage divide and the ridge line. Previous studies have indicated that breeding raptors prefer the cliffs and outcrops, therefore, raptors would not be directly affected by the road footprint, but may be affected from construction noise which could reduce chick productivity.

Most of the breeding songbirds that occur within the study area are ground-nesters with some shrub nesting species, therefore, the road footprint could directly affect songbirds through direct habitat loss and destruction of nests if construction occurs during the breeding season. However, it is anticipated that appropriate mitigation measures could be put into place to avoid such impacts.

The quarry sites to be used focus on the outcrops as approved in the Doris North EIS. Quarrying would lower the outcrops to grade and would be associated with drilling and blasting. As neither the quarry sites nor proposed road routes have recently been surveyed for bird nesting sites interaction of construction activities, between the road and birds cannot be excluded, as these quarry areas may be

used by nesting raptors. The outcrop areas near Quarry #2, for example, have been used in the past by nesting raptors.

The likelihood of proposed road routes interacting with bird nesting sites is moderate.

The likelihood of proposed quarry activities interfering with bird nesting is considered moderate.

5.2.5 Fish and Streams

Under the classification system used by HBML in this report Route 1 will cross three stream channels and Route 2 will cross one stream channel. The stream channels are narrow and have well defined banks.

It has not been possible to exclude the possibility that fish occur in the streams that will be crossed, but the opinion from the route reconnaissance was that the streams were unlikely to be good fish habitat. In response to this, the engineering design has been to treat the streams as fish bearing by planning for clear-spans across the streams supported on buttresses clear of the stream edge. On this basis the interaction of the road with the stream channel will be minimised and therefore the interaction with any fish which may occur is expected to be low.

The likelihood of interaction with stream channels is expected to be low.

The likelihood of influence on fish or fish habitat is expected to be low.

5.2.6 Acid Generating Rock

Quarries 2 and 4 as approved under the EIS for Doris North confirms the quarry rock at these locations and as sampled to date will not be acid generating.

The likelihood for acid generating rock being encountered in new quarry sites of the same rock type is low.

5.3 Environmental Mitigation Measures

5.3.1 Potential Acid Generating Rock

The quarries 2 and 4 have been subject to extensive ML/ARD (Metal Leaching/Acid Rock Drainage) testing and found to be not acid generating. HBML is committed to ensuring that the rock mass used for fill is subject to ABA (Acid Base Accounting) testing to verify that it is non acid generating. Samples spread equally over the approximately 200 000 m^3 of rock to be quarried will be collected and tested.

In the event that any new quarry sites are started in the same rock type as that occurring at quarries 2 and 4, an appropriate test programme will be applied to the rock body before use to confirm it is not acid generating.

In the event that any rock used is found to be acid generating this will be removed and safely disposed. HBML will keep a record of rock placement to ensure any material that may be acid generating can be found and removed.

5.3.2 Sediment and Erosion Control

During construction, operation and maintenance of the proposed road sediment traps and erosion control systems will be used to ensure that no sediments enter streams and that erosion is not caused. Where erosion is identified, HBML is committed to introducing erosion control systems.

5.3.3 Bird Nest Survey

Prior to road construction activities the proposed route will be surveyed for bird nest sites. If nests are encountered the road construction activities will be altered or halted in the immediate area to avoid disruption of breeding. HBML will use bird specialists to identify any potential bird nesting sited that occur in the broader road development corridor and will use mitigation techniques to prevent birds from nesting along the proposed road.

The bird nest survey will also include the quarry areas.

5.3.4 Fish Survey

It is HBML's intent to span all streams using clear-span structures, which will be constructed in accordance with all applicable Operational Statements and which would have no impact on fish or fish habitat. If alternative stream crossings are considered that could not be built in accordance with applicable Operational Statements or that otherwise could have potential to impact on fish or fish habitat, appropriate fish habitat studies would be initiated to confirm whether fish or fish habitat exists in the areas of potential impact.

5.3.5 Public Consultation

HBML is committed to work directly with stakeholders throughout the process to ensure that stakeholder issues and concerns are consistently understood and considered; and to work with stakeholders to ensure that their concerns and issues are directly reflected in the alternatives developed, and to provide feedback on how stakeholder input influences the decisions.

5.3.6 Archaeology

As the proposed road construction may encounter archaeological sites, the entire proposed route will be surveyed to ensure it is free of archaeological sites. If any archaeological sites are encountered on the site they will be recorded and removed or the road rerouted if the sites cannot be moved. HBML is committed to using appropriately qualified professionals to do this work to ensure cultural and historical data and artefacts are not lost or damaged. The goal is to ensure no activities encroach on the minimum 30 m buffer zone required around archaeological sites.

5.4 Potential Residual Environmental Issues

If the management options described above are followed there should be minimal residual issues that could affect the environment. By combining careful route selection, conservative assumptions and engineering, HBML can minimise the extent of the environmental footprint and potential effects.

This report, **"1CH008.000 – Doris Camp - Windy Camp Access Road Technical Report, Hope Bay, Nunavut, Canada",** was prepared by SRK Consulting (Canada) Inc.

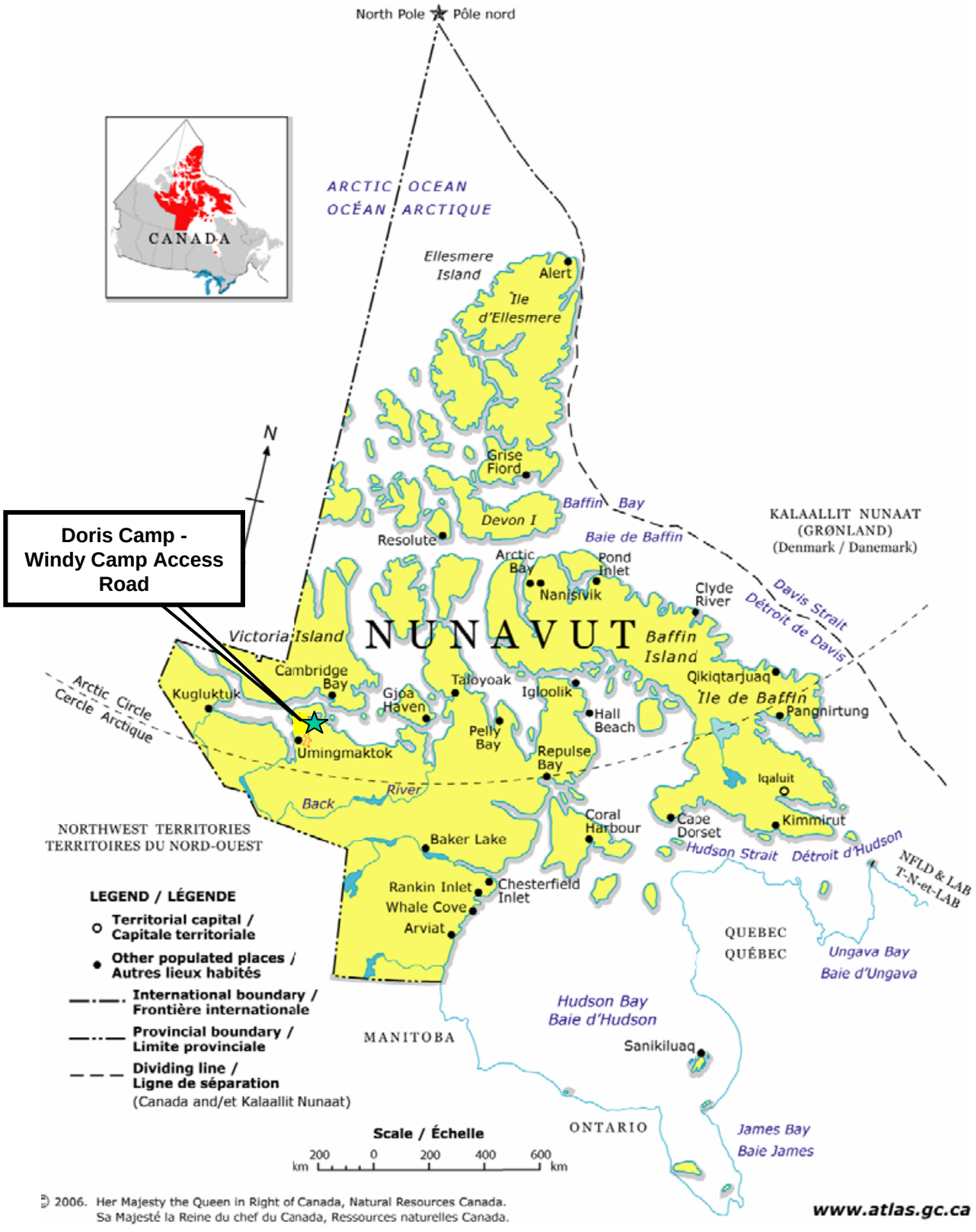
Prepared by

Mark Vendrig, MSc.
Principal Consultant

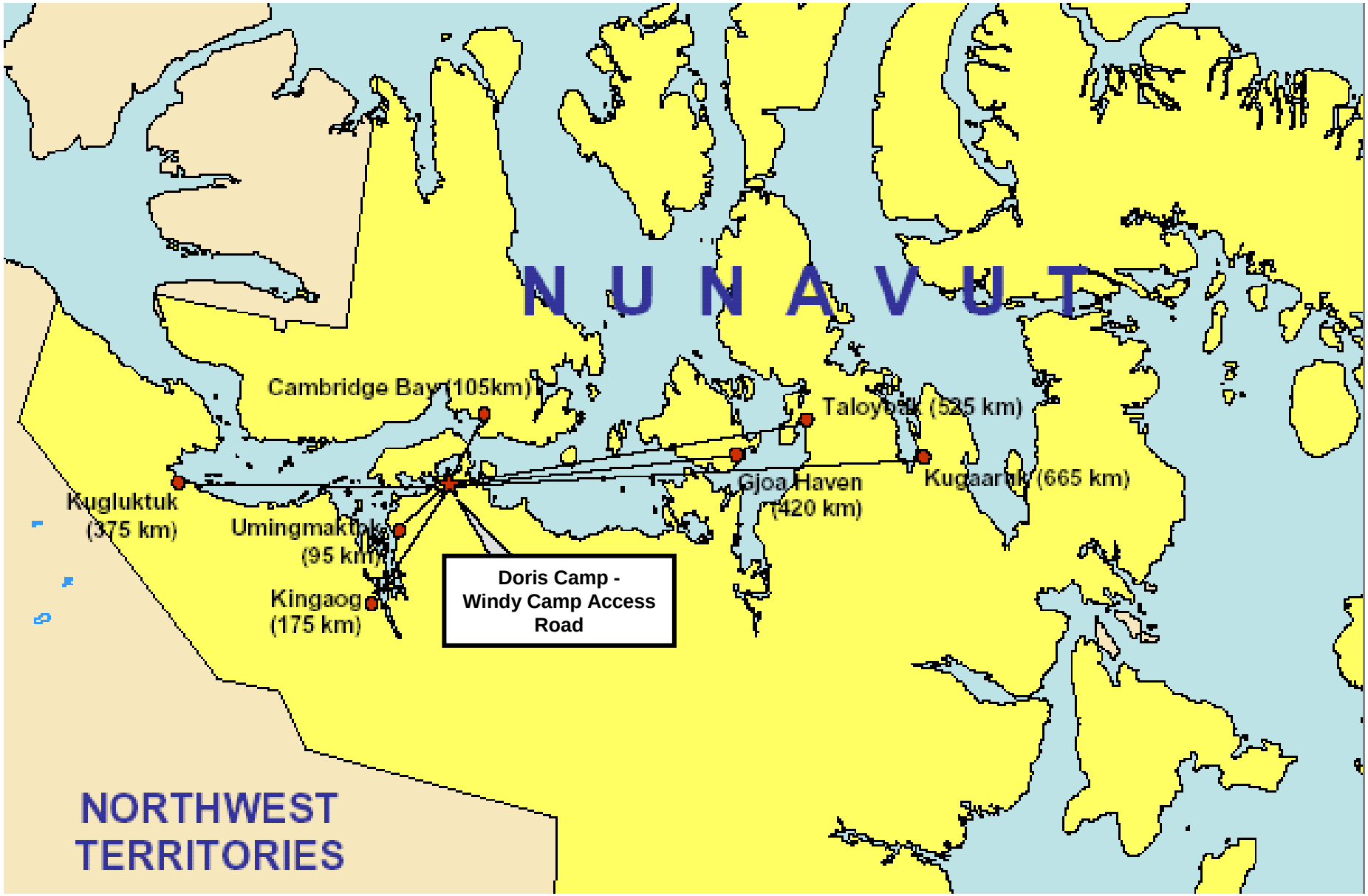
Reviewed by

Maritz Rykaart, Ph.D., P.Eng.
Principal Consultant

Figures

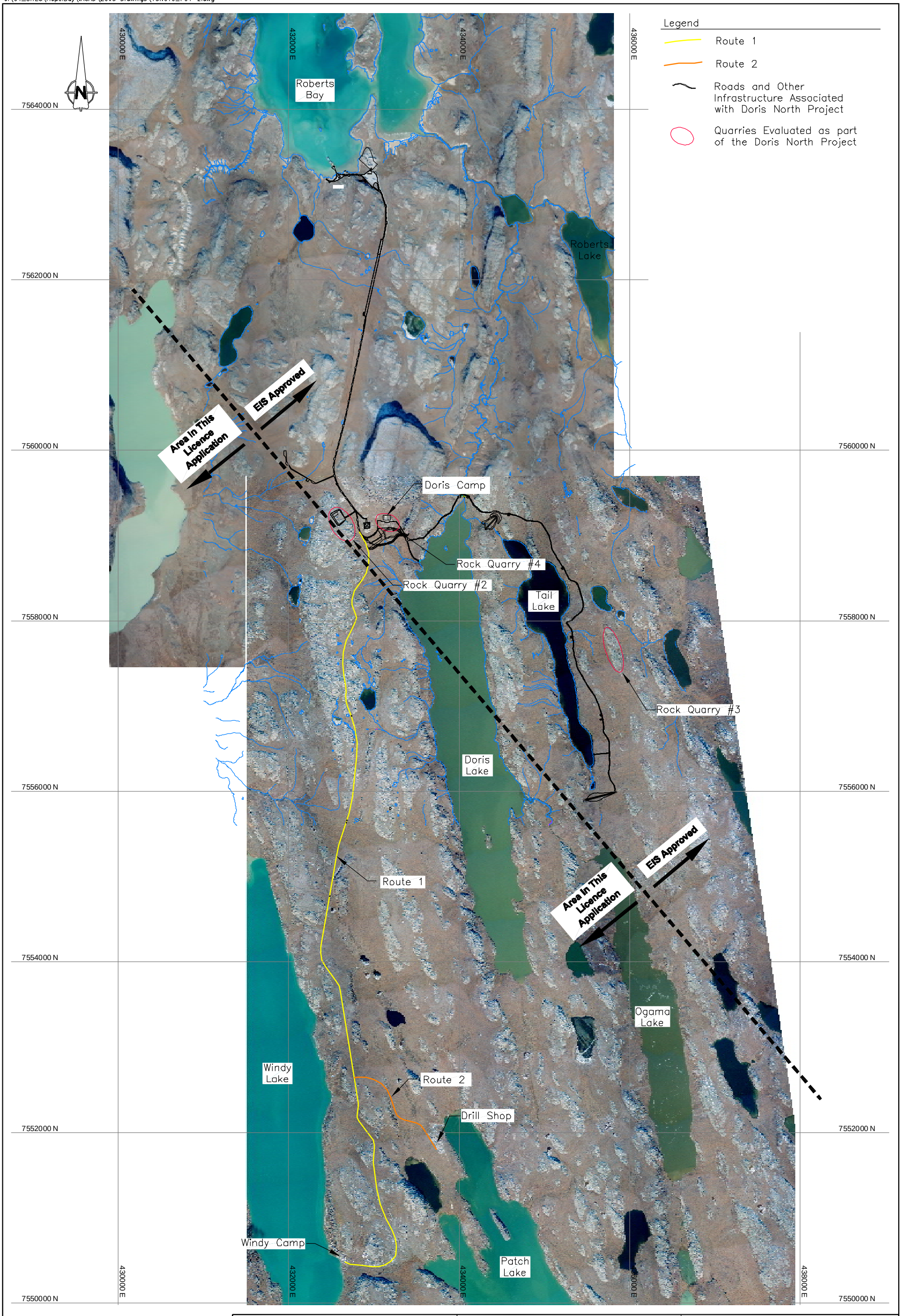


SRK Consulting Engineers and Scientists VANCOUVER	**Hope Bay Mining Ltd.**	**Location Map of HBML's Proposed Project**
Job No: 1CH008.000 Filename: Figure 1_Location_20080403.ppt	Doris Camp - Windy Camp Access Road	Date: April 2008 | Approved: EMR | Figure: **1**



SRK Consulting Engineers and Scientists VANCOUVER	Hope Bay Mining Ltd.	**Location Map Showing Project Location Relative to Nearby Communities**
Job No: 1CC008.000 Filename: Figure 2_Location Cummunities_20080407.ppt	Doris Camp – Windy Camp Access Road	Date: April 2008 | Approved: EMR | Figure: 2

J:\01_SITES\Hope.Bay\!ACAD\2008 Drawings\1UN010_P01-2.dwg



0 300 600 900 1200 1500 Metres

1: 40,000

SRK Consulting
Engineers and Scientists
Vancouver

SRK JOB NO.: 1UN010.P01

FILE NAME: 1UN010_P01-2.dwg

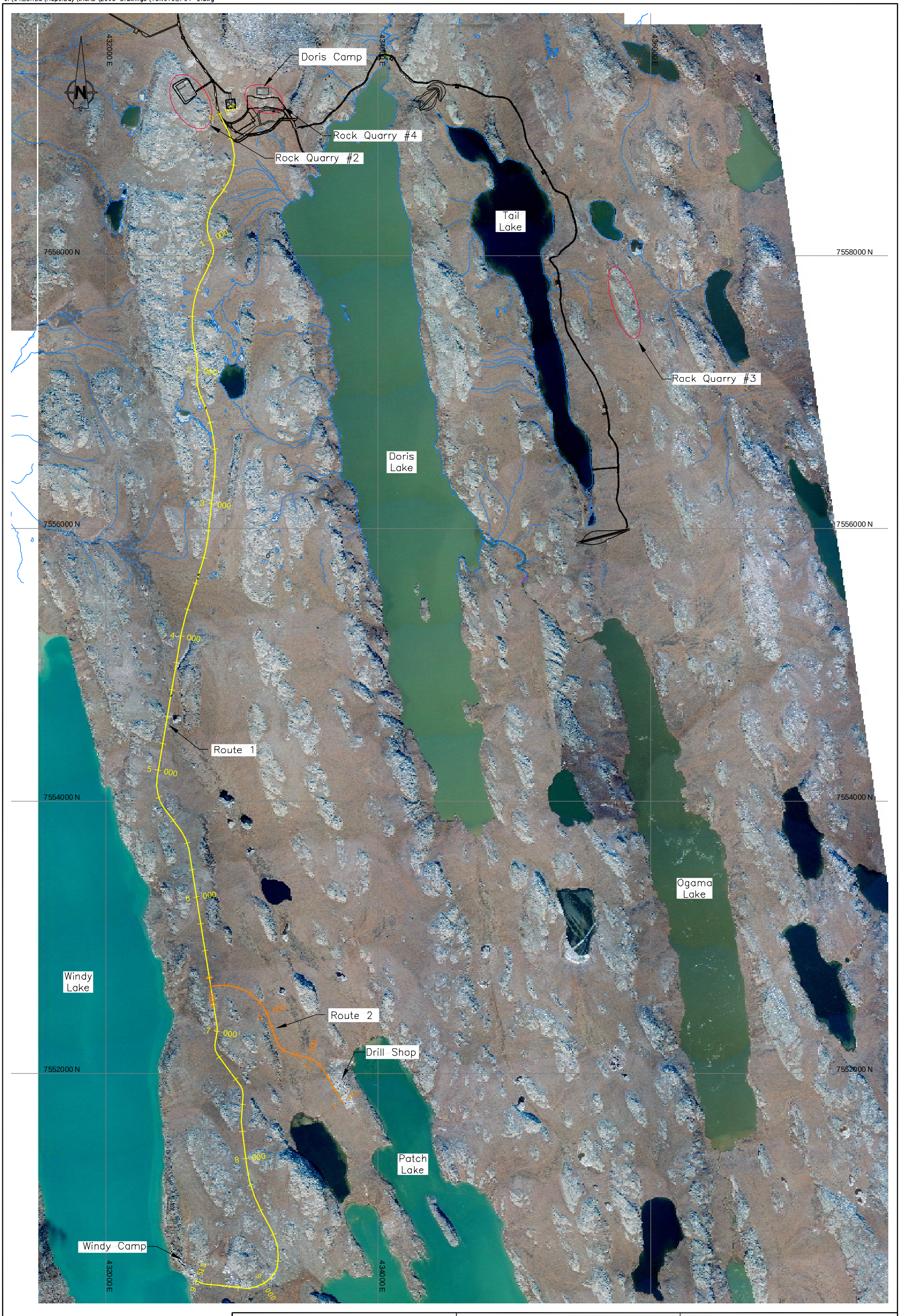
HOPE BAY MINING LTD

Doris Camp - Windy Camp Access Road

Image Showing the Contiguous Nature of the Doris North Project Site and the Study Area for the Doris-Windy Camp Road

DATE:	APPROVED:	FIGURE:
March 08	LW	3

J:\01_SITES\Hope.Bay\!ACAD\2008 Drawings\1UN010_P01-2.dwg



0 300 600 900 1200 1500 Metres

1: 40,000

SRK Consulting
Engineers and Scientists
Vancouver

SRK JOB NO.: 1UN010.P01

FILE NAME: 1UN010_P01-2.dwg

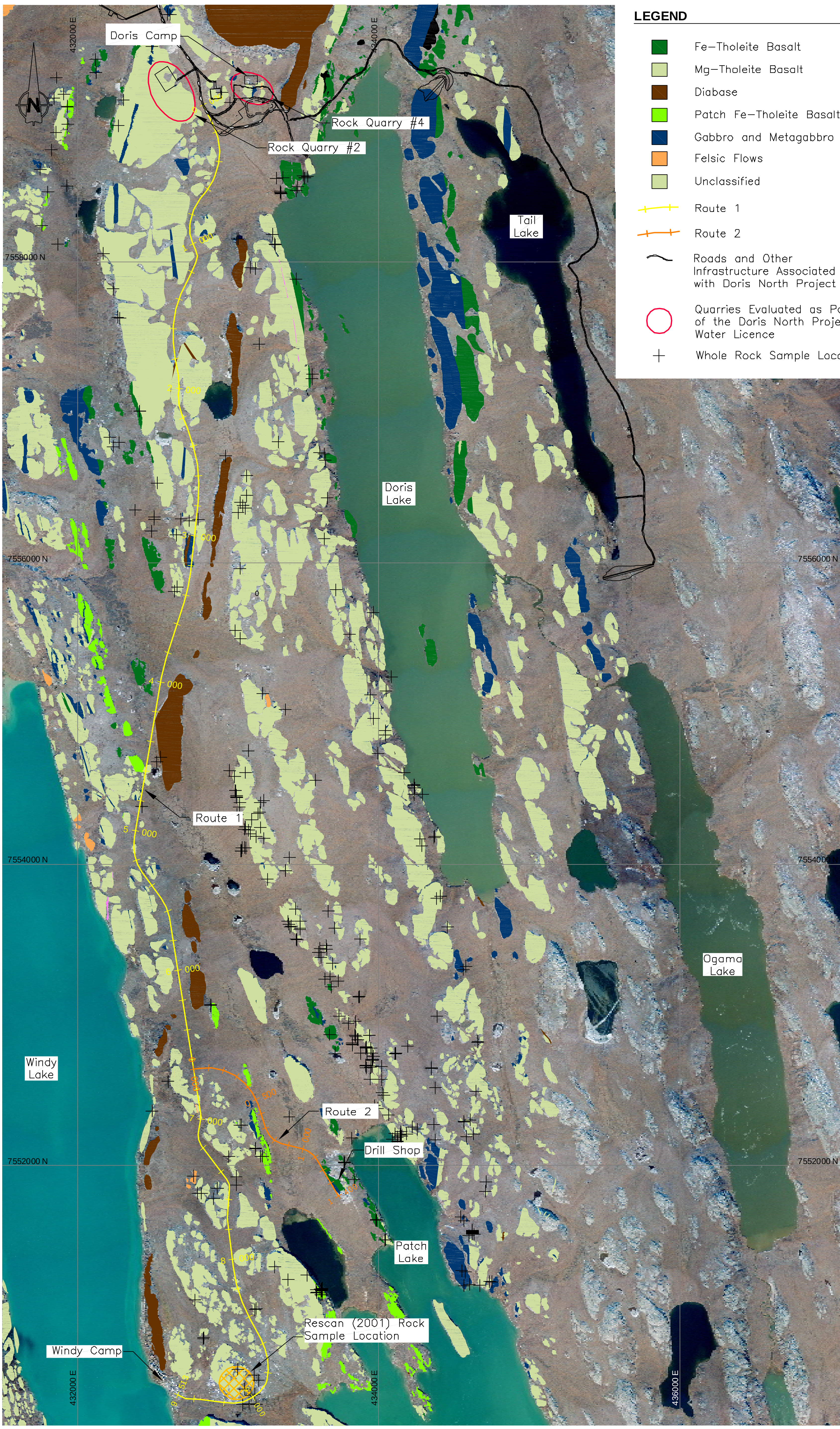
HOPE BAY MINING LTD

Doris Camp - Windy Camp Access Road

Proposed Route for the Doris-Windy Camp Road (Route 1) and Drill Shop Link Road (Route 2)

DATE:	APPROVED:	FIGURE:
March 08	LW	4

J:\01_SITES\Hope.Bay\ACAD\2008 Drawings\1UN010_P01-1.dwg



0 200 400 600 800 1000 Metres

1:25,000

SRK Consulting
Engineers and Scientists

SRK JOB NO.: 1UN010.P01

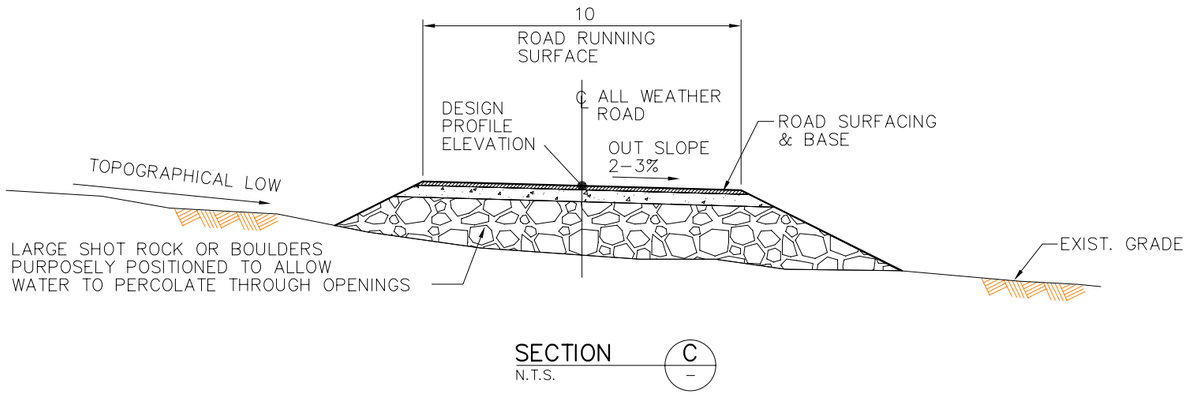
FILE NAME: 1UN010_P01-1.dwg

HOPE BAY MINING LTD

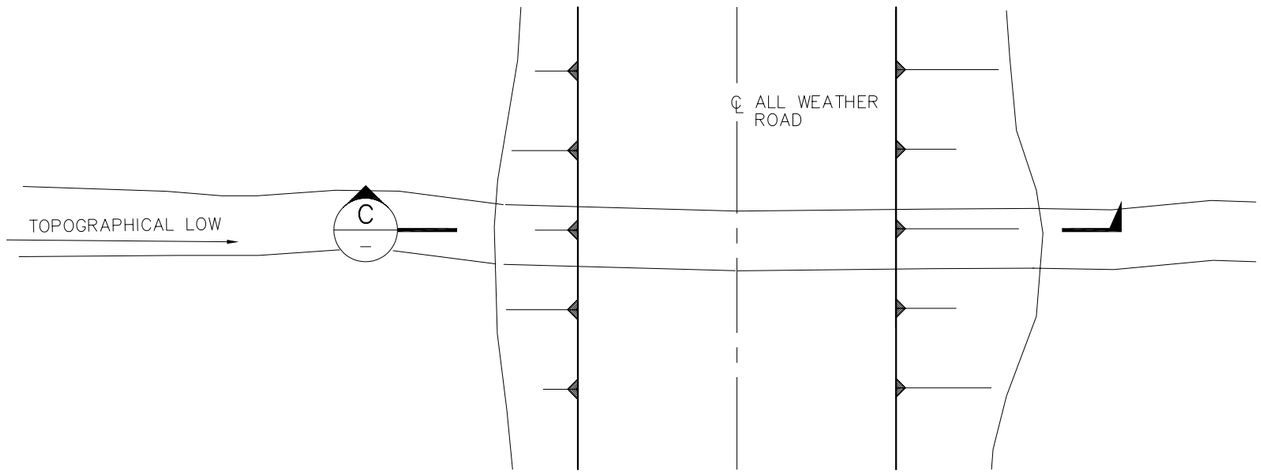
Doris Camp - Windy Camp Access Road

Regional Geological Map Showing Road Routing and Locations of Existing Quarry Sites 2 and 4

DATE:	APPROVED:	FIGURE:
March 08	MR	5



SECTION C
N.T.S.



TYPICAL TOPOGRAPHICAL LOW CROSSING

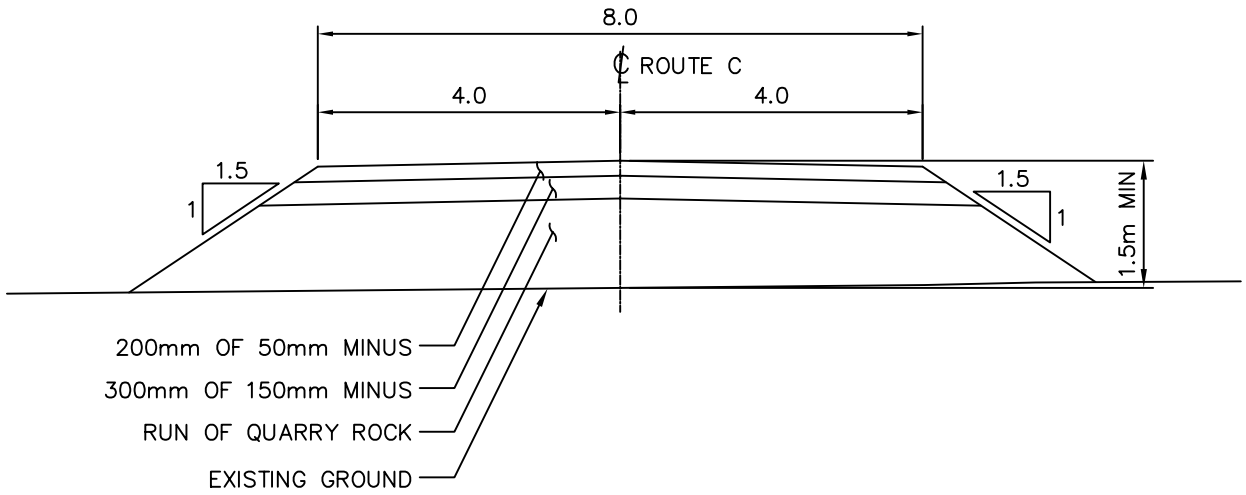
N.T.S.

CATCHMENT AREA < 5 km^2

SRK Consulting Engineers and Scientists, Vancouver B.C.	**HOPE BAY MINING LTD**	Typical Rock Drain Detail		
SRK JOB NO.: 1UN010.P01	Doris Camp - Windy Camp Access Road	DATE: March 08	APPROVED: MV	FIGURE: 6
FILE NAME: 1UN010_P01–6.dwg				

J:\01_SITES\Hope Bay\ACAD\2008 Drawings\1UN010_P01-6.dwg

J:\01_SITES\Hope.Bay\1ACAD\2008 Drawings\1UN010_P01-5.dwg



REFERENCES

Drawing produced by SNC Lavalin (Route C TYP SECTION.dwg).

0 1 2 3 4 5

Scale in Metres

SRK Consulting
Engineers and Scientists
Vancouver B.C.

SRK JOB NO.: 1UN010.P01

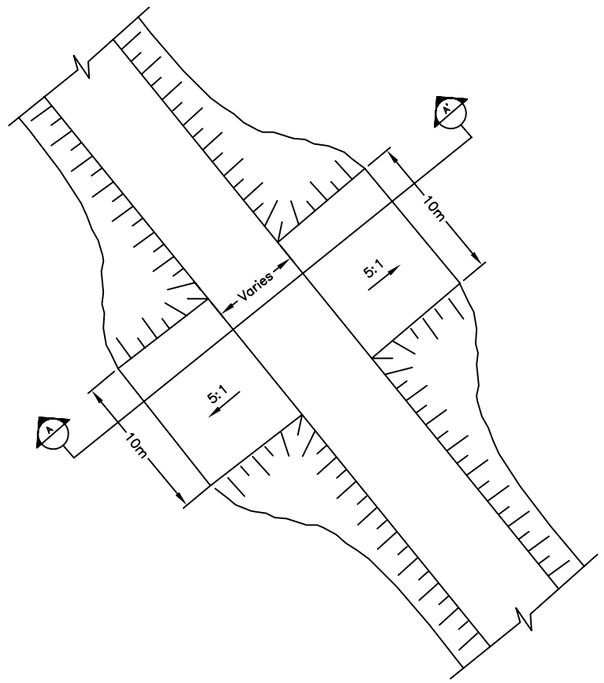
FILE NAME: 1UN010_P01-5.dwg

HOPE BAY MINING LTD

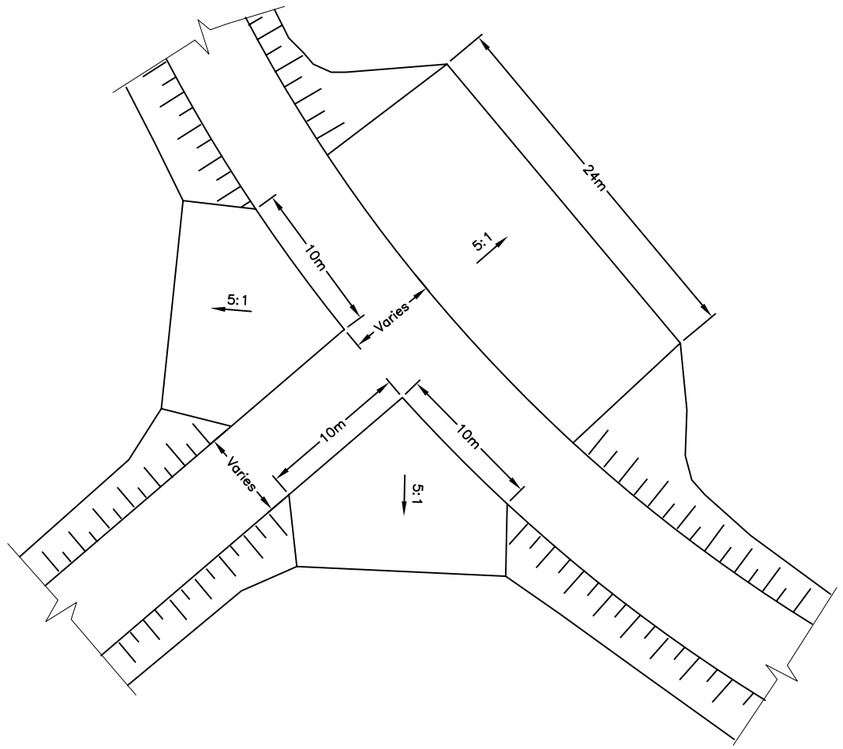
Doris Camp - Windy Camp Access Road

Cross Section of Proposed Road

DATE:	APPROVED:	FIGURE:
March 08	MV	7



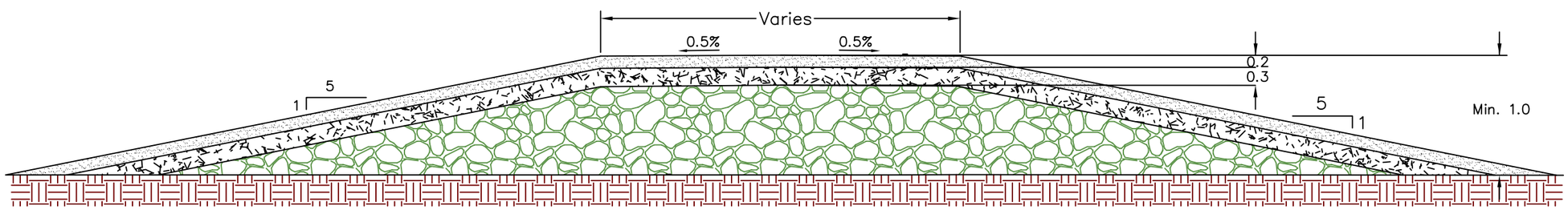
Plan View Along Straight Section
NTS



Plan View at Junction
NTS

Legend:

- Surfacing Material
- Select Subgrade
- Run of Quarry
- Natural Ground



Caribou Crossing Typical Section A–A'
NTS

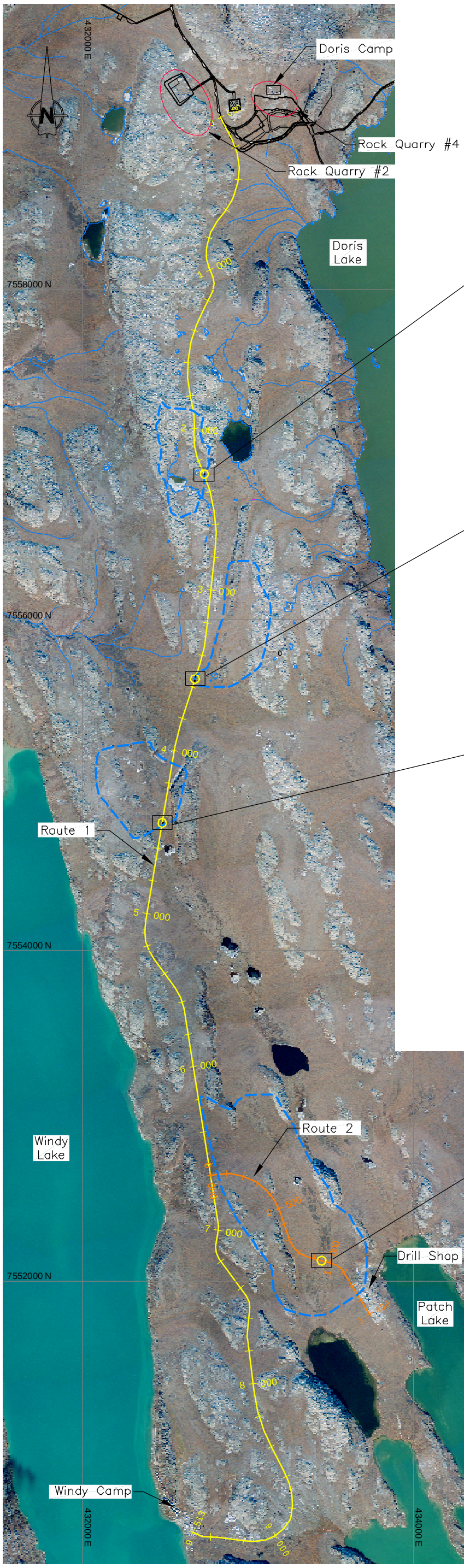
Notes:

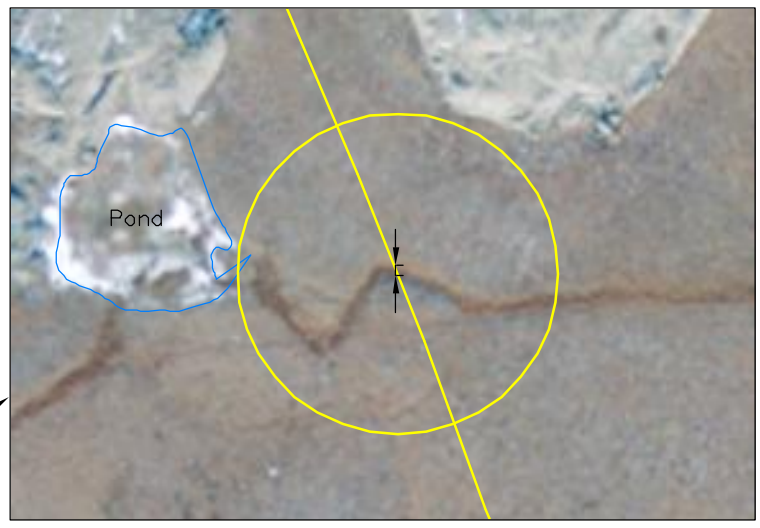
1. The final locations for the Caribou crossings shall be confirmed on site after consultation with the local landowner and Elders.
2. Caribou crossing dimensions are approximate and shall be site fitted to match each individual location.

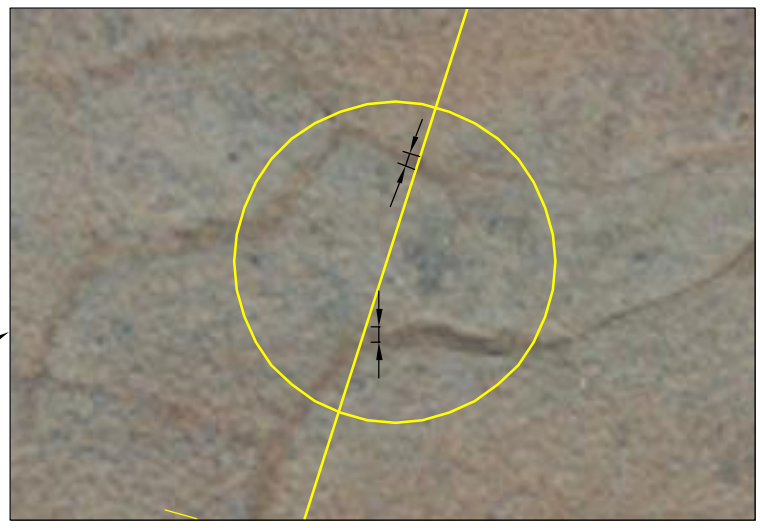
SRK Consulting Engineers and Scientists, Vancouver B.C.	**HOPE BAY MINING LTD**	Profile of Typical Animal Crossing
SRK JOB NO.: 1UN010.P01 FILE NAME: 1UN010_P01–6.dwg	Doris Camp - Windy Camp Access Road	DATE: March 08 · APPROVED: MV · FIGURE: 8

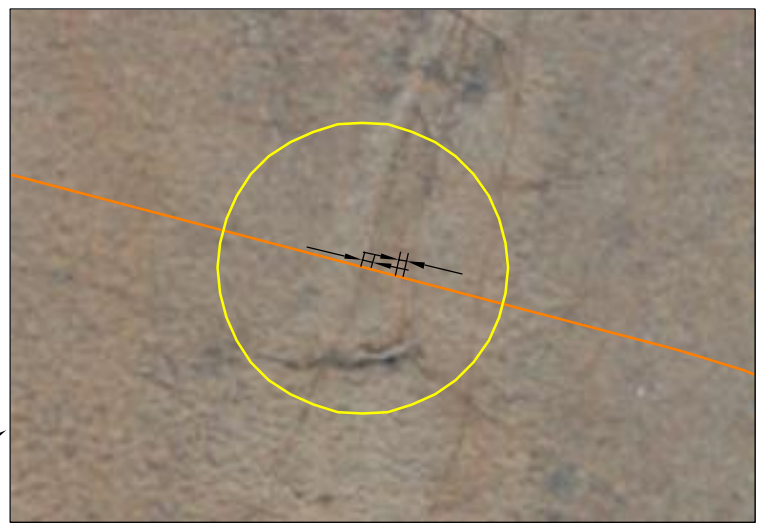
J:\01_SITES\Hope Bay\ACAD\2008 Drawings\1UN010_P01-6.dwg

J:\01_SITES\Hope.Bay\IACAD\2008 Drawings\1UN010_P01-2.dwg









0 10 20 30 40 50
1:1250

Legend

- Route 1
- Route 2
- Roads and Other Infrastructure Associated with Doris North Project
- Quarries Evaluated as part of the Doris North Project
- Interpreted Watershed Boundary
- Possible Stream Crossing Location

Notes

1. Road alignment will be adjusted in the field to adjust to the length of stream crossing.
2. Some streams may have more than one channel.

SRK Consulting
Engineers and Scientists
Vancouver

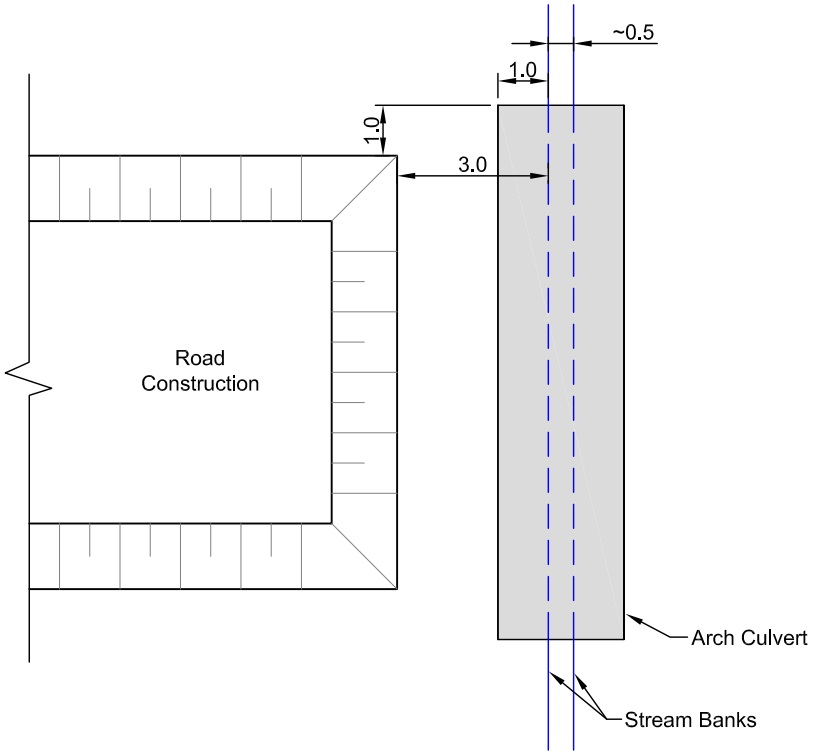
SRK JOB NO.: 1UN010.P01
FILE NAME: 1UN010_P01-2.dwg

HOPE BAY MINING LTD

Doris Camp - Windy Camp Access Road

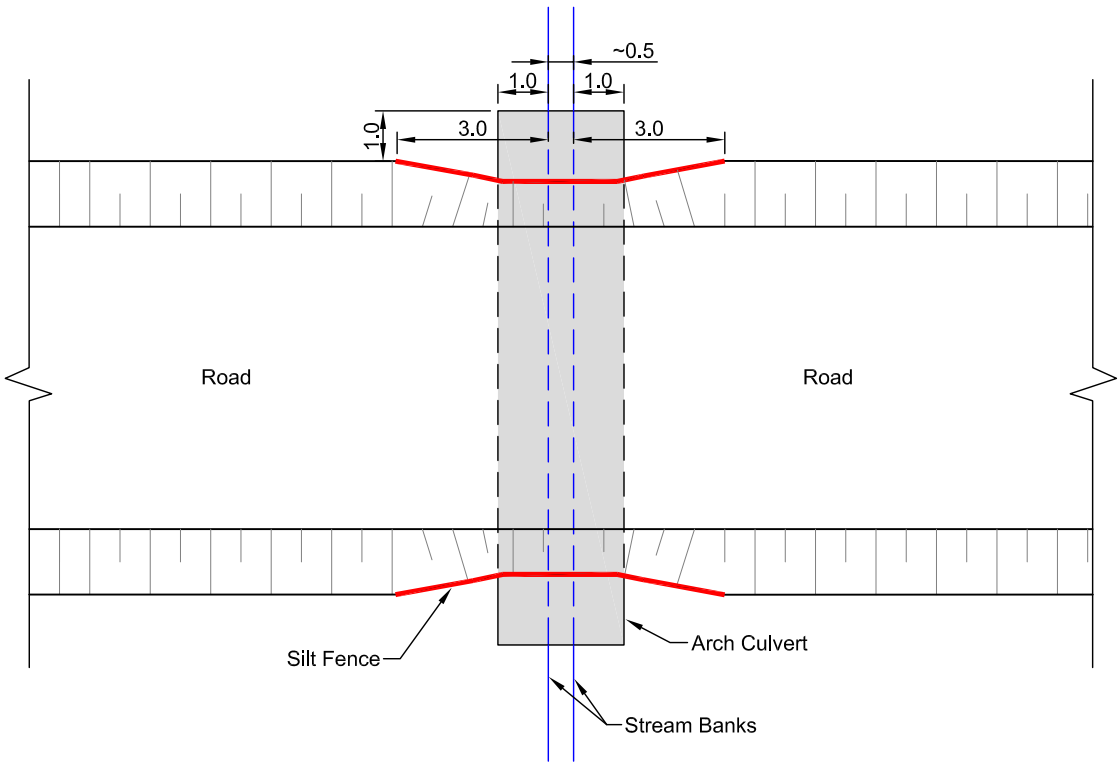
Stream Crossing Locations Along Proposed Road Routes

DATE:	APPROVED:	FIGURE:
March 08	MV	9



Plan View - Culvert Installation Limits

N.T.S.



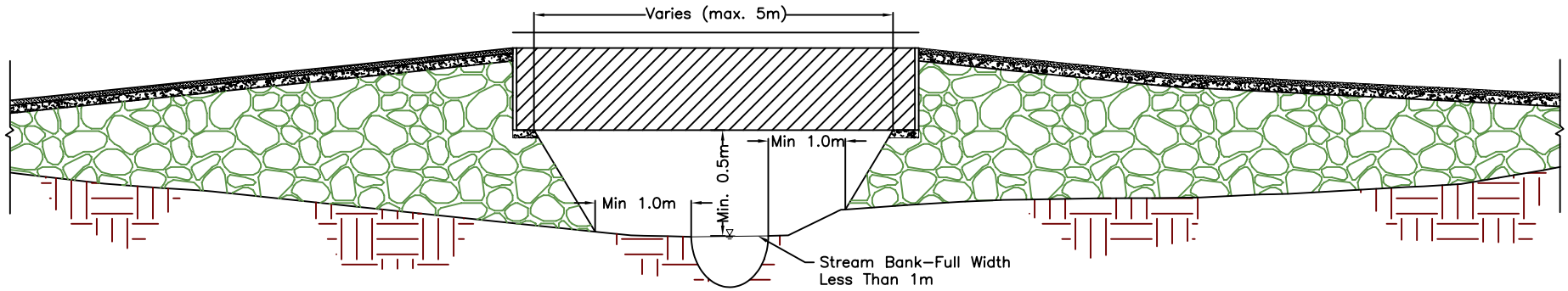
Plan View - After Culvert Installation

N.T.S.

SRK Consulting Engineers and Scientists, Vancouver B.C.	**HOPE BAY MINING LTD.**	Doris-Windy Access Road
		Culvert Installation Typical Plan
SRK JOB NO.: 1CH008.000	Hope Bay Gold Project	DATE: April 2008 / APPROVED: AT / FIGURE: 10
FILE NAME: 1CH008_000-1.dwg		

J:\01_SITES\Doris North\Shared\01_ACAD_Drawings\2008 Acad\1CH008_000-1.dwg

J:\01_SITES\Hope.Bay\IACAD\2008 Drawings\1UN010_P01-6.dwg



Typical Bridge Detail
N.T.S.

Legend:

- SURFACING MATERIAL
- SELECT SUBGRADE
- RUN OF QUARRY
- NATURAL GROUND

SRK Consulting
Engineers and Scientists
Vancouver B.C.

SRK JOB NO.: 1UN010.P01
FILE NAME: 1UN010_P01-6.dwg

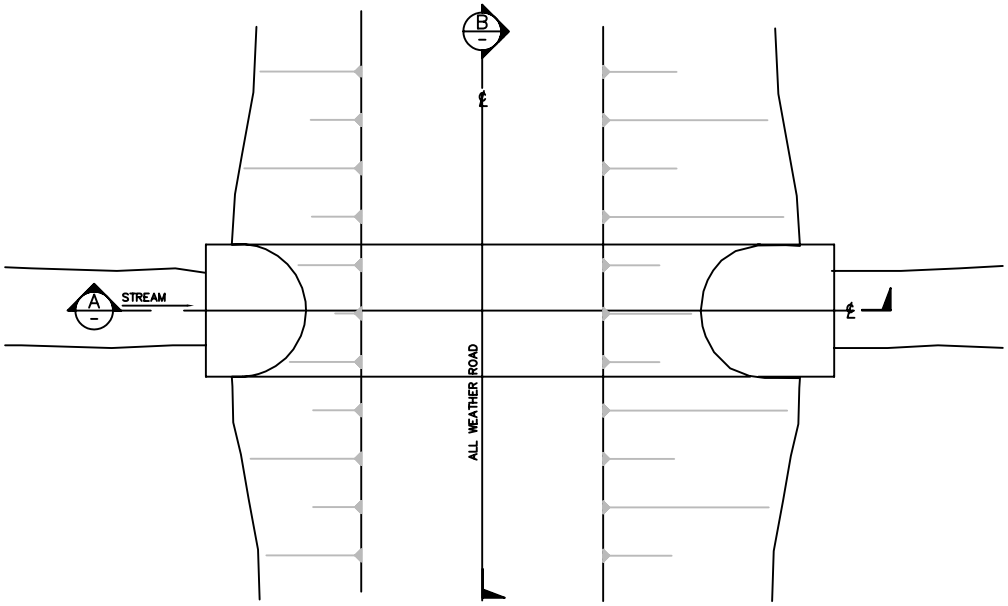
HOPE BAY MINING LTD

Doris Camp - Windy Camp Access Road

Typical Bridge Detail

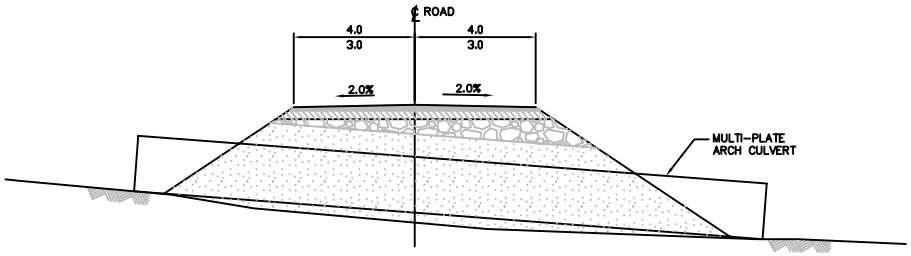
DATE:	APPROVED:	FIGURE:
March 08	MV	11

J:\01_SITES\Hope.Bay\IACAD\2008 Drawings\1UN010_P01-8.dwg

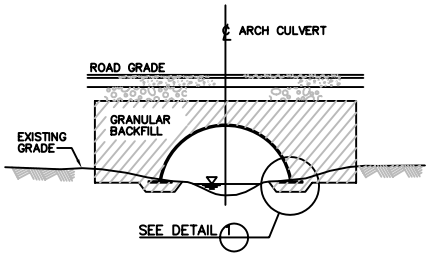


PLAN

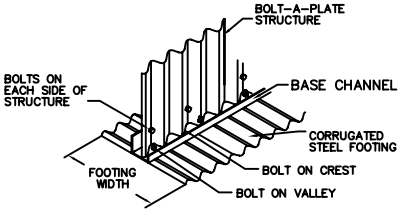
TYPICAL ARCH CULVERT STREAM CROSSING
NTS



SECTION A
NTS



SECTION B
NTS



DETAIL 1 STEEL FOOTING

REFERENCE

Drawing supplied by SNC Lavalin (334499-1410-41D1-0005.dwg).

SRK Consulting
Engineers and Scientists
Vancouver B.C.

SRK JOB NO.: 1UN010.P01

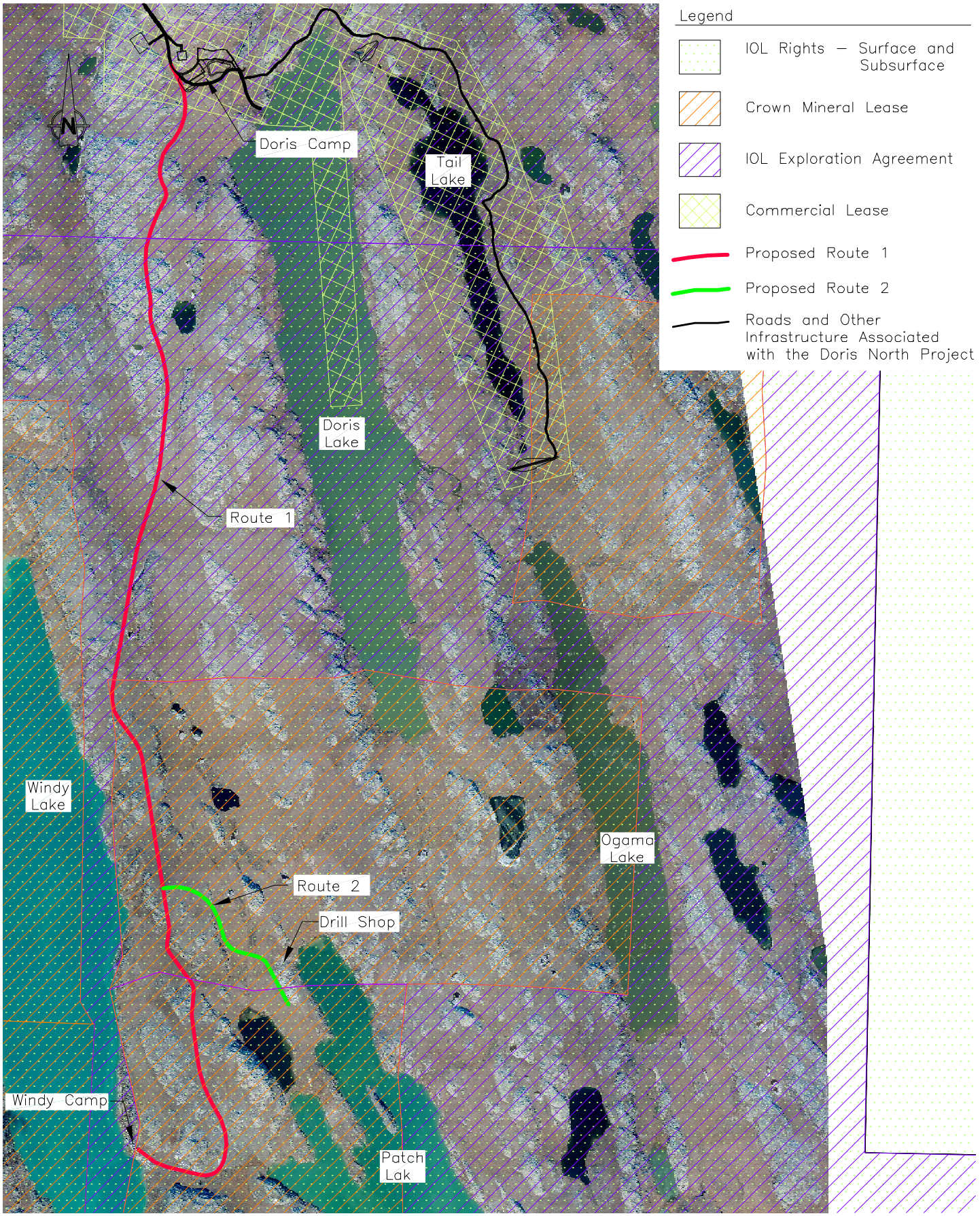
FILE NAME: 1UN010_P01-8.dwg

HOPE BAY MINING LTD

Doris Camp - Windy Camp Access Road

Typical Arch Culvert Detail

DATE:	APPROVED:	FIGURE:
April 08	MR	12



SRK Consulting
Engineers and Scientists
Vancouver B.C.

HOPE BAY MINING LTD

Land Surface Rights for the Doris-Windy Camp Road

SRK JOB NO.: 1UN010.P01

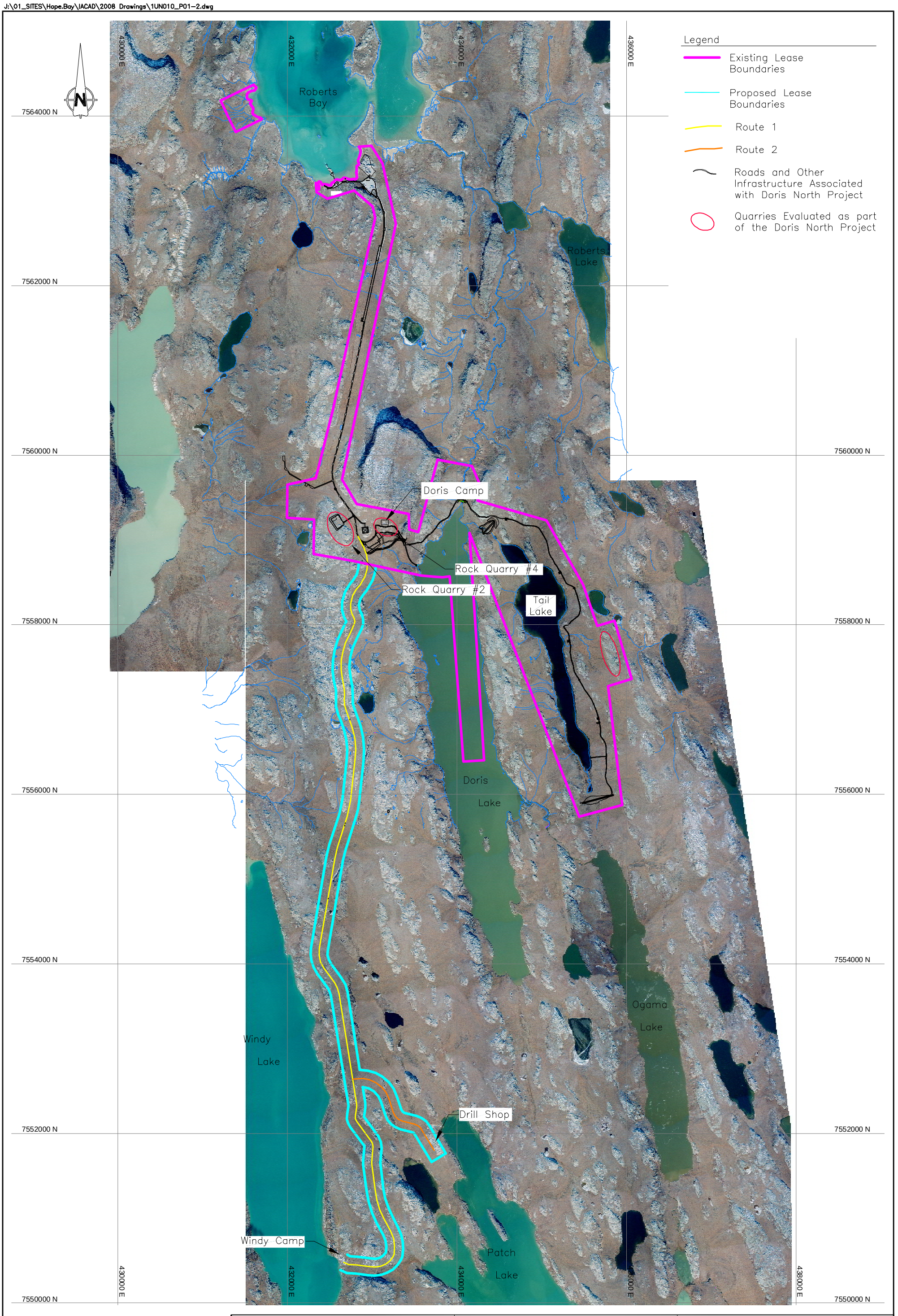
FILE NAME: 1UN010_P01-9.dwg

Doris Camp - Windy Camp Access Road

DATE:	APPROVED:	FIGURE:
March 08	MV	13

J:\01_SITES\Hope.Bay\ACAD\2008 Drawings\1UN010_P01-9.dwg

J:\01_SITES\Hope.Bay\IACAD\2008 Drawings\1UN010_P01-2.dwg



0 300 600 900 1200 1500 Metres

1: 40,000

SRK Consulting
Engineers and Scientists
Vancouver

SRK JOB NO.: 1CM014.011

FILE NAME: 1UN010_P01-2.dwg

HOPE BAY MINING LTD

Doris Camp - Windy Camp Access Road

Existing and Proposed Lease Areas

DATE: March 08

APPROVED: LW

FIGURE: 14

Appendices

Appendix 1

Doris Camp – Windy Camp, All-Weather Road Design Recommendations, Hope Bay, Nunavut, Canada

Doris Camp – Windy Camp All-Weather Access Road Design Recommendations

Hope Bay, Nunavut, Canada

Prepared for

Hope Bay Mining Ltd.

Prepared by

SRK Consulting
Engineers and Scientists

April 2008

Doris Camp – Windy Camp All-Weather Access Road Design Recommendations

Hope Bay, Nunavut, Canada

Prepared for

Hope Bay Mining Ltd.

Suite 300, 889 Harbourside Drive
North Vancouver, BC
CANADA V7P

SRK Consulting (Canada) Inc.

Suite 2200, 1066 West Hastings Street
Vancouver, B.C., V6E 3X2

Tel: 604.681.4196 Fax: 604.687.5532
E-mail: vancouver@srk.com Web site: www.srk.com

SRK Project Number 1CH008.000

April 2008

Table of Contents

List of Tables

List of Figures

List of Appendices

1 Introduction

Hope Bay Mining Ltd. (HBML) contracted SRK Consulting (Canada) Inc. (SRK) to prepare all-weather road design recommendations to link the Doris North Project Camp (Doris Camp) with the Windy Exploration Camp (Windy Camp) and the Patch Lake tank farm and drill shop complex (Drill Shop). These roads, defined as Route 1 and Route 2 respectively are illustrated on Figure 1. These roads are intended to ensure year-round access to the exploration infrastructure at Windy Camp and Patch Lake, which will greatly increase the length of the annual exploration season, result in cost savings due to decreased reliance on helicopter transport, and ensure critical medical evacuation support during poor light conditions by ensuring access to an all-weather airstrip.

This report presents technical support documentation relating to:

- Alternatives selection: Various viable routing options for the proposed roads were developed and evaluated against a set of variables that were expected to be the key environmental criteria if a road were developed. The road routing with the smallest environmental footprint was sought.
- Vertical and horizontal alignment for the proposed roads: Design of the roads is based on project specific design criteria provided by HBML. Taking into consideration these criteria, the alignment was selected making use of air photo interpretation and regional knowledge of site conditions along the alignment.
- Typical road cross section: The proposed road alignment is on permafrost which should be preserved as far as practical. Appropriate thermal analysis is documented to determine appropriate road fill thickness.
- Stream/Channel crossing designs: Potential streams and channels have been identified along the proposed road alignment. Appropriate strategies for crossing these streams and/or channels are presented.
- Source and gradation of road construction material: Road fill material must be sourced from local rock quarries to be developed along the alignment. Criteria for selecting appropriate quarry locations are provided.
- Estimate of construction material quantities: Volumes of construction material will be based on the geometric road design as presented.

Detailed design drawings for the roads and stream/channel crossings have been prepared by SNC-Lavalin Engineers and Constructors (SLEC), the appointed EPCM Contractor, with support from SRK. These are included as Appendix A and B of this document.

2 Background Information

2.1 Road Objectives

The HBML rationale for an all-weather road between Doris Camp and Windy Camp, and the link to the Drill Shop is as follows:

- To provide year-round access between the three facilities.
- To improve drill support efficiency and substantially reduce operating costs.
- To limit tundra damage on existing winter road routes and avoid new winter road routes being created.
- To improve site safety by ensuring year round exploration medical evacuation ability through access to the airstrip.

2.2 Project Specific Design Requirements

HBML provided the following project and site specific minimum design requirements for the all-weather roads:

- Two roads are required:
  - A link between Windy Camp and the Drill Shop, and
  - A link between Windy Camp and Doris Camp.

  The two proposed roads are not mutually exclusive, and to ensure the project objectives are met, both these roads have to be constructed within the same timeframe.
- Both roads will be private roads, with permission for use of the road controlled solely by HBML.
- To maximize the benefit of extending the exploration season, within HBML's strategic objectives for development in the Hope Bay belt, the road should ideally be operational by September 2008.
- HBML is working towards future development stages of the Hope Bay belt, following the Doris North Project. Based on current exploration showing, the Madrid area (close to Windy Camp) could be the location of a future mine site and as such any road leading north towards the Doris Camp site should preferably follow a route that could at a later date be upgraded to become a true mine haul road.
- Any routing must consider historic tundra damage from winter roads or exploration trenching, and where practical the new route should cover such damaged areas.

- Materials for construction of the road must ideally be locally sourced along the route to minimize haul distances and maximize construction efficiency.
- For the purpose of this design, the use of the road is limited to exploration support, i.e. transporting personnel and hauling supplies, drill core and fuel from the main infrastructure support center at Doris North and the Roberts Bay Jetty. For this purpose an 8 m wide road, which is suitable for dual lane light vehicle traffic is selected.
- It is recognized that winter snow clearing of these roads will require significant effort; therefore routing of the road should consider areas where the natural topography would assist in minimizing snow drifting.
- The routing should as far as is practical avoid stream and/or channel crossings, or any other wet, boggy areas where there may be a possibility for disturbance of fish habitat.

2.3 Design Criteria

Taking into consideration the objectives of the roads and the HBML's minimum design requirements, SRK assumed the following minimum design criteria for the roads:

- The design vehicles will be light vehicle traffic (crew cab trucks), personnel transfer (busses), fuel transfer (Super B-Fuel Trucks) and supplies transport (Super B-Trucks and Lowbed Truck). In addition construction equipment will periodically travel the road, including a 988 Loader, 325 Excavator, D10 Dozer, B-300 and 773 Haul Trucks.
- The maximum design speed for any vehicle will be 50 km/hr, when the road is used for single lane traffic. When dual lane traffic is considered this maximum speed will be lower.
- Since both roads will be constructed entirely on permafrost, no cut will be allowed in overburden soils. The road will consist entirely of appropriate fill. Cut will be allowed in sections that pass entirely through bedrock, but only if the final grade remains above normal surrounding ground elevation.
- Thermal analysis indicates that road fill on overburden soils containing permafrost should be a minimum of 1.5 m thick.
- The road will initially be limited to a crown width of 8 m.
- The maximum allowable grade is 10% (10H:1V); however, wherever possible flatter grades should be targeted.
- The minimum allowable radius of curvature for the road is 100 m; however, wherever possible greater radii should be targeted.
- With the understanding that the roadway will initially be 8 m wide, and that the roads will require dual lane traffic, road turnouts will be constructed at a frequency of at least two per kilometre, provided there is a sightline between turnouts. Each turnout shall be at least 30 m long and 3 m wide (beyond the normal crown width).
- No safety berms will be installed as this is not a mine haul road.

- General road design principles and guidelines for improved safety and driveability were applied to the horizontal and vertical road alignments. This implies that wherever possible smooth grades with gradual changes were targeted.
- These roads are intended to be used as a private road and as such will not be designed and built to meet the same geometric standards as public roads.
- Topographical lows where seasonal runoff will collect will be spanned using rock drains.
- Stream crossings (i.e. permanent streams) confirmed not to be fish habitat will be spanned using rock drains if the peak flow is less than 0.25 m^3/sec.
- Stream crossings which may contain fish habitat, or which has a peak flow exceeding 0.25 m^3/sec will be spanned using a free-span structure (i.e. an arch culvert or bridge).
- Materials for road construction will be sourced from local geochemically suitable rock quarries developed along the route.

2.4 Limitations

The proposed road alignments presented in this report has not been ground truthed by an appropriately qualified geotechnical engineer, but is based on detailed air photo interpretation as well as SRK's in depth knowledge of the area in question. It is expected that prior to construction, the design engineer will physically inspect the site, to confirm design assumptions.

3 Site Conditions

3.1 General

Climate, topography, bedrock geology, surficial geology and permafrost conditions at the project area are well defined and understood. Detailed descriptions, including complete reference documentation can be found in the Environmental Impact Statement and Water Licence Application for the Doris North Project submitted respectively in 2006 and 2007 (MHBL 2005; MHBL 2007). Below are short excerpts of data relevant to the proposed roads, including any additional supporting information as appropriate.

3.2 Climate

Site specific baseline climate data for the Hope Bay belt spans back as far as 1993. This includes data from weather stations located at the Doris Camp and Windy Camp. To allow development of long-term climate profiles for the project site, this site specific data was evaluated against three regional weather stations operated by Environment Canada (Lupin, Cambridge Bay and Kugluktuk).

The project site has a low arctic ecoclimate with a mean annual air temperature of -12.1^{o}C. Mean summer air temperatures (June to September) range from -14^{o}C to +30^{o}C, and mean winter air temperatures (October to May) range between -50^{o}C to +11^{o}C. Mean annual precipitation range from 94 to 207 mm, with only 40% falling as rain. Annual lake evaporation (typically occurring between June and September) is about 220 mm.

Typical wind speed ranges from 5 to 7.5 m/sec, with the predominant wind direction being northwest to northeast. Calm conditions (i.e. wind speed less than 1 m/sec) occur about 9% of the time.

3.3 Topography

Site topographical maps are based on aerial photography flown in 2007, with 1 m contour intervals. Generally the topography along the proposed road alignment is typical of coastal lowland with numerous lakes and ponds separated by glacial landforms. These geological features run parallel to the geological intrusions of diabase dykes and sills. The shape of the drainage basins is generally long and narrow and is predominantly orientated along the north-south axis. Lakes are usually present along the bottom of those elongated valleys. Elevation ranges from sea level at Roberts Bay to elevation 158 m at the summit of the Doris mesa approximately 3 km inland.

3.4 Bedrock Geology

The project area is in the faulted Bathurst Block, forming the northeast portion of the slave Structural Province, a geological sub-province of the Canadian Shield. The region is underlain by the Late Achaean Hope Bay Belt Greenstone belt, which is seven to 20 km wide and over 80 km long in a

north-south direction. The belt is mainly comprised of mafic metavolcanic (meta-basalts) and meta-sedimentary rocks that are bound by Achaean granite intrusives and gneisses. The greenstone package has been deformed during multiple events, and is transacted by major-north-south trending shear zones that appear to exert significant control on the occurrence of mineralization, particularly where major flexures are apparent and coincident with antiforms.

3.5 Surficial Geology

Figure 2 presents the results of airphoto analysis completed for the project area. The original coverage was completed by Thurber Engineering in 2003 (Appendix C), and SRK completed the analysis along the remainder of the project area covering the proposed routes in February 2008 (Appendix D).

The area contains continuous permafrost with an active layer generally less than 1 m thick. Within the active zone soils include frost-churned mineral and organic soils overlain by a thin cover of tundra-heath vegetation. Most soils are marine in origin and include clay, silt and some sand. Patterned ground masks the underlying soils. The entire area is situated below the post-glacial marine limit of elevation 200 m. Pleistocene deposits, including till, are buried beneath Holocene marine sediments deposited during the post-glacial marine emergence. Some glacial deposits were reworked by marine wave action.

3.6 Permafrost Conditions

Permafrost in the project area extends to depths of about 550 m. The mean surface temperature is about -6.3°C and the geothermal gradient is 11.4°C km^{-1}. The geothermal gradient in the upper 100 m appears to be isothermal or slightly negative.

Temperature data collected in the project area indicates that the active layer in the marine clay/silt soils appears to be about 0.5 m, while the sand deposit has an active zone no greater than 2 m. The depth of zero annual amplitude varies between 11 and 17 m. The ground temperatures at the depth of zero annual amplitude are generally in the range of -9 to -7°C.

3.7 Hydrology

The project area straddles two major catchment systems, independently flowing to the ocean, i.e. Doris Lake to the east and Windy Lake to the west. Generally streams in the project area are frozen with negligible flow from November until May. Peak flows typically occur in June during snowmelt, and a second smaller peak may occur from rainfall in late August or early September.

4 Road Design

4.1 Alternatives

4.1.1 Approach

There are two distinct and separate routes (though not mutually exclusive) for which designs are presented in this report, as illustrated in Figure 1. They are:

- Route 1: Doris Camp to Windy Camp running north to south with an approximate length of 10 km.
- Route 2: Windy Camp to the Drill Shop running east to west with an approximate length of 1 km.

For each of the routes various alternatives have been evaluated, as illustrated in Figures 3 and 4 using a multi-variable criteria set in order to identify the option with the lowest environmental effect.

The variables used for analysis include the following (each is associated with environmental and technical reasoning for being included in the analysis):

- Length: The road length that needs to be constructed for an alternative will have implications on the construction cost, the amount of quarry rock required, and the extent of the disturbed footprint of the roads.
- Potentially wet areas crossed: These are areas that will be more challenging to construct on and may be attractive to animals as they support variations in vegetation.
- Stream crossings: Due to the lack of data relating to the fish potential of the streams, all permanent streams are assumed to be fish bearing and will therefore require a free-span structure to be constructed to avoid affecting fish habitat.
- Topographical lows: Crossings that require unimpeded seasonal flow of water, such as a rock drain. This has an effect on the construction cost.
- Potential animal movement disruption: As there are herds of caribou that pass through the area the road routing with the smallest footprint in the flat areas will be the most attractive.
- Cliffs and outcrops passed: The largest concentration of bird nesting sites and archaeological artefacts are found in the cliff and outcrop areas of the region. The greater the number of passes to these areas the greater the likelihood that a potential environmental effect will be observed or a heritage loss will occur.

4.1.2 Alternatives Evaluation: Route 1

Four alternative routes were presented for evaluation and are described and evaluated through Table 1. These alternatives are illustrated in Figure 3.

Table 1: Alternatives Evaluated for Route 1

Criteria	Alternative A	Alternative B	Alternative C (Preferred)	Alternative D
Description of route.	Starts at Doris Camp and follows the open flat land between Windy Lake and Doris Lake heading south-east closer to Doris Lake. On reaching the Drill Shop it heads west and then south with a final short distance west to Windy Camp.	Starts at Doris Camp and follows the open flat land between Windy Lake and Doris Lake heading almost directly south with a final short distance west to Windy Camp. This route requires a separate link to the Drill Shop.	Starts at Doris Camp, running south and follows the drainage divide and rocky ridge on the western side of the land between Windy Lake and Doris Lake and then south with a final short distance west to Windy Camp. This route requires a separate link to the Drill Shop.	Starts at Doris Camp heading East to the north of Doris lake and then proceeding south bisecting the land between Doris Lake and Ogama Lake before heading south-west to Windy Camp. The final short distance is west to Windy Camp. This route requires a separate link to the Drill Shop.
Motivation for proposed alternative.	Link to Drill Camp and Windy Camp. Single route as opposed to other alternatives requiring two routes.	The shortest straightest route and possibly the quickest to construct. The route avoids rock outcrops.	Proposed to minimise stream channel and wet area crossings and minimise the length of potential animal crossings.	Links with road already approved and permitted.
Length (km).	10,1	9,3	9,5	14,7
Potentially wet areas crossed.	25	22	6	11
Stream crossings.	6	3	3	5
Topographical lows.	25	36	14	20
Potential animal movement disruption.	Moderate	Moderate	Minimal	Very likely
Cliffs and outcrops passed.	5 Sections	4 Sections	6 Sections	12 Sections
Overall assessment of alternative.	Highest number of streams and potentially wet areas crossed and a significant number of topographical lows crossed. Moderate number of cliffs and outcrops passed.	Highest number of topographical lows crossed, but lowest number of stream crossings and, lowest number of passes on cliffs and outcrops.	Lowest number of stream, topographical lows and potentially wet areas crossed. Moderate number of cliffs and outcrops passed. Environmentally the most attractive option.	The longest length with a high number of stream crossings and topographical lows crossings. The highest number of passes on cliffs and outcrops.

4.1.3 Alternatives Evaluation: Route 2

Three alternative routes, as illustrated in Figure 4 were presented for evaluation and are described and evaluated through Table 2.

Table 2: Alternatives Evaluated for Route 2

Criteria	Alternative X (Preferred)	Alternative Y	Alternative Z
Description of route.	Starts at Drill Shop and heading north-west over a potentially wet area and then turns between outcrops before veering south-west to join Route 1.	Starts at Drill Shop and heading directly to the west between outcrops and then veering south west to join Route 1. The route crosses a fairly large potentially wet area.	Starts at Drill Shop and heading directly to the west between outcrops and then veering south west to join Route 1.
Motivation for proposed alternative.	Simplest engineering route.	Shortest route.	Use of existing pathway.
Length (km).	1.4	0.7	0.9
Potentially wet areas crossed.	4	2	1
Stream channel crossings.	1	3	1
Topographical lows.	3	0	5
Potential animal movement disruption.	Moderate	Low	Low
Cliffs and outcrops crossed.	1 Section	2 Sections	3 Sections
Overall assessment of alternative.	Longest route but the lowest number of interactions with environmental variables.	Largest number of stream crossings and the largest potentially wet areas to cross of the three alternatives.	Most topographical lows crossed and cliffs and outcrops passed.

4.1.4 Alternative Selection

A detailed quantitative and qualitative alternatives assessment was carried out to select the preferred alternatives for each route as presented in Tables 1 and 2. For Route 1, Alternative C and for Route 2, Alternative X was selected by HBML as the preferred road alignments for the following reasons:

- They completely satisfy the project objectives.
- They meet all stated design criteria.
- They each have the lowest number of potential stream crossings.

It was deemed that stream crossings and the possibility of the roads interfering with fish habitat posed the most significant environmental risk, and therefore HBML are of the opinion that their alternative selection process is both technically and environmentally sound.

4.2 Road Geometry

4.2.1 Alignment and Profile

The proposed alignment for Route 1 and Route 2 is illustrated in Figure 1, and detailed engineering drawings showing the alignment and profiles for each of these roads are presented in Appendix A. Both routes meet the design specification with respect to maximum grade and curvature.

Road alignment will be field-fitted based on actual conditions encountered during construction. Such deviations from the design are expected to be minor and will not materially affect the cost and predicted environmental effects of the project. The final alignment will be surveyed and documented in an as-built report.

4.2.2 Typical Cross Section

The road section will have a crown width of 8 m. Side slopes will be at angle of repose for the construction fill material. Roadway drainage will be via 0.5% surface grading in both directions from the centerline of the roadway. The minimum fill thickness along any section of the roadway will be 1.5 m. Design drawings of the road are presented in Appendix B.

This minimum road thickness is based on thermal modeling, and is designed to ensure that the fill material is sufficiently thick to protect the underlying permafrost. Details of the thermal modeling analysis are presented in Appendix E, and states that the recommended minimum pad thickness should be 2.5 m. SRK recommended that any structures sensitive to settlement be constructed on fill pads meeting this specification; however, where settlement (either due to thaw or consolidation) can be accommodated though routine maintenance, the minimum design thickness could be reduced to 1.5 m.

In some areas the roads will be constructed on ice-rich soils and creep settlement could be expected in some locations. This is however a slow process, most likely occurring over several years and will result in overall settlement of the roadway. This can be mitigated by flattening the road shoulders; however, given the added construction cost and associated environmental effects of having to increase the roadway footprint and the amount of quarry rock, HBML will address problem areas as part of routine maintenance. This is an acceptable practice as there is no risk of a major failure which may lead to human and/or environmental risk.

4.2.3 Road Turnouts

Road turnouts will be constructed to ensure safe passing for larger vehicles. Turnouts will be located at a frequency of two every kilometre, provided there is a clear line of sight between turnouts. Each turnout will be 30 m long, and will be 12 m wide (i.e. 4 m beyond the normal 8 m crown-width). The cross section of each turnout is similar to that of the roadway. Turnout locations will be

identified on site as construction progresses according to the design requirements. Design drawings are presented in Appendix A.

4.2.4 Animal Crossings

The landowner has requested that specific portions of the roadway be designed as animal crossings as the roadway may restrict normal movement of caribou in the region. Animal crossings will consist of designated sections of the roadway where side slopes will be flattened to 5H:1V, and topped with similar fine gravel material as is used for the roadway surface (see Appendix B for design drawings) crossings will be at least 10 m wide. Animal crossings will generally be located at major horizontal bends in the alignment, and at junctions. Final animal crossing locations will be decided on in consultation with the landowner and local Elders, after they have inspected the completed roads.

4.3 Construction Material

4.3.1 Fill Source

The current plan is to source construction fill from local rock quarries (2 and 4) approved through the Doris North EIS and Water Licence. Appendix F contains a detailed description of the geochemical characteristics of quarry material. The magnesium (Mg) theolite basalt rock outcrops where Quarry 2 and Quarry 4 are located, as illustrated on Figure 5, have been extensively tested and shown to be geochemically ideal material for road construction. This material is not potentially acid generating and poses little risk of metal leaching.

Mg-theolite basalt outcrops are relatively abundant along Route 1 and Route 2, and based on regional assessment, as demonstrated in Appendix F, rock from any of these outcrops would be geochemically suitable as construction material. At this time no specific new quarry locations have been identified; however, prior to the start of construction HBML may identify specific new quarry locations within these geochemically suitable rock units. At that time the landowner will be approached for obtaining the relevant quarry development permit(s).

4.3.2 Fill Classification

All construction material shall be sourced from designated rock quarries. Three separate material classes have been identified:

- Run-of-Quarry Material: the base foundation course of the roadway.
- Select Subgrade Material: graded transition layer between Run-of-Quarry and Surfacing Material.
- Surfacing Material: final graded topping protection layer for road surface and animal crossings.

Grading curve envelopes for each of these materials are presented in Figure 6. All material shall be free from organic matter, soil, snow and ice.

4.3.3 Fill Volume

A first order estimate of the required construction fill quantities have been calculated based on the typical road cross section as described in this report plus a contingency allowance of 20% for turnouts and animal crossings. The total required fill quantities are as follows:

Run-of-Quarry Material	141,000 m^3 (306,000 tonnes)
Select Subgrade Material	37,000 m^3 (82,000 tonnes)
Surfacing Material	22,000 m^3 (47,000 tonnes)
TOTAL MATERIAL	200,000 m^3 (435,000 tonnes)

For fill estimates the material density is assumed to be 2.95 kg/m^3. The bulking factor and shrinkage factors are assumed to be 1.64 and 1.36 respectively.

4.4 Stream/Channel Crossings

4.4.1 Definition

The following definitions apply to identify stream and channel crossings in this document:

- Topographical lows: these are ephemeral drainage channels, most likely associated with seasonal melt water. These drainage channels are assumed not to contain fish habitat due to the seasonality of the flow.
- Stream crossings: these are assumed to be permanent streams, i.e. they have some sustainable upstream source of water feeding them. Within the definition of streams, three categories are anticipated:
    - Streams confirmed not to contain fish habitat, and with a peak flow of less than 0.25 m^3/sec.
    - Streams confirmed not to contain fish habitat, but with a peak flow of more than 0.25 m^3/sec.
    - Streams that do contain fish habitat, or which has a peak flow exceeding 0.25 m^3/sec.

At the time of preparing this document, Route 1 and Route 2 has not been ground truthed by an appropriately qualified aquatic habitat specialist, and therefore potential stream crossings has been identified as illustrated on Figure 7, based on a review of aerial photography. The four potential crossings subsequently identified, due to the absence of data, have all been assumed to contain fish habitat.

4.4.2 Stream Hydrology

Appendix G summarizes calculated streamflow hydrology for each of the four identified possible stream catchments. Peak flows for the streams range between 0.01 and 0.03 m^3/sec. The flows associated with a 24-hr duration storm event with a 1:100 year recurrence interval range between 0.57 and 0.13 m^3/sec.

4.4.3 Rock Drains

Topographical lows and streams with peak flows less than 0.25 m^3/sec and not suitable for fish habitat will be crossed using rock drains. A detailed design of these rock drains are provided in Appendix A.

4.4.4 Free-Span Crossings

Streams that contain fish habitat, irrespective of their peak flow, and streams that do not contain fish habitat, but with a peak flow greater than 0.25 m^3/sec will require a crossing involving a free-span structure. Free-span structure abutments must be completely outside the bankfull width of the stream and must be able to pass the 24-hr duration storm event with a recurrence interval of 1:100 years. The bankfull width of any of the potential stream identified have not been measured; however, preliminary air photo analysis and regional knowledge suggest that they are most likely less than 1 m wide, and probably only about 0.5 m wide.

For the purpose of this report it has been assumed that free-span structure abutments will be offset from the bankfull width by 1 m on either side. Free-span structures will thus require spans ranging between 2.5 and 3 m at most. This will be confirmed in the field prior to construction.

Two types of free-span structures are being considered; arch culverts and prefabricated bridge decks. Typical design details for these structures are provided in Appendix A.

5 Closure

This report provides details pertaining to design recommendations for an all-weather road between the Doris Camp and Windy Camp. A separate road link to the Drill Shop is also included. These design recommendations are based on specific objectives for the road as stipulated by HBML together with minimum design requirements. It should however be noted that the proposed routes have not been ground truthed by an appropriately qualified SRK engineer.

This report, "**Doris Camp - Windy Camp All-Weather Access Road Design Recommendations, Hope Bay, Nunavut, Canada**," was prepared by SRK Consulting (Canada) Inc.

Prepared by

Lowell Wade, M.Sc., E.I.T.
Consultant

Reviewed by

Maritz Rykaart, Ph.D., P.Eng.
Principal Consultant

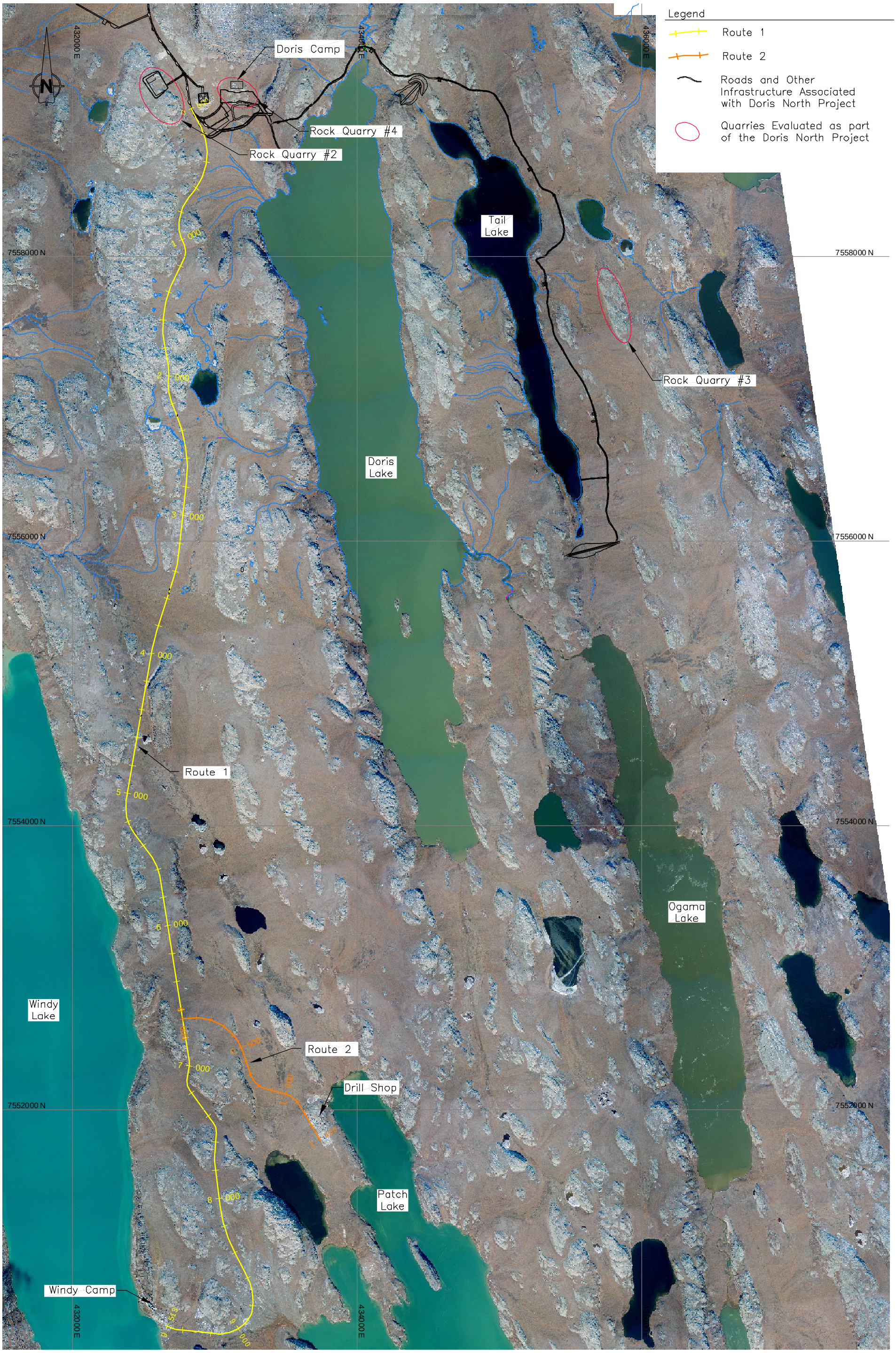
6 References

MHBL 2005. Final Environmental Impact Statement. Doris North Project, Nunavut, Canada. Report submitted to Nunavut Impact Review Board, October 2005.

MHBL 2007. REVISED Water License Application Support Document. Doris North Project, Nunavut, Canada. Report submitted to Nunavut Water Board, April 2007.

Figures

J:\01_SITES\Hope.Bay\!ACAD\2008 Drawings\1UN010_P01-2.dwg



0 300 600 900 1200 1500 Metres

1: 40,000

SRK Consulting
Engineers and Scientists
Vancouver

SRK JOB NO.: 1UN010.P01

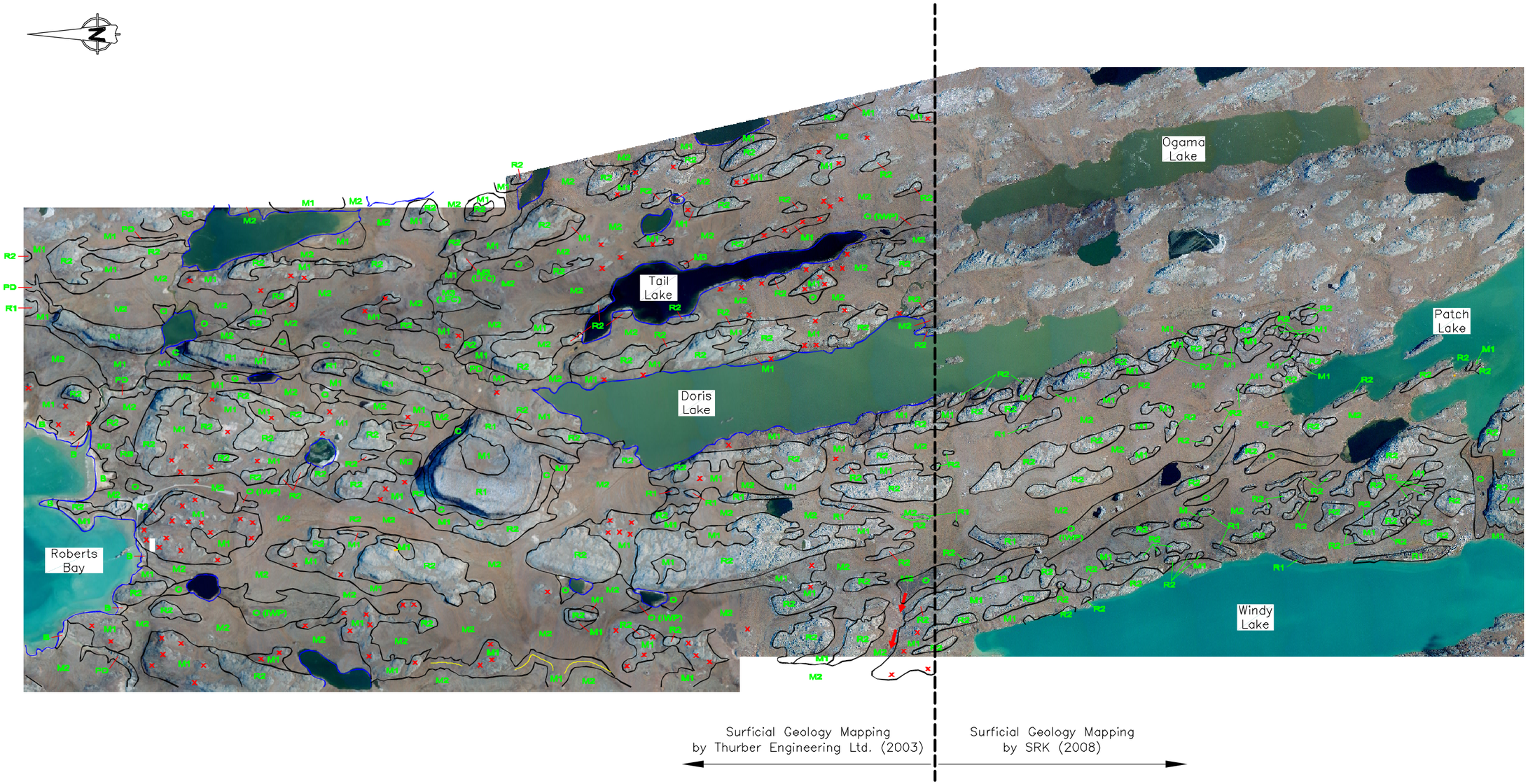
FILE NAME: 1UN010_P01-2.dwg

HOPE BAY MINING LTD

Doris Camp - Windy Camp Access Road

Proposed Route for the Doris-Windy Camp Road (Route 1) and Drill Shop Link Road (Route 2)

DATE:	APPROVED:	FIGURE:
March 08	LW	1



Note: Refer to Appendix C, Table 2 for a legend of the map units.

0 300 600 900 1200 1500 Metres

1:40,000

SRK Consulting Engineers and Scientists
Vancouver B.C.

SRK JOB NO.: 1UN010.P01

FILE NAME: 1UN010_P01-4.dwg

HOPE BAY MINING LTD

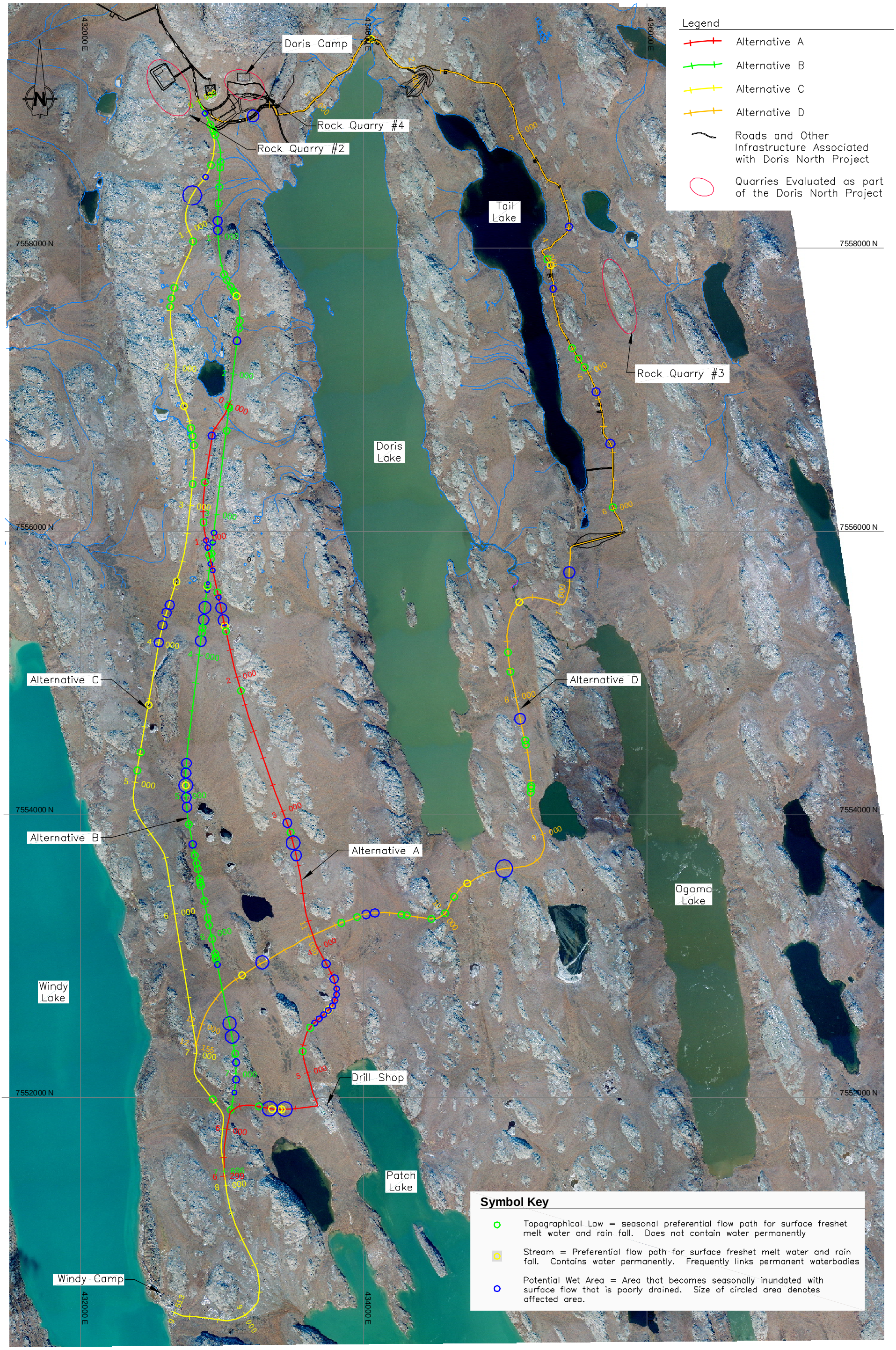
Doris Camp - Windy Camp Access Road

Air Photo Analysis for the Project Area

DATE:	APPROVED:	FIGURE:
March 2008	LW	2

J:\01_SITES\Hope Bay\ACAD\2008 Drawings\1UN010_P01-4.dwg

J:\01_SITES\Hope.Bay\IACAD\2008 Drawings\1UN010_P01-2.dwg



0 200 400 600 800 1000 Metres

1: 25,000

SRK Consulting
Engineers and Scientists
Vancouver

SRK JOB NO.: 1UN010.P01

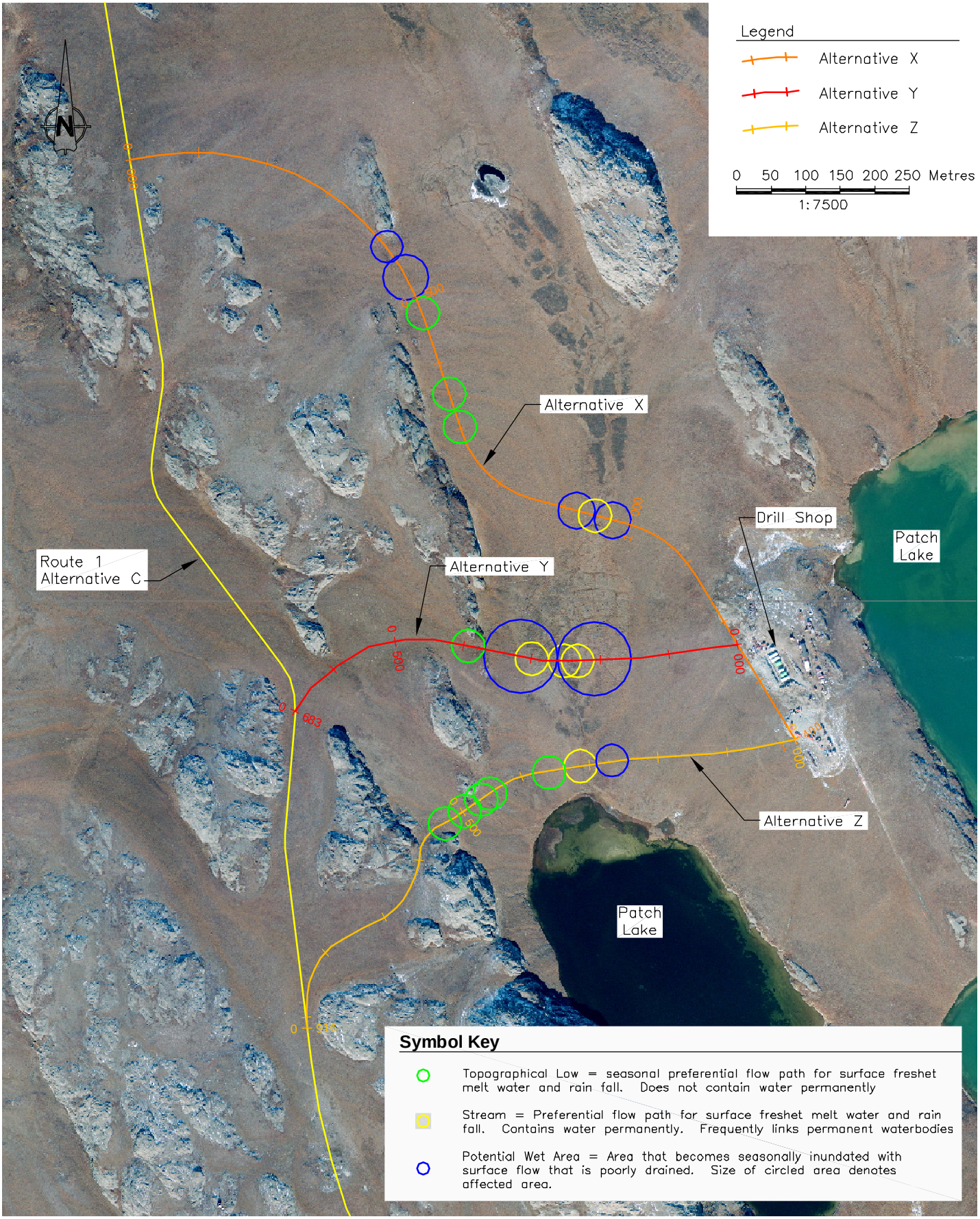
FILE NAME: 1UN010_P01-2.dwg

HOPE BAY MINING LTD

Doris Camp - Windy Camp Access Road

Alternatives Considered for the Doris-Windy Camp Road (Route 1)

DATE:	APPROVED:	FIGURE:
March 08	LW	3



SRK Consulting
Engineers and Scientists
Vancouver B.C.

HOPE BAY MINING LTD

Alternatives Considered for the Drill Shop Link Road (Route 2)

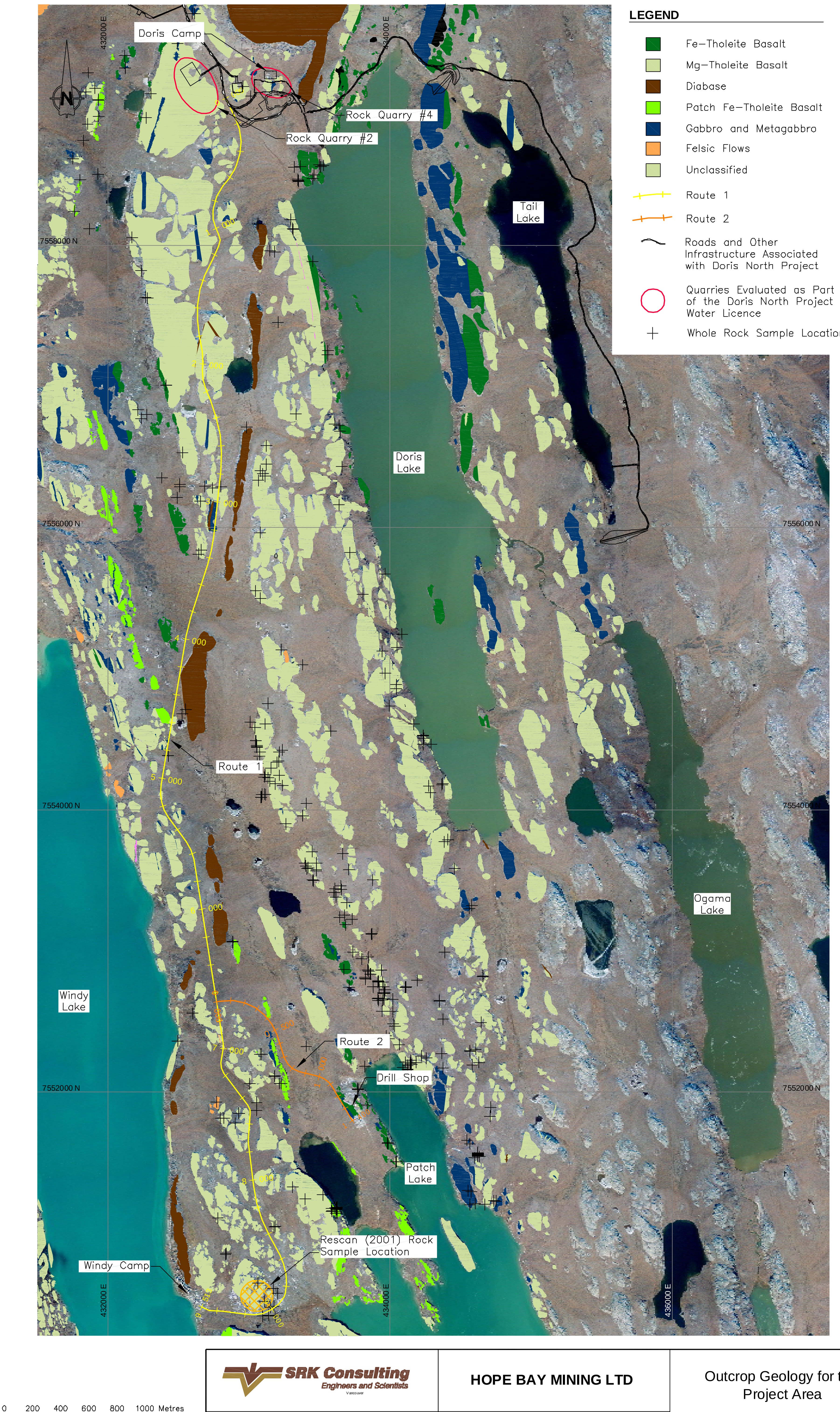
SRK JOB NO.: 1UN010.P01
FILE NAME: 1UN010_P01-2.dwg

Doris Camp - Windy Camp Access Road

DATE:	APPROVED:	FIGURE:
March 08	MR	4

J:\01_SITES\Hope Bay\ACAD\2008 Drawings\UN010_P01-2.dwg

J:\01_SITES\Hope.Bay\!ACAD\2008 Drawings\1UN010_P01-1.dwg



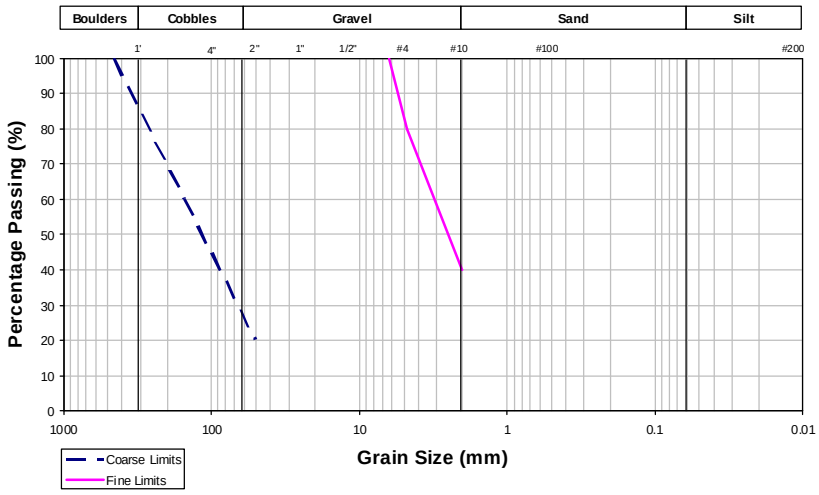
SRK Consulting
Engineers and Scientists

HOPE BAY MINING LTD

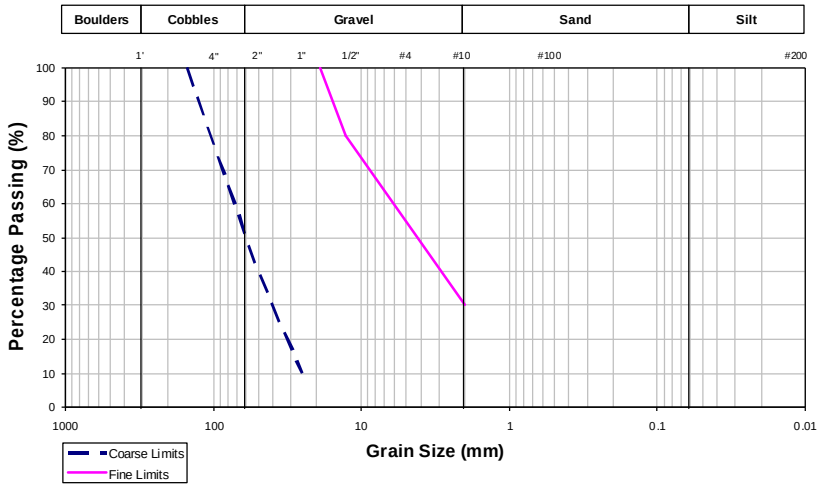
Outcrop Geology for the Project Area

SRK JOB NO.: 1UN010.P01	Doris Camp - Windy Camp Access Road	DATE: March 08	APPROVED: MR	FIGURE: 5
FILE NAME: 1UN010_P01-1.dwg				

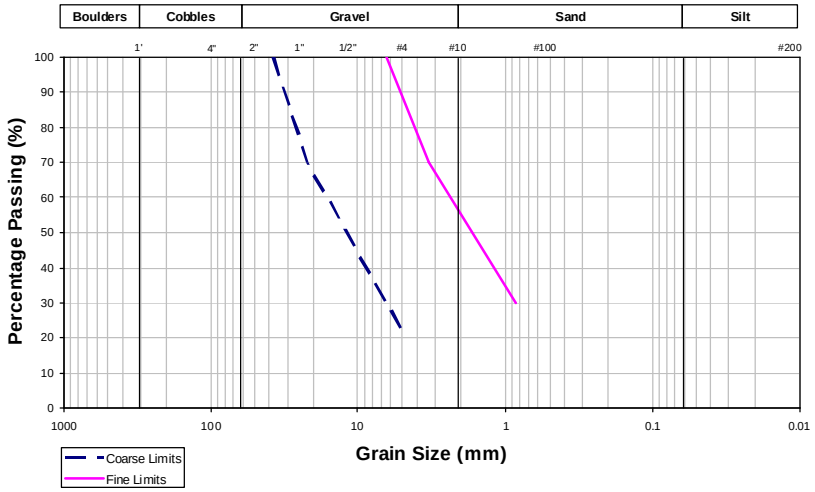
Run of Quarry (ROQ)



Select Subgrade



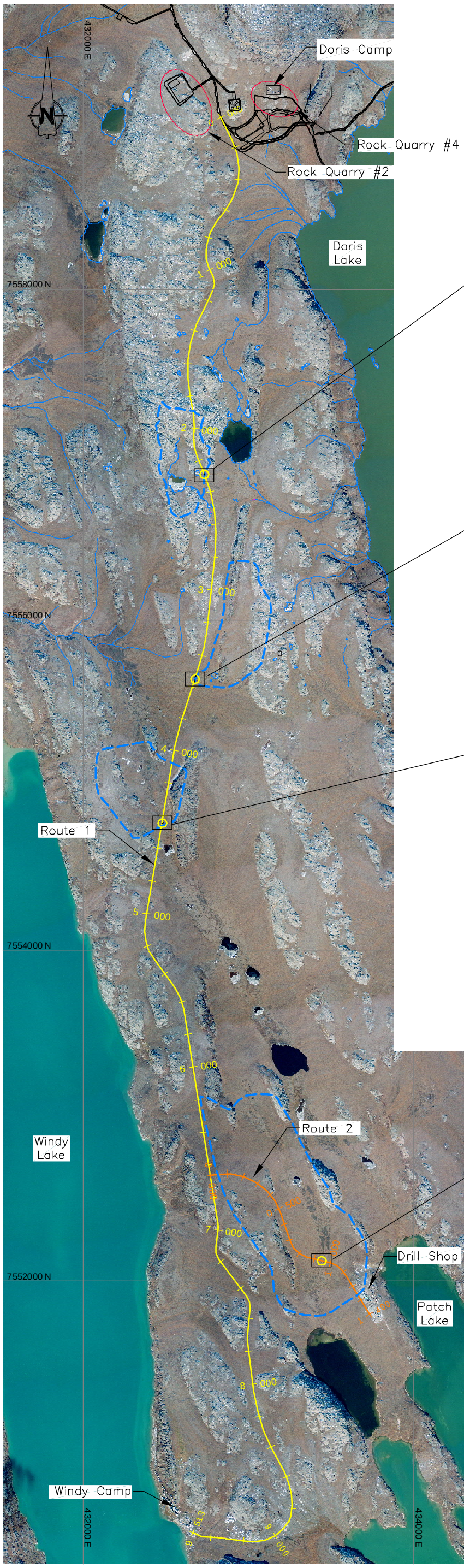
Surfacing Material

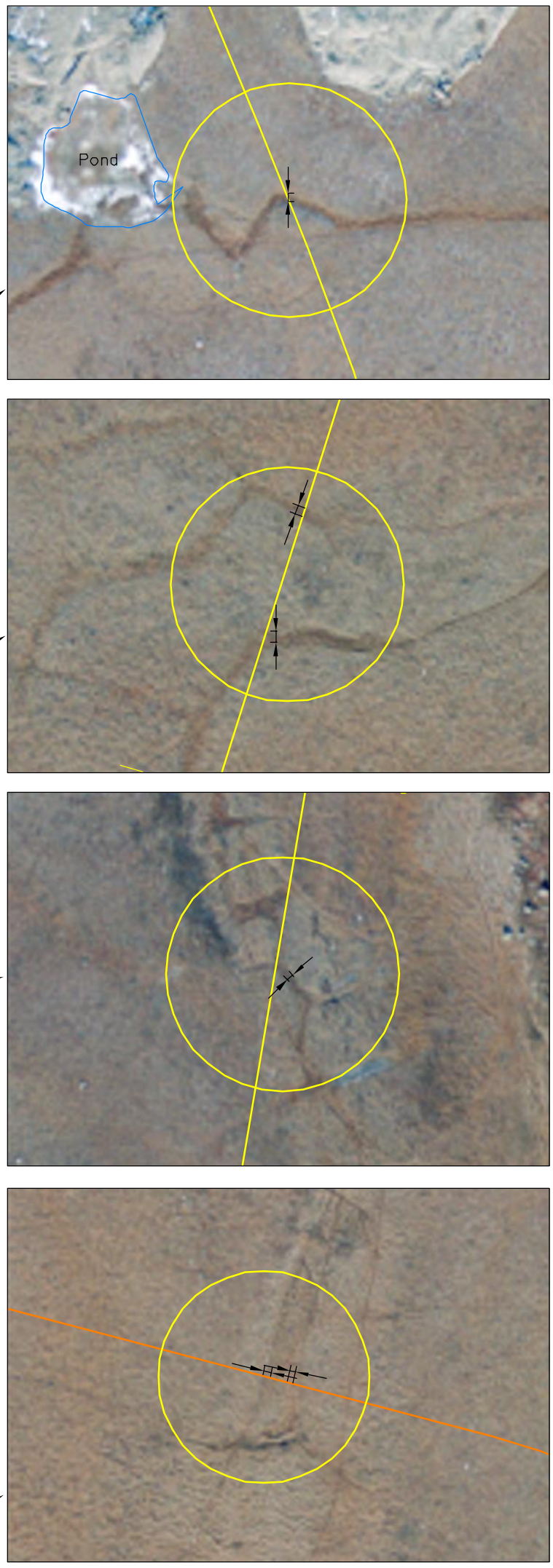


SRK Consulting Engineers and Scientists, Vancouver B.C.	**HOPE BAY MINING LTD**	Gradation Curve Envelopes for Construction Materials
SRK JOB NO.: 1UN010.P01 FILE NAME: 1UN010_P01-2.dwg	Doris Camp - Windy Camp Access Road	DATE: March 08 · APPROVED: MR · FIGURE: 6

J:\01_SITES\Hope Bay\ACAD\2008 Drawings\1UN010_P01-2.dwg

J:\01_SITES\Hope Bay\!ACAD\2008 Drawings\1UN010_P01-2.dwg





Legend

- Route 1
- Route 2
- Roads and Other Infrastructure Associated with Doris North Project
- Quarries Evaluated as part of the Doris North Project
- Interpreted Watershed Boundary
- Possible Stream Crossing Location

Notes

1. Road alignment will be adjusted in the field to adjust to the length of stream crossing.
2. All stream dimensions are measured perpendicular to channel.
3. Some streams may have more than one channel.

0 200 400 600 800 1000 Metres
1:25,000

SRK Consulting
Engineers and Scientists
Vancouver

SRK JOB NO.: 1UN010.P01
FILE NAME: 1UN010_P01-2.dwg

HOPE BAY MINING LTD

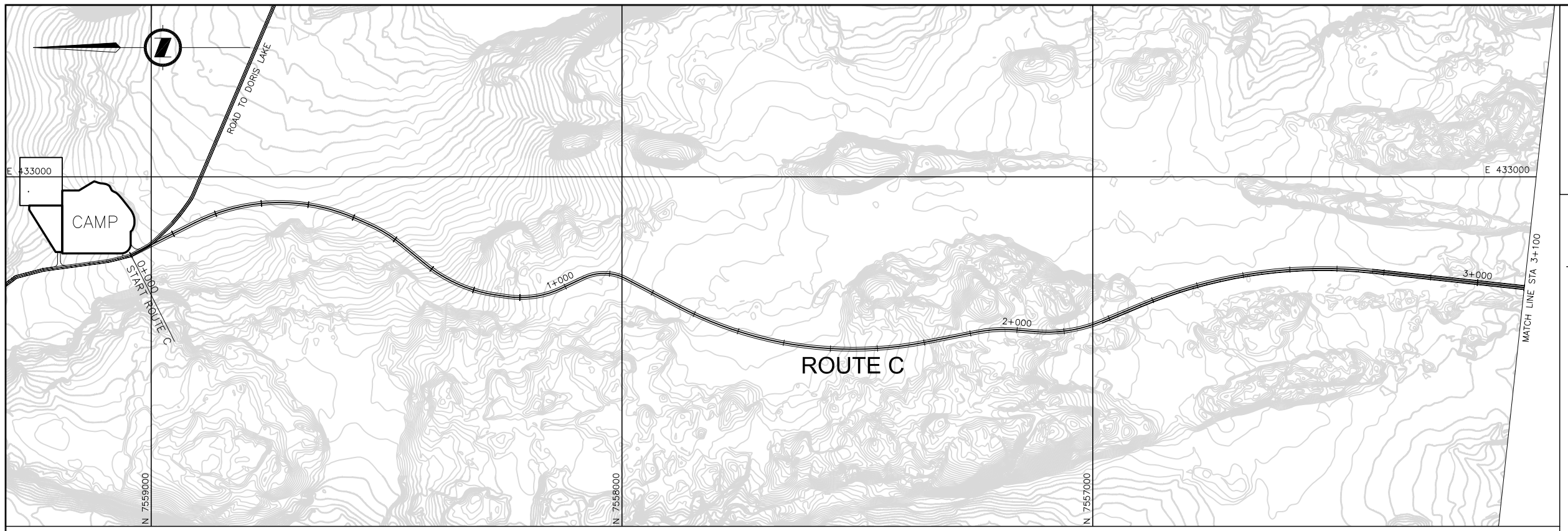
Doris Camp - Windy Camp Access Road

Possible
Stream Crossing Locations

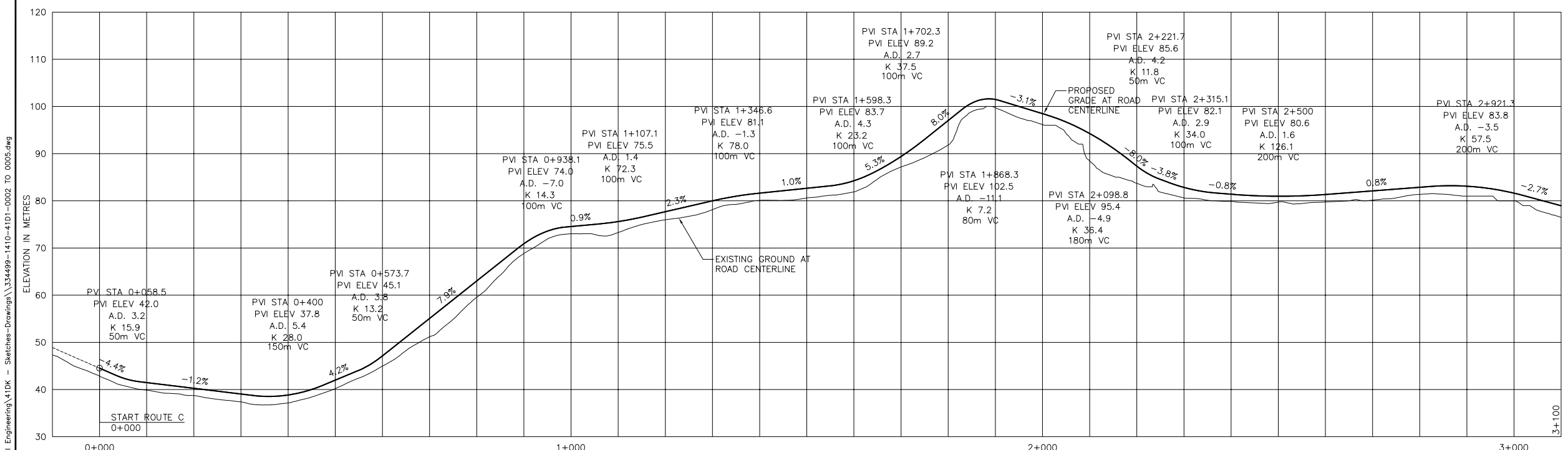
DATE:	APPROVED:	FIGURE:
March 08	MV	7

Appendices

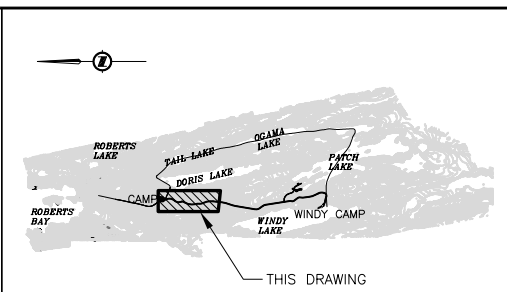
Appendix A
Road Design Drawings (SNC-Lavalin)



PLAN
1:5000



PROFILE
1:5000 HOR & 1:500 VER



KEY PLAN
SCALE 1:200000

NOTES:

1. ALIGNMENT AND GRADE TO BE OPTIMIZED DURING DETAILED SURVEY AND DESIGN.
2. ROAD WIDTH SHALL BE 8m WITH 50mm MINUS GRAVEL SURFACING. MINIMUM COVER ALONG THE ROAD AXIS SHALL BE 1.5m.
3. COARSE ROCK DRAINS TO BE INSTALLED AS DETERMINED BY THE ENGINEER TO SUIT FIELD CONDITIONS.

0 Horiz. 1:5000 250
0 Vert. 1:500 25

CONTOUR INTERVAL=1m
ALL DIMENSIONS AND ELEVATIONS IN METRES UNLESS NOTED OTHERWISE

ENGINEER'S STAMP

NEWMONT
The Gold Company

CLIENT HOPE BAY MINING LTD.

CLIENT DWG. NO.

SNC·LAVALIN

PROFESSIONAL ENGINEER | NAME | NO.

TITLE
HOPE BAY MINING LIMITED
DORIS 2008 PROJECT
ROUTE C
PLAN AND PROFILE
STA 0+000 TO 3+100

DWG. NO.	REFERENCES	NO.	DATE	REVISIONS	BY	CHK	LEAD DISCPL.	ENG. MAN.	AREA MAN.	CLIENT ENG.	CLIENT AREA
		PB		ISSUED FOR							
		PA	08/01/25	ISSUED FOR COMMENTS	CT	ARW					

SNC-LAVALIN INC.

DESIGNED	JOS A. CAVE	JAC	08/02/19
DRAWN	ELISA S. LAY	ESL	08/03/04
CHECKED			
APPROVED LEAD ENG.			
APPROVED ENG. MAN.			
APPROVED AREA MAN.			
APPROVED ENG. COORD.			
APPROVED AREA MAN.			

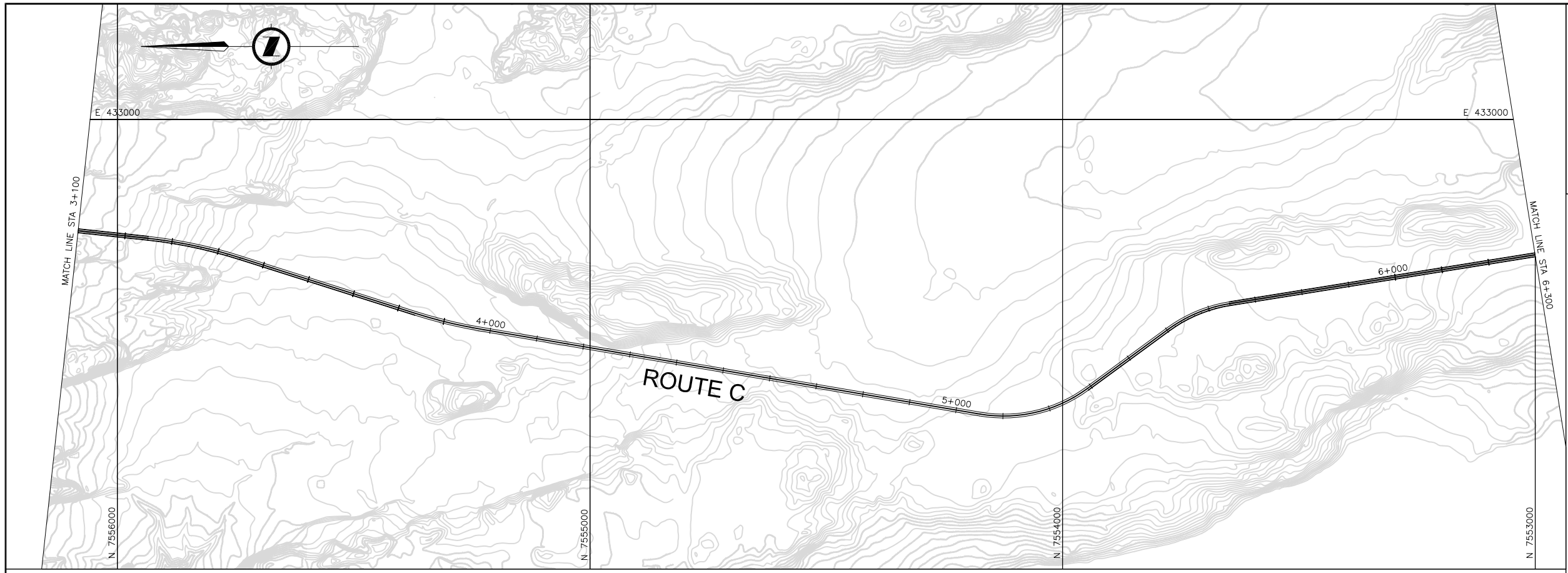
CLIENT

SCALE	NAME (PRINT)	INIT.	DATE
AS SHOWN			

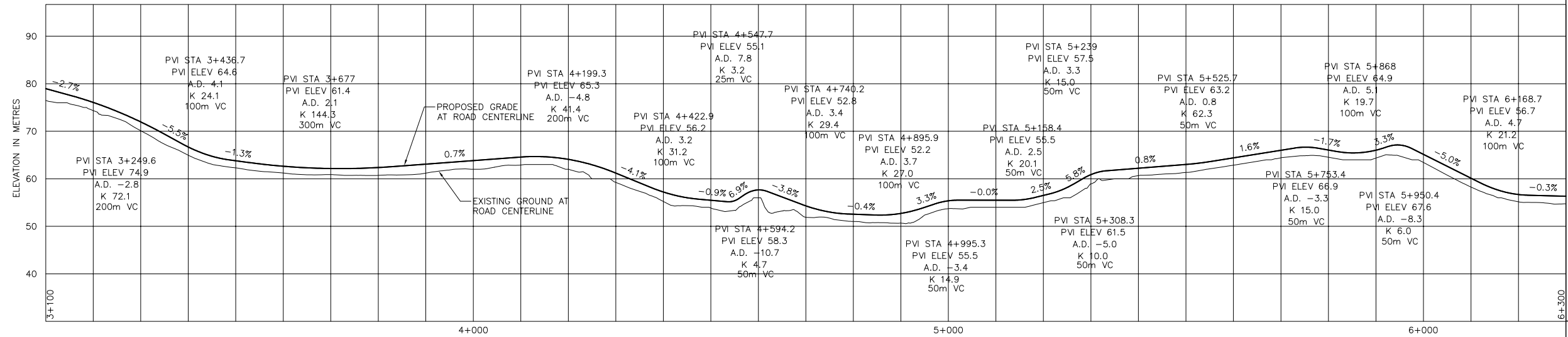
PROJECT NO.	AREA	DISCPL.	DOC.	DRAWING NUMBER	LOC.	REVISION NUMBER
334499	1410	41	D1	0002		PB

Format: Metric D (TRUE SCALE)

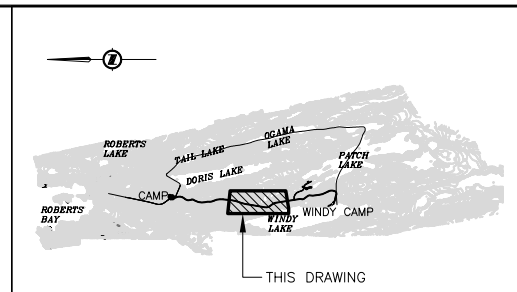
DATE: 2008/03/06 - 11:28am
PATH: J:\334499 - HBML Doris 2008\41 - Civil Engineering\41DK - Sketches-Drawings\334499-1410-4101-0002 TO 0005.dwg



PLAN
1:5000



PROFILE
1:5000 HOR & 1:500 VER



KEY PLAN
SCALE 1:200000

NOTES:

1. ALIGNMENT AND GRADE TO BE OPTIMIZED DURING DETAILED SURVEY AND DESIGN.
2. ROAD WIDTH SHALL BE 8m WITH 50mm MINUS GRAVEL SURFACING. MINIMUM COVER ALONG THE ROAD AXIS SHALL BE 1.5m.
3. COARSE ROCK DRAINS TO BE INSTALLED AS DETERMINED BY THE ENGINEER TO SUIT FIELD CONDITIONS.

0 Horiz. 1:5000 250
0 Vert. 1:500 25

CONTOUR INTERVAL=1m
ALL DIMENSIONS AND ELEVATIONS IN METRES UNLESS NOTED OTHERWISE

ENGINEER'S STAMP

NEWMONT™ The Gold Company

CLIENT HOPE BAY MINING LTD.

CLIENT DWG. NO.

SNC·LAVALIN

PROFESSIONAL ENGINEER | NAME | NO.

DWG. NO.	REFERENCES	NO.	DATE	REVISIONS	BY	CHK	LEAD DISCPL.	ENG. MAN.	AREA MAN.	CLIENT ENG.	CLIENT AREA
		PB		ISSUED FOR							
		PA	08/01/25	ISSUED FOR COMMENTS	CT	ARW					

SNC-LAVALIN INC.: DESIGNED JOS A. CAVE JAC 08/02/19; DRAWN ELISA S. LAY ESL 08/03/04; CHECKED; APPROVED LEAD ENG.; APPROVED ENG. MAN.; APPROVED AREA. MAN.

CLIENT: APPROVED ENG. COORD.; APPROVED AREA MAN.

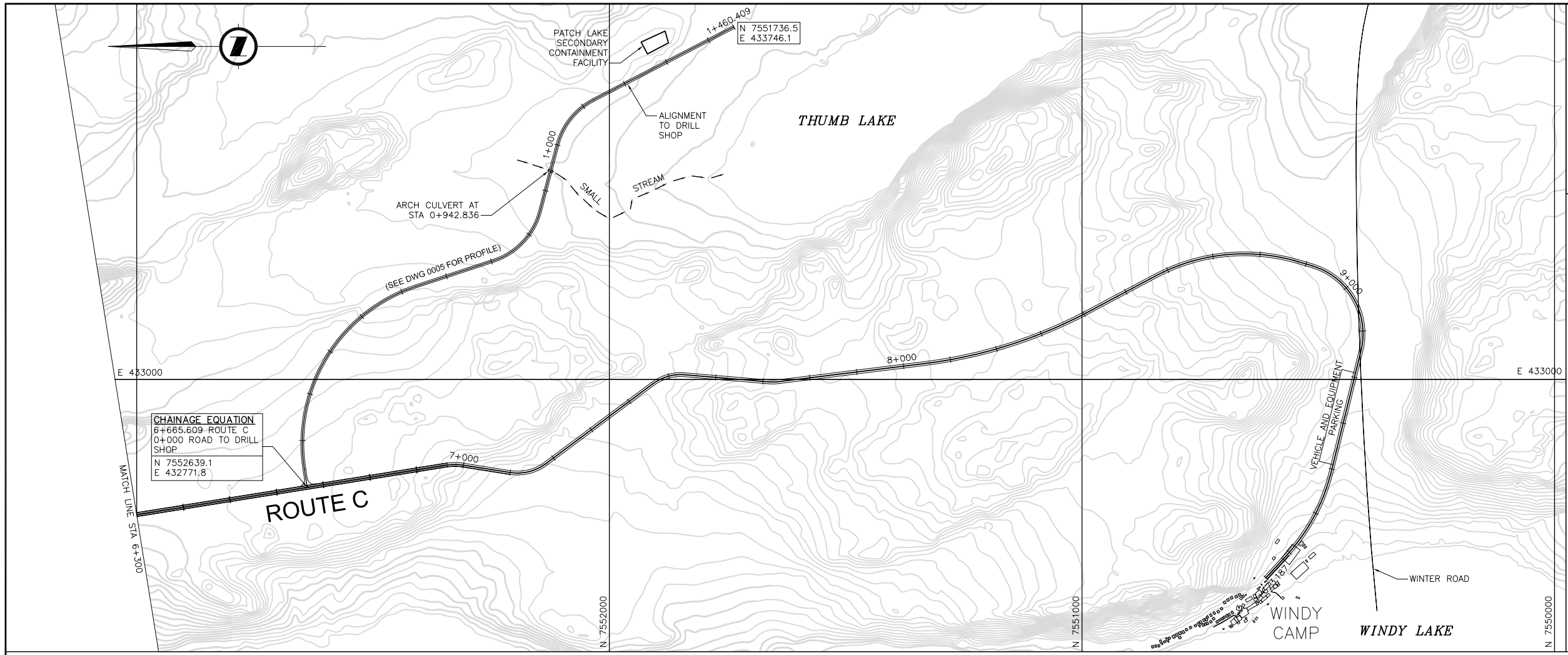
DRAWING AS SHOWN NAME (PRINT) INIT. DATE

TITLE
HOPE BAY MINING LIMITED
DORIS 2008 PROJECT
ROUTE C
PLAN AND PROFILE
STA 3+100 TO 6+300

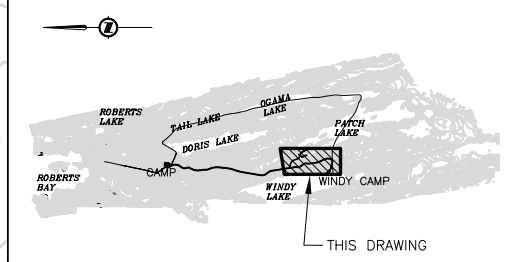
PROJECT NO.	AREA	DISCPL.	DOC.	DRAWING NUMBER	LOC.	REVISION NUMBER
334499	1410	41	D1	0003		PB

Format: Metric D (TRUE SCALE)

DATE: 2008/03/06 – 11:27am
PATH: J:\334499 – HBML Doris 2008\41 – Civil Engineering\41DK – Sketches-Drawings\\334499-1410-41D1-0002 TO 0005.dwg



PLAN
1:5000



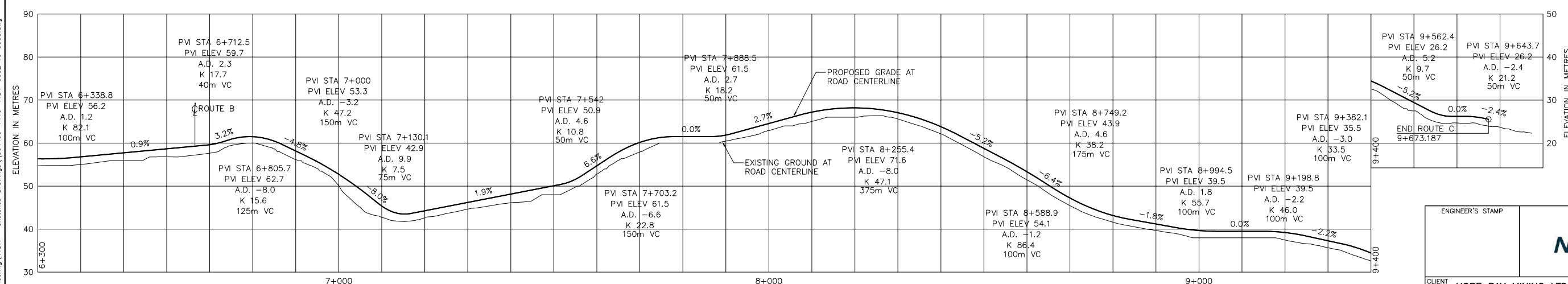
KEY PLAN
SCALE 1:200000

NOTES:

1. ALIGNMENT AND GRADE TO BE OPTIMIZED DURING DETAILED SURVEY AND DESIGN.
2. ROAD WIDTH SHALL BE 8m WITH 50mm MINUS GRAVEL SURFACING. MINIMUM COVER ALONG THE ROAD AXIS SHALL BE 1.5m.
3. COARSE ROCK DRAINS TO BE INSTALLED AS DETERMINED BY THE ENGINEER TO SUIT FIELD CONDITIONS.

0 Horiz. 1:5000 250
0 Vert. 1:500 25

CONTOUR INTERVAL=1m
ALL DIMENSIONS AND ELEVATIONS IN METRES UNLESS NOTED OTHERWISE



PROFILE
1:5000 HOR & 1:500 VER

DATE: 2008/03/06 - 11:25am
PATH: J:\334499 - HBML Doris 2008\41 - Civil Engineering\41DK - Sketches-Drawings\334499-1410-41D1-0002 TO 0005.dwg

DWG. NO.	REFERENCES	NO.	DATE	REVISIONS	BY	CHK	LEAD DISCPL.	ENG. MAN.	AREA MAN.	CLIENT ENG.	CLIENT AREA
		PB		ISSUED FOR							
		PA	08/01/25	ISSUED FOR COMMENTS	CT	ARW					

SNC-LAVALIN INC.			
	DESIGNED	JOS A. CAVE	JAC 08/02/19
	DRAWN	ELISA S. LAY	ESL 08/03/04
	CHECKED		
	APPROVED LEAD ENG.		
	APPROVED ENG. MAN.		
	APPROVED AREA MAN.		
CLIENT	APPROVED ENG. COORD.		
	APPROVED AREA MAN.		
	SCALE	AS SHOWN	NAME (PRINT) INIT. DATE

ENGINEER'S STAMP

NEWMONT™ The Gold Company

CLIENT HOPE BAY MINING LTD.

CLIENT DWG. NO.

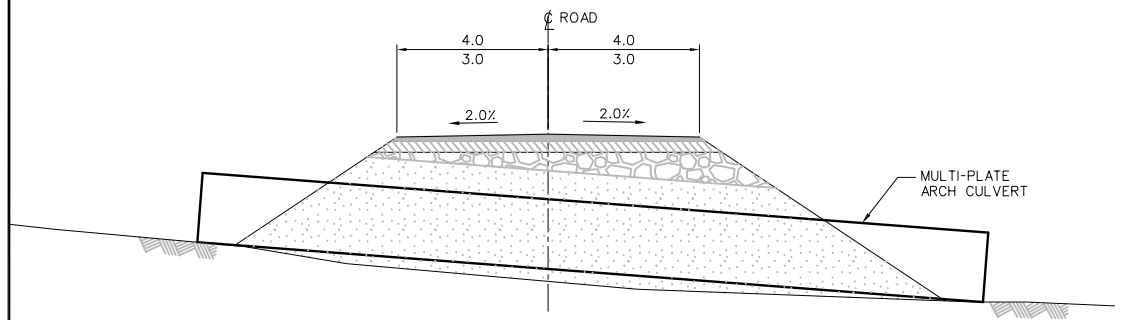
SNC·LAVALIN

PROFESSIONAL ENGINEER | NAME | NO.

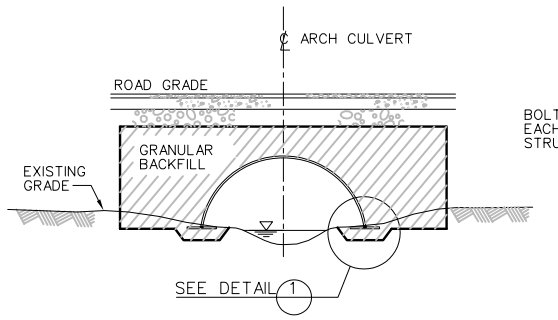
TITLE
HOPE BAY MINING LIMITED
DORIS 2008 PROJECT
ROUTE C
PLAN AND PROFILE
STA 6+300 TO 9+673.187

PROJECT NO.	AREA	DISCPL.	DOC.	DRAWING NUMBER	LOC.	REVISION NUMBER
334499	1410	41	D1	0004		PB

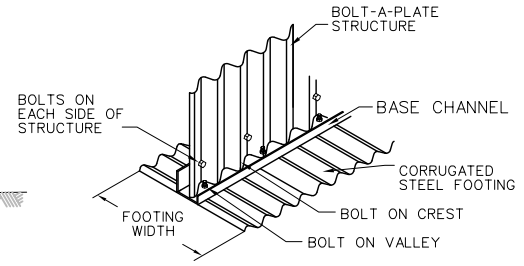
Format: Metric D (TRUE SCALE)



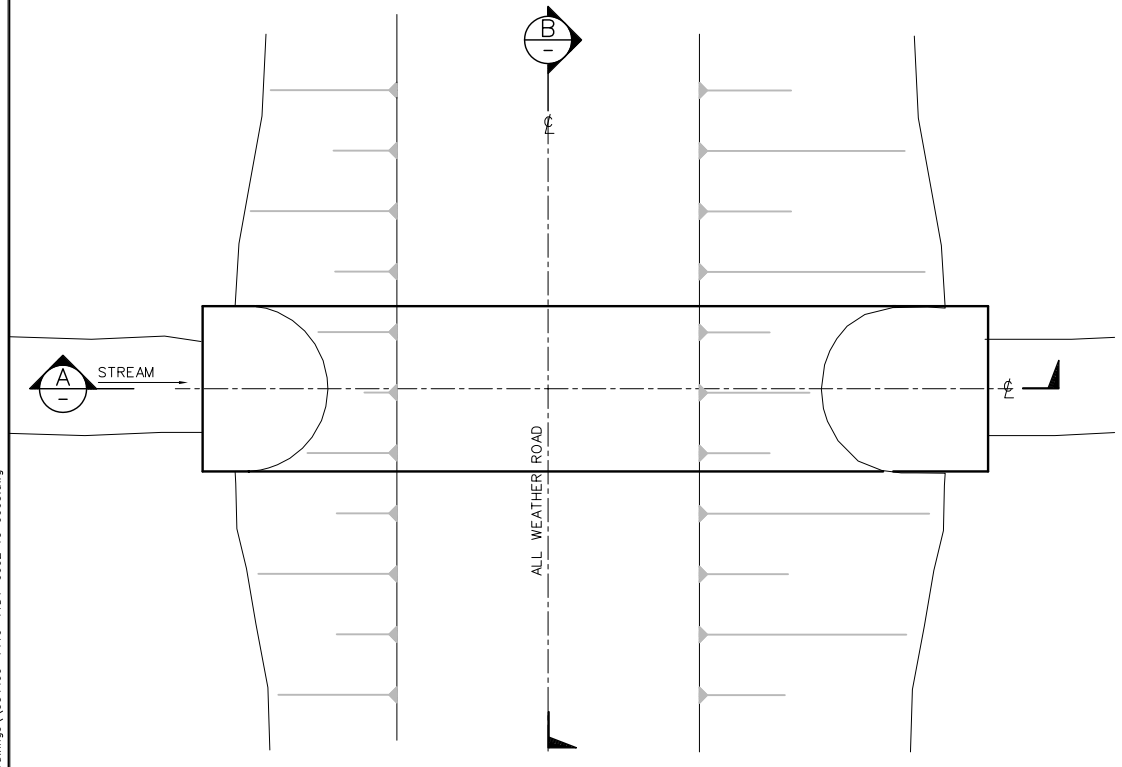
SECTION A
NTS



SECTION B
NTS

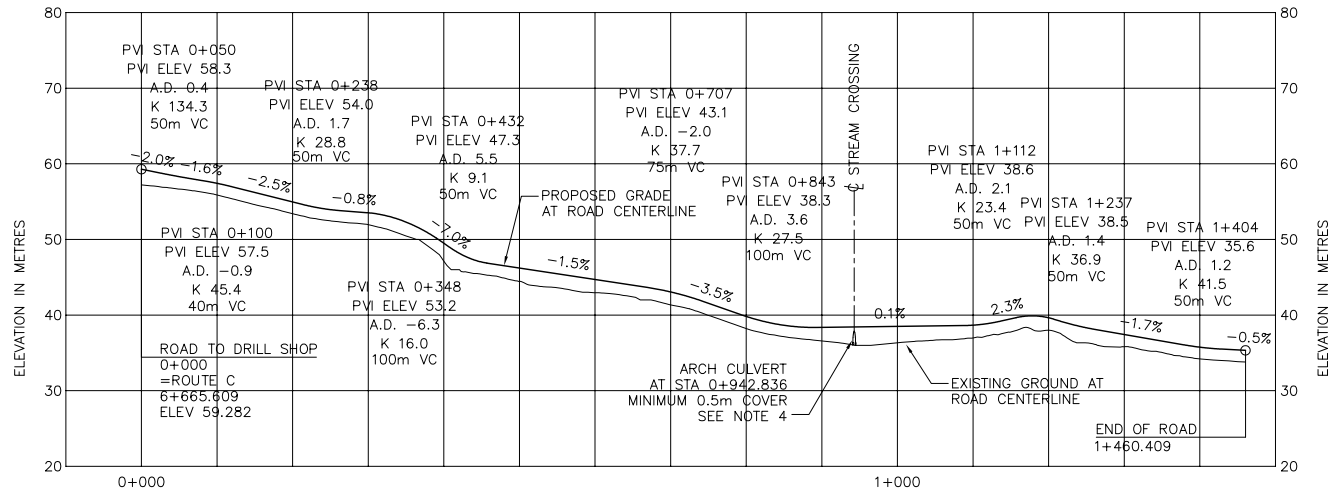


DETAIL 1 STEEL FOOTING

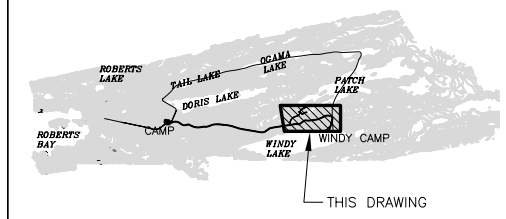


PLAN

TYPICAL ARCH CULVERT STREAM CROSSING
NTS



PROFILE–ROAD TO PATCH LAKE FUEL TANK FARM
1:5000 HOR & 1:500 VER



KEY PLAN
SCALE 1:200000

NOTES:

1. ALIGNMENT AND GRADE TO BE OPTIMIZED DURING DETAILED SURVEY AND DESIGN.
2. ROAD WIDTH SHALL BE 8m WITH 50mm MINUS GRAVEL SURFACING. MINIMUM COVER ALONG THE ROAD AXIS SHALL BE 1.5m.
3. COARSE ROCK DRAINS TO BE INSTALLED AS DETERMINED BY THE ENGINEER TO SUIT FIELD CONDITIONS.
4. 3660mm SPAN x 1520mm RISE x 11m LONG STRUCTURAL PLATE CORRUGATED STEEL ARCH CULVERT.

   152x51mm CORRUGATED PROFILE SAND BAG WING WALLS AT INLET AND OUTLET.

   GEOTECHNICAL INVESTIGATION REQUIRED TO DETERMINE TYPE OF FOUNDATION THAT WILL CAUSE THE LEAST DISRUPTION TO THE STREAM.
5. FOOTING ELEVATION MUST PROVIDE ADEQUATE FROST AND SCOUR PROTECTION AS DETERMINED BY OWNER'S GEOTECHNICAL ENGINEER.
6. FOOTING DESIGN (WIDTH AND THICKNESS) BASED ON SPECIFIED MINIMUM ALLOWABLE SOIL BEARING CAPACITY.

0 Horiz. 1:5000 250
0 Vert. 1:500 25

CONTOUR INTERVAL=1m
ALL DIMENSIONS AND ELEVATIONS IN METRES UNLESS NOTED OTHERWISE

ENGINEER'S STAMP

NEWMONT™ The Gold Company

CLIENT HOPE BAY MINING LTD.

CLIENT DWG. NO.

SNC·LAVALIN

PROFESSIONAL ENGINEER | NAME | NO.

TITLE
HOPE BAY MINING LIMITED
DORIS 2008 PROJECT
ROAD TO PATCH LAKE FUEL TANK FARM
PROFILE, SECTIONS AND DETAIL
STA 0+000 TO 1+460.149

DWG. NO.	REFERENCES	NO.	DATE	REVISIONS	BY	CHK	LEAD DISCPL.	ENG. MAN.	AREA MAN.	CLIENT ENG.	CLIENT AREA

ISSUED FOR

NO.	DATE	REVISIONS	BY	CHK	LEAD DISCPL.	ENG. MAN.	AREA MAN.	CLIENT ENG.	CLIENT AREA
PA									

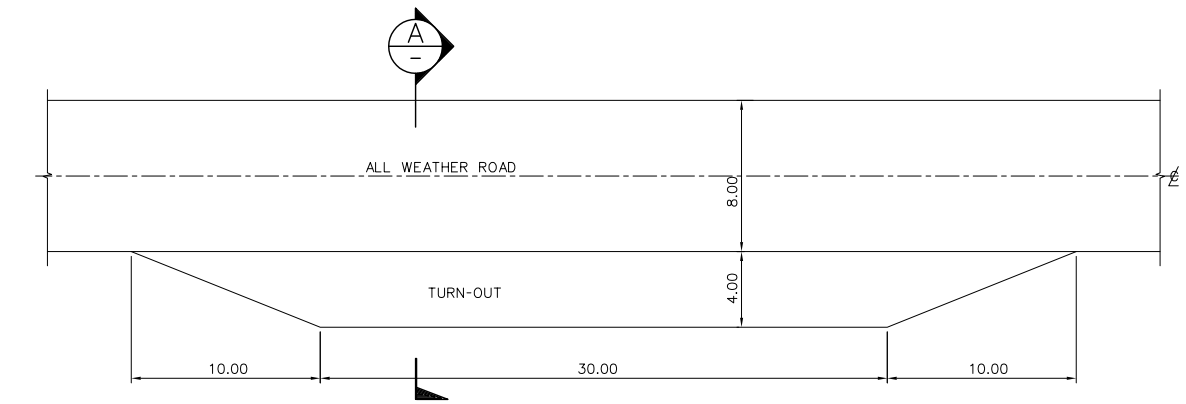
SNC-LAVALIN INC.	DESIGNED	JOS A. CAVE	JAC	08/02/19	
	DRAWN	ELISA S. LAY	ESL	08/03/05	
	CHECKED				
	APPROVED LEAD ENG.				
	APPROVED ENG. MAN.				
	APPROVED AREA MAN.				
CLIENT	APPROVED ENG. COORD.				
	APPROVED AREA MAN.				
	SCALE	AS SHOWN	NAME (PRINT)	INIT.	DATE

PROJECT NO.	AREA	DISCPL.	DOC.	DRAWING NUMBER	LOC.	REVISION NUMBER
334499	1410	41	D1	0005		PA

Format: Metric D (TRUE SCALE)

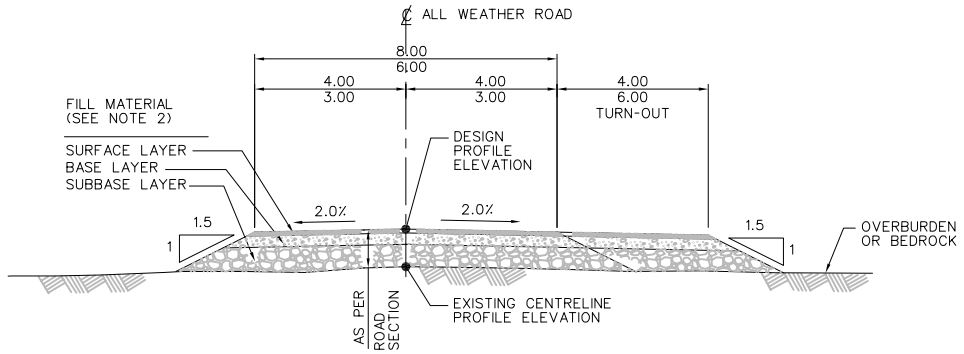
DATE: 2008/03/10 - 5:04pm
PATH: J:\334499 - HBML Doris 2008\41 - Civil Engineering\41DK - Sketches-Drawings\334499-1410-41D1-0002 TO 0005.dwg

J:\334499 - HBML Doris 2008\41 - Civil Engineering\41DK - Sketches-Drawings\334499-1410-41D1-0002 TO 0005.dwg, 2008-03-10 5:04:38 PM, 1:2, Elisa S. Lay



PLAN-8m WIDE ROAD

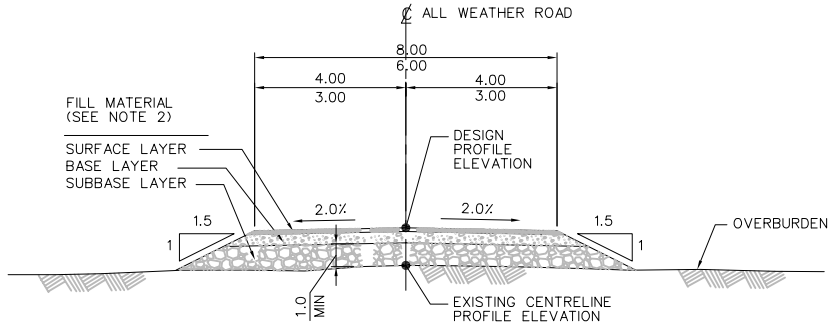
SCALE 1:200



SECTION A –

TYPICAL ALL WEATHER ROAD WITH TURN-OUT

SCALE 1:100



TYPICAL ALL WEATHER ROAD SECTION

SCALE 1:100

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. CONSTRUCTION FILL MATERIAL FOR ALL WEATHER ROADS SHALL MEET THE FOLLOWING REQUIREMENTS:

ALL WEATHER ROAD		
LAYER	THK.	MATERIAL DESCRIPTION
SURFACE	200mm	50mm CRUSHED ROCK
BASE	300mm	150mm CRUSHED ROCK
SUBBASE	MIN. 1.0m	600/900mm RUN OF QUARRY ROCK

PLACE BASE MATERIAL IN MAX. 300mm LIFTS. PLACE SUBBASE MATERIAL IN MAX. 1000mm LIFTS. COMPACT SURFACE MATERIAL TO STD. PROCTOR DRY DENSITIES, UNLESS DIRECTED OTHERWISE BY THE SITE ENGINEER.

✳ COMPACT BASE & SUBBASE MATERIAL USING LOADED ROCK TRUCKS. CONTINUALLY STAGGER ROCK TRUCK WHEEL PATH TO COMPLETELY COVER LIFT BEING PLACED. EACH LIFT SHALL BE SUBJECTED TO MINIMUM 4 PASSES. WHEREVER POSSIBLE, WHEEL PATH SHALL NOT TO BE PARALLEL WITH DIRECTION OF TRAFFIC.

3. SAFETY BARRIERS WHERE REQUIRED SHALL BE ROCK BERMS AS DIRECTED BY MANAGER'S REPRESENTATIVE.

DWG. NO.	REFERENCES	NO.	DATE	REVISIONS	BY	CHK	LEAD DISCPL.	ENG. MAN.	AREA MAN.	CLIENT ENG.	CLIENT AREA
		PA	08/04/03	ISSUED FOR PERMIT	ESL	JAC					

DATE: 2008/04/03 – 11:12am
PATH: J:\334499 – HBML Doris 2008\41 – Civil Engineering\410K – Sketches-Drawings\334499-1410-41d1-0006.dwg

SNC-LAVALIN INC.				
DESIGNED	A. R. WACHMANN	ARW	08/03/07	
DRAWN	ELISA S. LAY	ESL	08/03/07	
CHECKED				
APPROVED LEAD ENG.				
APPROVED ENG. MAN.				
APPROVED AREA MAN.				
CLIENT	APPROVED ENG. COORD.			
	APPROVED AREA. MAN.			
SCALE	AS SHOWN	NAME (PRINT)	INIT.	DATE

ENGINEER'S STAMP

NEWMONT™ The Gold Company

CLIENT HOPE BAY MINING LTD.

CLIENT DWG. NO.

SNC·LAVALIN

PROFESSIONAL ENGINEER | NAME | NO.

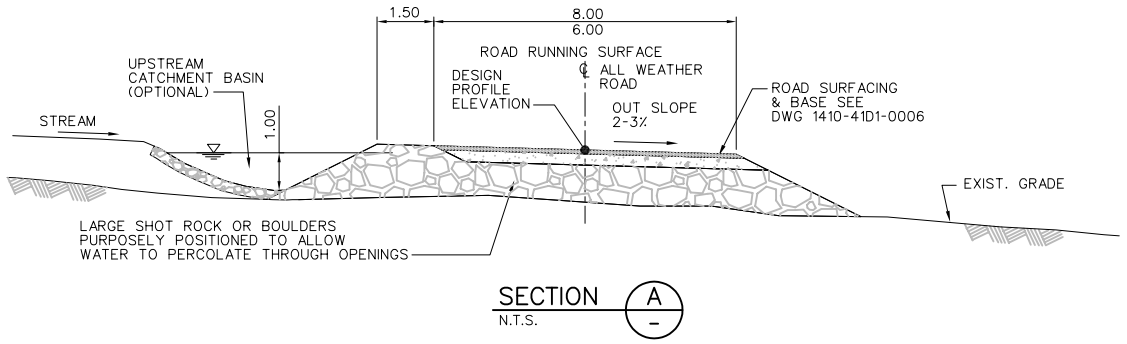
TITLE

HOPE BAY MINING LIMITED
DORIS NORTH INFRASTRUCTURE PROJECT

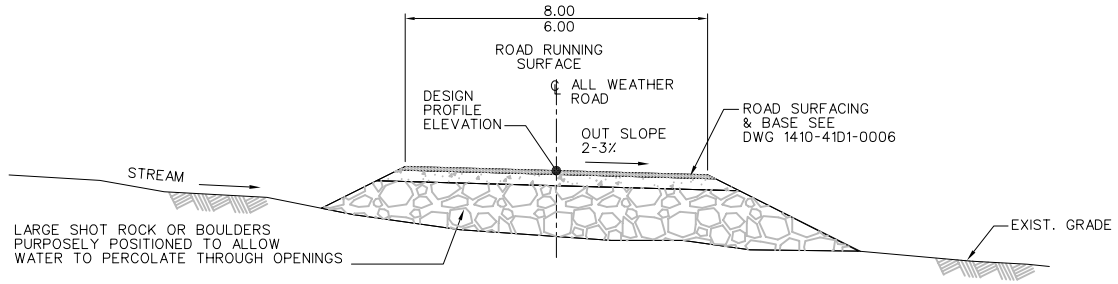
ALL WEATHER ROAD
TYPICAL DETAILS

PROJECT NO.	AREA	DISCPL.	DOC.	DRAWING NUMBER	LOC.	REVISION NUMBER
334499	1410	41	D1	0006		PA

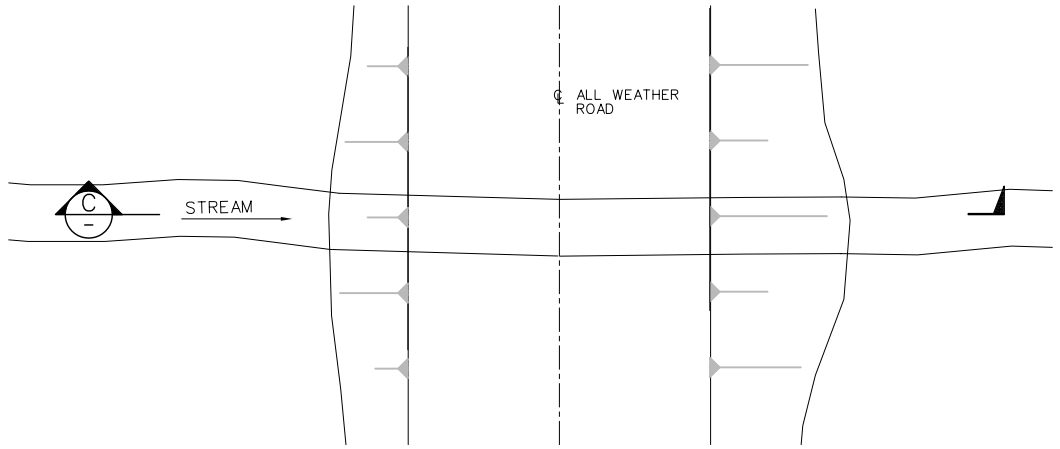
Format: Metric D (TRUE SCALE)



SECTION A
N.T.S.



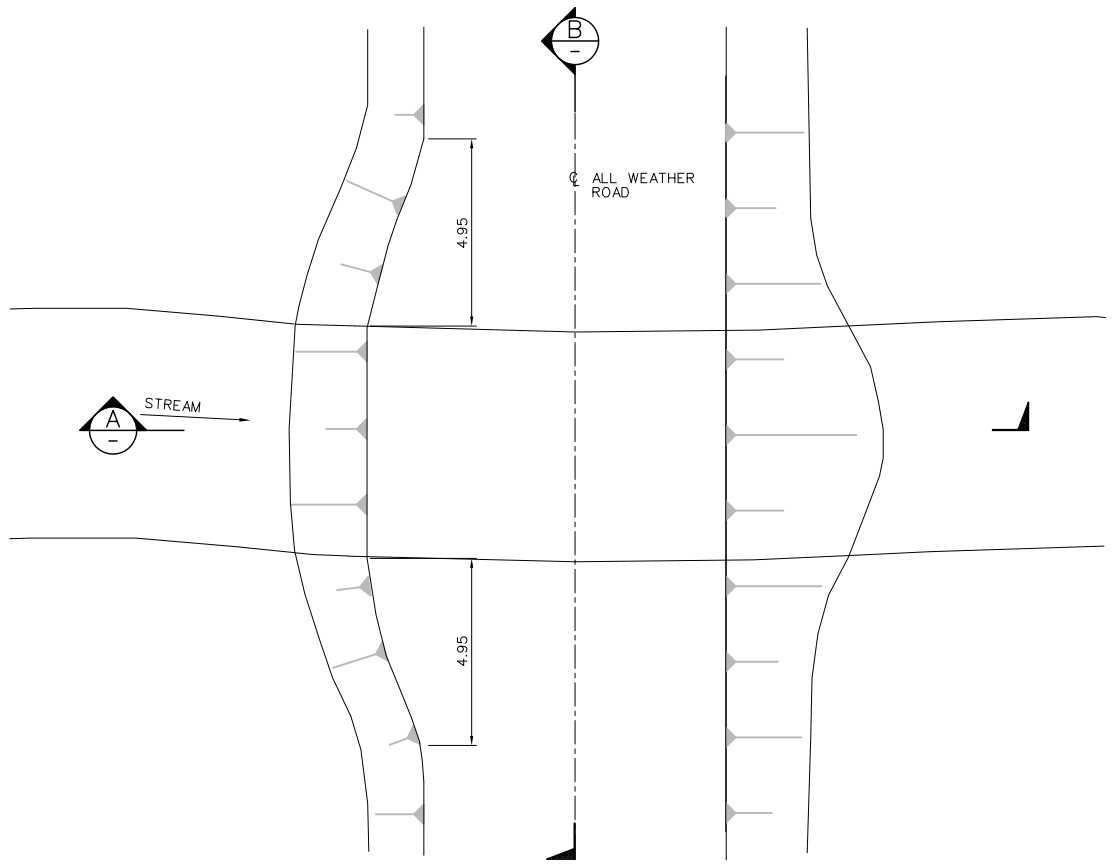
SECTION C
N.T.S.



TYPICAL INTERMITTENT STREAM CROSSING

N.T.S.

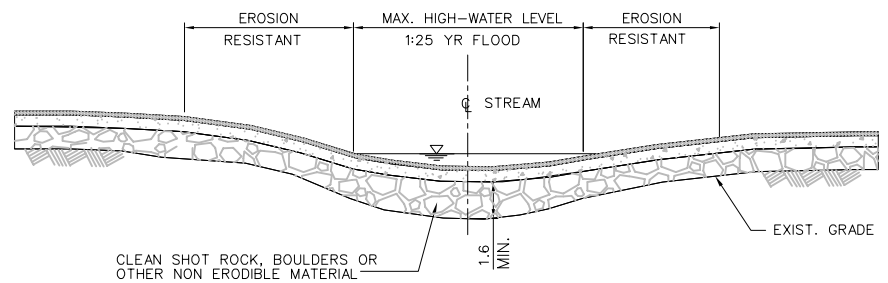
CATCHMENT AREA < 5 km^2



TYPICAL MINOR STREAM FORD CROSSING

N.T.S.

CATCHMENT AREA > 5 km^2



SECTION B
N.T.S.

NOTES:

1. FOR GENERAL NOTES SEE DWG 1410-41D1-0006.

ALL DIMENSIONS AND ELEVATIONS IN METRES UNLESS NOTED OTHERWISE

ENGINEER'S STAMP

NEWMONT The Gold Company

CLIENT HOPE BAY MINING LTD.

CLIENT DWG. NO.

SNC·LAVALIN

PROFESSIONAL ENGINEER | NAME | NO.

TITLE

HOPE BAY MINING LIMITED
DORIS 2008 PROJECT

ALL WEATHER ROAD
TYPICAL DETAILS

DWG. NO.	REFERENCES	NO.	DATE	REVISIONS	BY	CHK	LEAD DISCPL.	ENG. MAN.	AREA MAN.	CLIENT ENG.	CLIENT AREA

NO.	DATE	REVISIONS	BY	CHK	LEAD DISCPL.	ENG. MAN.	AREA MAN.	CLIENT ENG.	CLIENT AREA
PA		ISSUED FOR							

NO.	DATE	REVISIONS	BY	CHK	LEAD DISCPL.	ENG. MAN.	AREA MAN.	CLIENT ENG.	CLIENT AREA

SNC-LAVALIN INC.	DESIGNED	A. R. WACHMANN	ARW	08/03/10
	DRAWN	ELISA S. LAY	ESL	08/03/10
	CHECKED			
	APPROVED LEAD ENG.			
	APPROVED ENG MAN.			
	APPROVED AREA. MAN.			
CLIENT	APPROVED ENG. COORD.			
	APPROVED AREA MAN.			
DOC.	AS SHOWN	NAME (PRINT)	INIT.	DATE

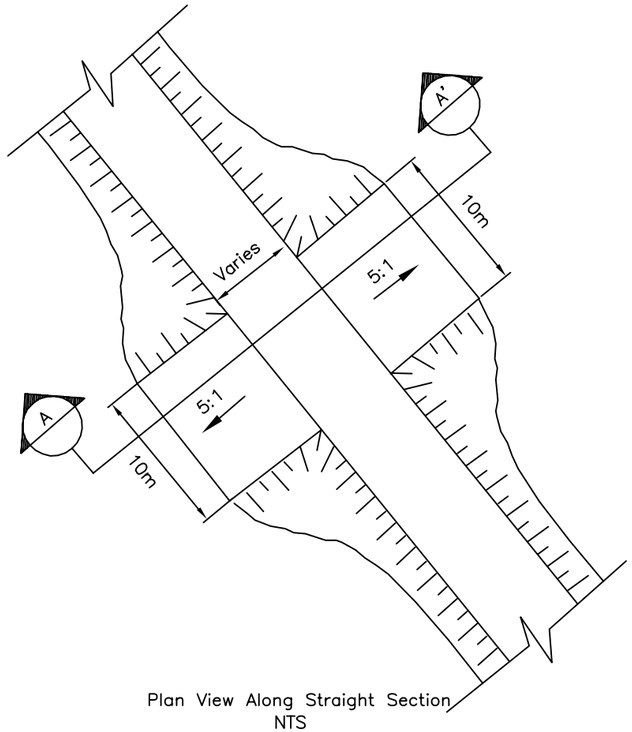
PROJECT NO.	AREA	DISCPL.	DOC.	DRAWING NUMBER	LOC.	REVISION NUMBER
334499	1410	41	D1	0007		PA

Format: Metric D (TRUE SCALE)

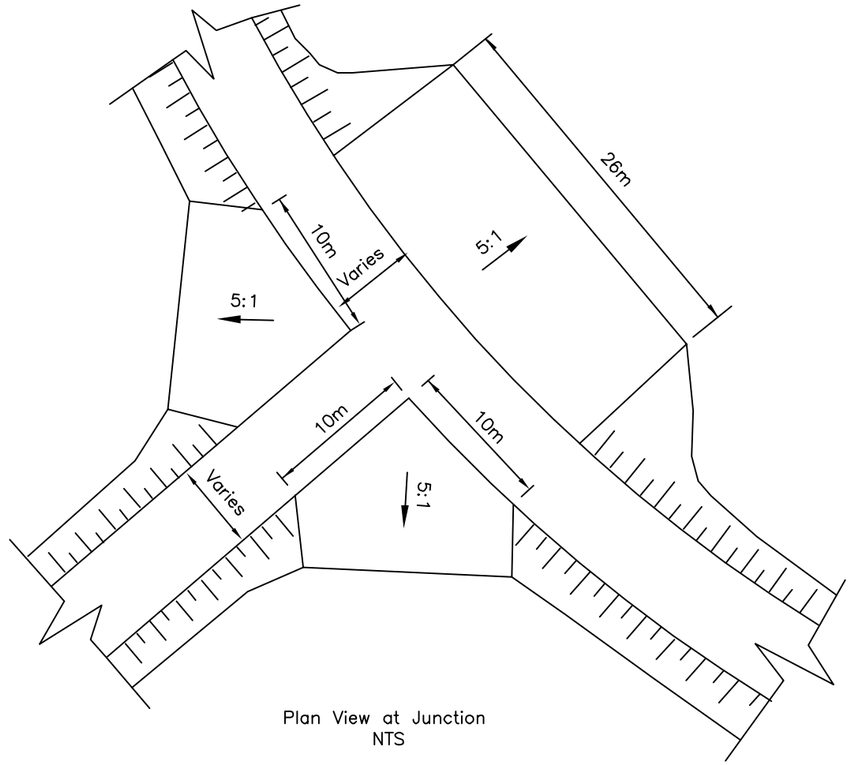
DATE: 2008/03/10 - 5:40pm
PATH: J:\334499 - HBML Doris 2008\41 - Civil Engineering\41DK - Sketches-Drawings\334499-1410-41D1-0002 TO 0005.dwg

J:\334499 - HBML Doris 2008\41 - Civil Engineering\41DK - Sketches-Drawings\334499-1410-41D1-0002 TO 0005.dwg, 2008-03-10 5:40:54 PM, 1:2, Elisa S. Lay

Appendix B
Road Design Drawings (SRK)



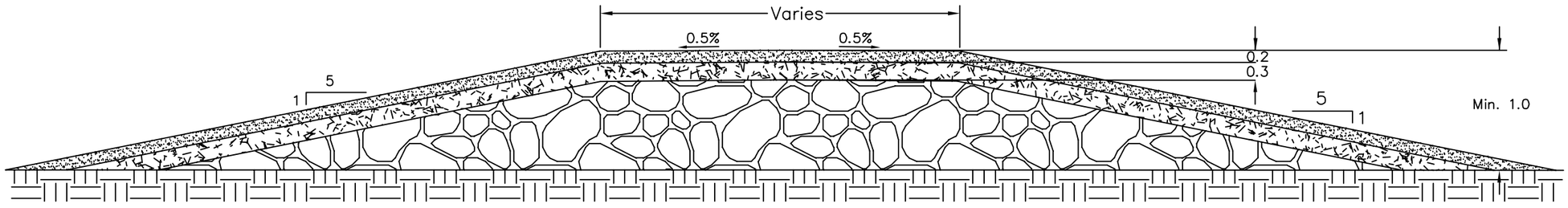
Plan View Along Straight Section
NTS



Plan View at Junction
NTS

Legend:

- Surfacing Material
- Select Subgrade
- Run of Quarry
- Natural Ground



Caribou Crossing Typical Section A–A'
NTS

Notes:

1. The final locations for the Caribou crossings shall be confirmed on site after consultation with the local landowner and Elders.
2. Caribou crossing dimensions are approximate and shall be site fitted to match each individual location.

Note: Drawings plotted to half scale

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
B	WATER LICENSE APPLICATION			
A	WATER LICENSE APPLICATION			

REVISIONS

Stamped, signed and dated originals submitted to the Nunavut Water Board

PROFESSIONAL ENGINEERS STAMP

SRK Consulting
Engineers and Scientists
Vancouver

DESIGN:	DRAWN:	REVIEWED:
AT	JJH	EMR
CHECKED:	APPROVED:	DATE:
AT	EMR	Mar. 2007

FILE NAME: caribou_crossing.dwg

MIRAMAR HOPE BAY LTD.

DORIS NORTH PROJECT
DETAILED DESIGN

SRK JOB NO.: 1CM014.008

Doris North Project

DRAWING TITLE:
Caribou Crossing Typical Plan and Sections

DRAWING NO.	SHEET	REVISION NO.
S-10	18 OF 49	B

Appendix C
Airphoto Analysis by Thurber Engineering (2003)

THURBER ENGINEERING LTD.
Suite 200, 1445 West Georgia St.
VANCOUVER, B.C. V6G 2T3
Phone [604] 684-4384
Fax [604] 684-5124

THURBER

October 1, 2003 File: 17-713-35

SRK Consulting
800-1066 West Hastings St.
Vancouver, BC
V6E 3X2

Attention: Dr. M. Rykaart, P.Eng.

HOPE BAY DORIS NORTH PROJECT, NUNAVUT
SURFICIAL GEOLOGIC MAPPING

Dear Sirs:

Thurber Engineering Ltd. (TEL) is pleased to submit this report on the surficial geology of the Hope Bay Doris North Project area in Nunavut. The work has been carried out in general accordance with our proposal dated May 30, 2003.

Use of this report is subject to the enclosed Statement of General Conditions.

1. SCOPE OF WORK

The study area is shown on Dwg. 17-713-35-1. It covers roughly 45 km^2. Surficial features were first mapped by photo interpretation. Helicopter supported fieldwork was conducted on July 6-7, 2003. Aerial oblique photos were obtained for much of the study area during the field program and diagnostic features were ground checked. We understand the mapping will be used for environmental and engineering review of the project.

2. BACKGROUND INFORMATION

The surficial geology of the region is mapped at 1:125,000 scale by Kerr and Knight (2001). Bedrock is also mapped by Sherlock and Carpenter (2003). Technical reports, particularly drill hole logs by SRK and others, assisted the work. Reports, aerial photos and other information utilized in the study are listed in *References*.

Continued.....

3. OVERVIEW GEOLOGIC DESCRIPTION

The study area is just south of Roberts Bay on Melville Sound, Nunavut. It is about 140 km north of the Arctic Circle. Bedrock ridges, oriented north to south parallel with the dominant strike of bedrock units, indicate erosive effects of northward flowing Pleistocene (Keewatin Lobe) continental glacier ice over 10,000 years ago.

The area contains continuous permafrost. The active layer is about 2 m thick. Frozen ground was encountered at a depth of 0.3 m in shovel pits near Tail Lake on July 7. Drill hole logs indicate that soils below the active layer contain interstitial and segregated ground ice. Most of the soils are marine in origin and include clay, silt and some sand. Drill holes along proposed valley floor infrastructure corridors between Roberts Bay and Tail Lake indicate that bedrock is as much as 20 m below ground.

Active zone earth materials include frost-churned mineral and organic soils mantled by a thin cover of tundra-heath vegetation. Patterned ground, usually consisting of surface drainage rills, mask the underlying soils. Small, frost-heaved clay-silt polygons are very common. Linear frost cracks are noted in raised marine spit deposits. Ice wedge polygons are common in muskegs. There is evidence of naturally degrading permafrost along two creeks near Roberts Bay and at several other locations. Permafrost degradation is ascribed to past human activity just north of Roberts Lake in the northeast map area.

The entire area is situated below the post-glacial marine limit of El. 200 m. Pleistocene deposits, including till, are buried beneath Holocene marine sediments deposited during the post-glacial marine emergence. Some glacial deposits were reworked by marine wave action. Two deposits of raised, littoral sand and gravel are mapped about 1.5 km north of Tail Lake. Our preliminary estimate indicates they contain between 25,000 and 50,000 m^3 of granular material.

Soil samples were collected at four locations. They are judged to be representative of littoral sand and gravel (Samples 03-01 and 03-03), and reworked silty to sandy marine deposits (Sample 03-02) and marine clay (Sample 03-04). Test results are presented in Table 1.

Continued.....

4. SURFICIAL GEOLOGY MAP

Surficial geologic materials and geomorphic features in the study area are mapped at 1:25,000 scale on Dwg. 17-713-35-2. The base map shows major topographic forms without large scale resolution of its 2 and 10 m (index) contours. The map legend is presented in Table 2. Our map classifications generally follow those of Kerr and Knight (2001).

The geologic map shows interpretive information regarding estimated depths of marine deposits. They are probably thickest on ice-scoured valley floors but thick sediments undoubtedly also occur on bedrock controlled upland surfaces. Areas of comparatively thin marine deposits are interpreted along the margins of bedrock exposures. Report users should refer to a detailed bedrock outcrop map at 1:2,000 scale prepared by Sherlock (undated). It does not cover areas east of Tail Lake.

5. ENVIRONMENTAL AND ENGINEERING CONSIDERATIONS

Environmental and engineering considerations are closely linked in this arctic environment. Mine works such as roads and tailings embankments must be constructed in a manner that preserves the permafrost.

Consequences of permafrost degradation may be severe, as indicated where fine grained marine soils are severely eroded by discharges of surface water and groundwater. Gullies and landslides (particularly flow slides) develop in these areas. A notable area of gully erosion caused by incautious road construction and use is located near an abandoned mine just north of Roberts Lake in the northeast map area. Eroded clay-rich slopes along creeks which empty into Roberts Bay regress to a slope angle of about 15^0 (27%).

Proposed winter construction will limit the use of borrow to quarried rock. Three quarry sites are being considered (SRK, 2003); all contain metavolcanic rocks. No sulphides are observed in chip samples from the three sites. We understand winter test blasting will be carried out to determine blast rock gradations and processing requirements.

Continued.....

We trust that this report meets your present needs. Please do not hesitate to contact us if you have any questions.

Yours very truly,
Thurber Engineering Ltd.
D. Smith, P.Eng.
Project Principal

R. Gerath, P.Geol.
Geologist and Associate

RFG\D\Reports\17\713-35finalrpt.wpd

REFERENCES

Aerial Photos

Black and white images by Foto Flight, Calgary. Flown July 27, 1996. 152 mm camera focal length. Lines oriented NNW-SSE: 1:15,000 scale nominal.

Line 7 123-135
Line 8, 144-151

Maps and Reports

AMEC Earth & Environmental Ltd., 2003. Environmental baseline conditions, Doris North Project supporting Document 'C' to the Environmental Impact Statement. Report to Miramar Hope Bay Ltd.

_____, 2003. Meteorology and hydrology baseline, Doris North Project supporting Document 'D' to the Environmental Impact Statement. Report to Miramar Hope Bay Ltd.

Dyke, A. S. and L. A. Dredge, 1989. Quaternary geology of the Canadian Shield *in* Quaternary geology of Canada and Greenland, Geological Survey of Canada, Geology of Canada No. 1, pp. 175-317.

EBA Engineering Consultants Ltd., 1996. Boston Gold Project, surficial geology and permafrost features. Report to Rescan Environmental Services Ltd.

_____, 1997. Boston Gold Project geotechnical investigation proposed Roberts Bay Port. Report to BHP World Minerals.

Golder Associates Ltd., 2001. Report on thermistor data review- Hope Bay Project. Report to Miramar Mining Corporation.

J. M. Ryder and Associates, 1992. Spider Lake area (Hope Bay Greenstone Belt) terrain analysis and surficial geology. Report to W. K Fletcher and BHP Utah Mines Ltd.

Kerr, D. E. and Knight, R.D., 2001: Surficial geology, Koignuk River. Geological Survey of Canada Map 1998A, scale 1:125,000.

(References cont.)

National Topographic Series (NTS) 77 A/3. Hope Bay. 1:50,000 scale.

Sherlock, R. L., (undated). Bedrock geology of the Wolverine-Doris corridor, Hope Bay volcanic belt, Nunavut. Canada-Nunavut Geoscience Office. 1:2.000 scale.

Sherlock, R. L., Carpenter, R. L., 2003. Volcanic Bedrock geology of the Wolverine-Doris corridor, Hope Bay volcanic belt, Nunavut. Geological Survey of Canada Open File 1553.

SRK Consulting, December 2002. Hope Bay Doris North Project. Tail Lake dam site geotechnical investigation and conceptual design report. Report to Miramar Hope Bay Ltd.

SRK Consulting, 2003. Geological summary proposed quarry sites, Doris North Project. Hope Bay, Nunavut, Canada.

Table 1

LABORATORY TEST RESULTS

Sample No.	Location	Gradation (%)			Natural Moisture Content %	Plastic Limit	Liquid Limit
		Gravel	Sand	Fines			
03-01	Large raised spit 1.5 km north of Tail Lake	48	51	1	0.2		
03-02	Capping unit in marine clay deposits on north side of Windy Creek	2	52	46	12.9		
03-03	Small raised spit just west of Roberts Bay	27	55	18	3.3		
03-04	Proposed tailings embankment site at the north end of Tail Lake. Permafrost encountered at 0.3 m	0	5	95	4.8	24	39

Table 2

LEGEND FOR SURFICIAL GEOLOGIC MAP (Dwg. 17-713-35-2)

Quaternary Holocene Deposits

B Active marine beach deposits. Sand, gravel, cobbles and boulders around the margins of Roberts Bay. Includes some wind blown silt and sand.

C Colluvium. Rock fall debris mapped around the margins of the 'Mesa'.

O Organic deposits: Peat and organic mud. Commonly with ice-wedge polygons.

PD Areas of permafrost degradation indicated by gullying and flow slide activity in silt and clay rich marine deposits. Permafrost degradation along Lower Windy Creek (informal name) appears to result from natural warming processes. Another area, apparently generated by incautious road construction and use near an abandoned mine is located just north of Roberts Lake in the northeast map area.

M Inactive marine deposits: Clay, silt, sand and gravel, deposited during the marine regression beginning at the end of the Pleistocene some 10,000 years ago. Marine shells are relatively common. The maximum elevation of uplifted marine deposits is thought to be about 200 m. Almost all physical features are below this elevation.

M3 Littoral deposits. Sand, gravel, cobbles and boulders. Emergent spit and beach deposits. Generally judged to be less than 2 m thick and may overlie bedrock or finer grained marine deposits (M2 and M1). Small bedrock controlled deposits may be very sandy.

M2 Marine blanket. Undifferentiated clay, silt and sand judged to be 2.5 to 20 m thick. This type of deposit is commonly indicated by frost-heaved, non-sorted soil polygons. Frost table (bottom of permafrost active layer) is 1 to 2 m below the ground surface.

M1 Marine veneer. Same as M2 but generally judged to be less than 2.5 m thick. Most M1 areas contain small bedrock outcrops.

Note: Marine units are mantled by unmapped frost-churned, mineral and organic soils and tundra heath. Vegetation hummocks and narrow drainage rills are common surface features. The rills originate on bedrock surfaces and persisting snow banks and form linear drainage patterns which are evident on aerial photos.

Table 2 (con't)

Quaternary Pleistocene Deposits (Late-Wisconsinan [Keewatin] Glaciation)

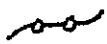
No Pleistocene (Ice Age) sediments were found exposed within the map area. They are buried by post-glacial marine deposits or they have been reworked and redeposited by wave action during the marine emergence. Glacially eroded bedrock surface features indicate the most recent glacier ice flowed northward (see Kerr, and Knight, 2001).

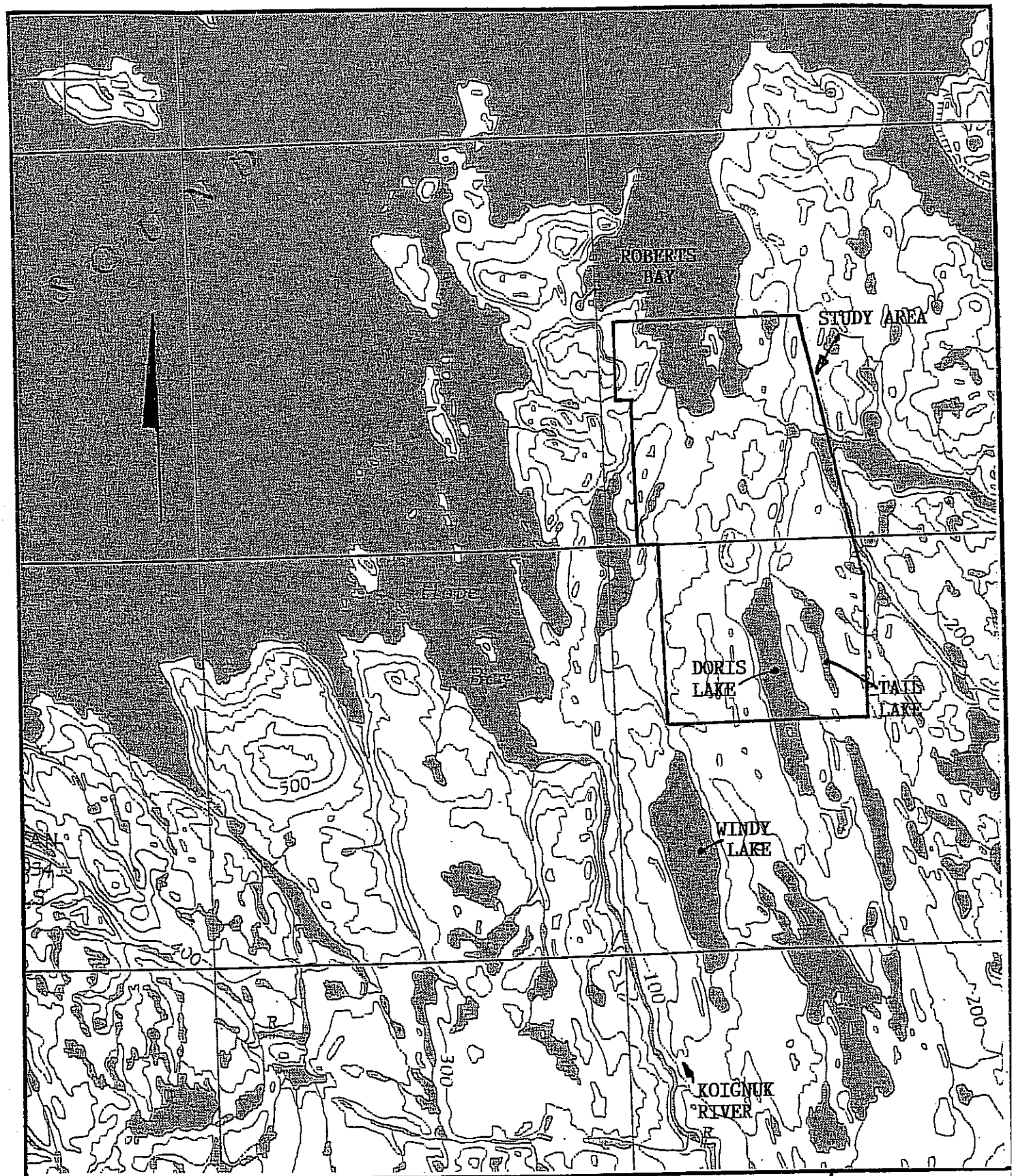
Pre-Cambrian Bedrock

R1 Neoproterozoic-Age diabase dykes and sills (the 'Mesa'). These topographically prominent igneous bodies were emplaced in during the 723 Ma Franklin Igneous Event.

R2 Folded, northward striking, metamorphosed and foliated Archaen volcanics and lesser sedimentary rocks. Minimum age is 2600 Ma. Includes small areas of M1.

On-Site Symbols

	Geologic boundaries interpreted from topographic map and aerial photos. All boundaries are approximate.
(IWP)	Ice wedge polygons
(LFC)	Linear frost cracks
Δ	Frost shattered rock
	Gully
	Marine wave eroded slope
RB	Raised marine beach
x	Small bedrock outcrops (also see R. L. Sherlock, undated)
◬ 03-04	Soil sample location and number



DESIGNED RFG	SRK CONSULTING	THURBER
DRAWN RFG		
DATE SEPT. 30/03	LOCATION MAP	
APPROVED		DRAWING NO
SCALE 1:125,000	HOPE BAY DORIS NORTH PROJECT HOPE BAY, NUNAVUT	17-713-35-1

October 1, 2003

Note:
For legend, see Table 2.

7,565,000 N | 7,564,000 N | 7,563,000 N | 7,562,000 N | 7,561,000 N | 7,560,000 N | 7,559,000 N | 7,558,000 N | 7,557,000 N | 7,556,000 N

436,000 E
435,000 E
434,000 E
433,000 E
432,000 E
431,000 E

Roberts Lake
Little Roberts Lake
Tail Lake
Doris Lake
Roberts Bay (Arctic Ocean)
Windy Creek
"MESA"
03-01
03-02
03-03
03-04
O (IWP)
Lake

DESIGNED	RFG
DRAWN	KM
DATE	July 21, 2003
APPROVED	
SCALE	1:25,000

SRK Consulting

SURFICIAL GEOLOGY

Hope Bay Doris North Project — Hope Bay, Nunavut

THURBER

DWG. NO. 17-713-35-2

VED01495 .DWG

STATEMENT OF GENERAL CONDITIONS

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering or environmental consulting practices in this area. No other warranty, expressed or implied, is made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorized use of the Report.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgemental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

(see over...)

INTERPRETATION OF THE REPORT *(continued)*

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of persons providing information.

6. RISK LIMITATION

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause an accidental release of those substances. In consideration of the provision of the services by us, which are for the Client's benefit, the Client agrees to hold harmless and to indemnify and defend us and our directors, officers, servants, agents, employees, workmen and contractors (hereinafter referred to as the "Company") from and against any and all claims, losses, damages, demands, disputes, liability and legal investigative costs of defence, whether for personal injury including death, or any other loss whatsoever, regardless of any action or omission on the part of the Company, that result from an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project. This indemnification shall extend to all Claims brought or threatened against the Company under any federal or provincial statute as a result of conducting work on this Project. In addition to the above indemnification, the Client further agrees not to bring any claims against the Company in connection with any of the aforementioned causes.

7. SERVICES OF SUBCONSULTANTS AND CONTRACTORS

The conduct of engineering and environmental studies frequently requires hiring the services of individuals and companies with special expertise and/or services which we do not provide. We may arrange the hiring of these services as a convenience to our Clients. As these services are for the Clients' benefit, the Client agrees to hold the Company harmless and to indemnify and defend us from and against all claims arising through such hirings to the extent that the Client would incur had he hired those services directly. This includes responsibility for payment for services rendered and pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. In particular, these conditions apply to the use of drilling, excavation and laboratory testing services.

8. CONTROL OF WORK AND JOBSITE SAFETY

We are responsible only for the activities of our employees on the jobsite. The presence of our personnel on the site shall not be construed in any way to relieve the Client or any contractors on site from their responsibilities for site safety. The Client acknowledges that he, his representatives, contractors or others retain control of the site and that we never occupy a position of control of the site. The Client undertakes to inform us of all hazardous conditions, or other relevant conditions of which the Client is aware. The Client also recognizes that our activities may uncover previously unknown hazardous conditions or materials and that such a discovery may result in the necessity to undertake emergency procedures to protect our employees as well as the public at large and the environment in general. These procedures may well involve additional costs outside of any budgets previously agreed to. The Client agrees to pay us for any expenses incurred as the result of such discoveries and to compensate us through payment of additional fees and expenses for time spent by us to deal with the consequences of such discoveries. The Client also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the Client agrees that notification to such bodies by us will not be a cause of action or dispute.

9. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on our interpretation of conditions revealed through limited investigation conducted within a defined scope of services. We cannot accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes decisions made to either purchase or sell land.

Appendix D
Airphoto Analysis by SRK (2008)

SRK Consulting (Canada) Inc.
Suite 2200 – 1066 West Hastings Street
Vancouver, B.C. V6E 3X2
Canada

vancouver@srk.com
www.srk.com

Tel: 604.681.4196
Fax: 604.687.5532

Memo

To:	Maritz Rykaart	**Date:**	March 6, 2008
cc:	File	**From:**	Lowell Wade
Subject:	Doris Camp to Windy Camp Surficial Geological Mapping	**Project #:**	1UN010.P01

1 Introduction

Thurber Engineering Ltd. conducted an air photo interpretation of surficial geology supported by fieldwork in July, 2003 (Thurber 2003). The air photo interpretation extended from Roberts Bay to the north end of Windy Lake.

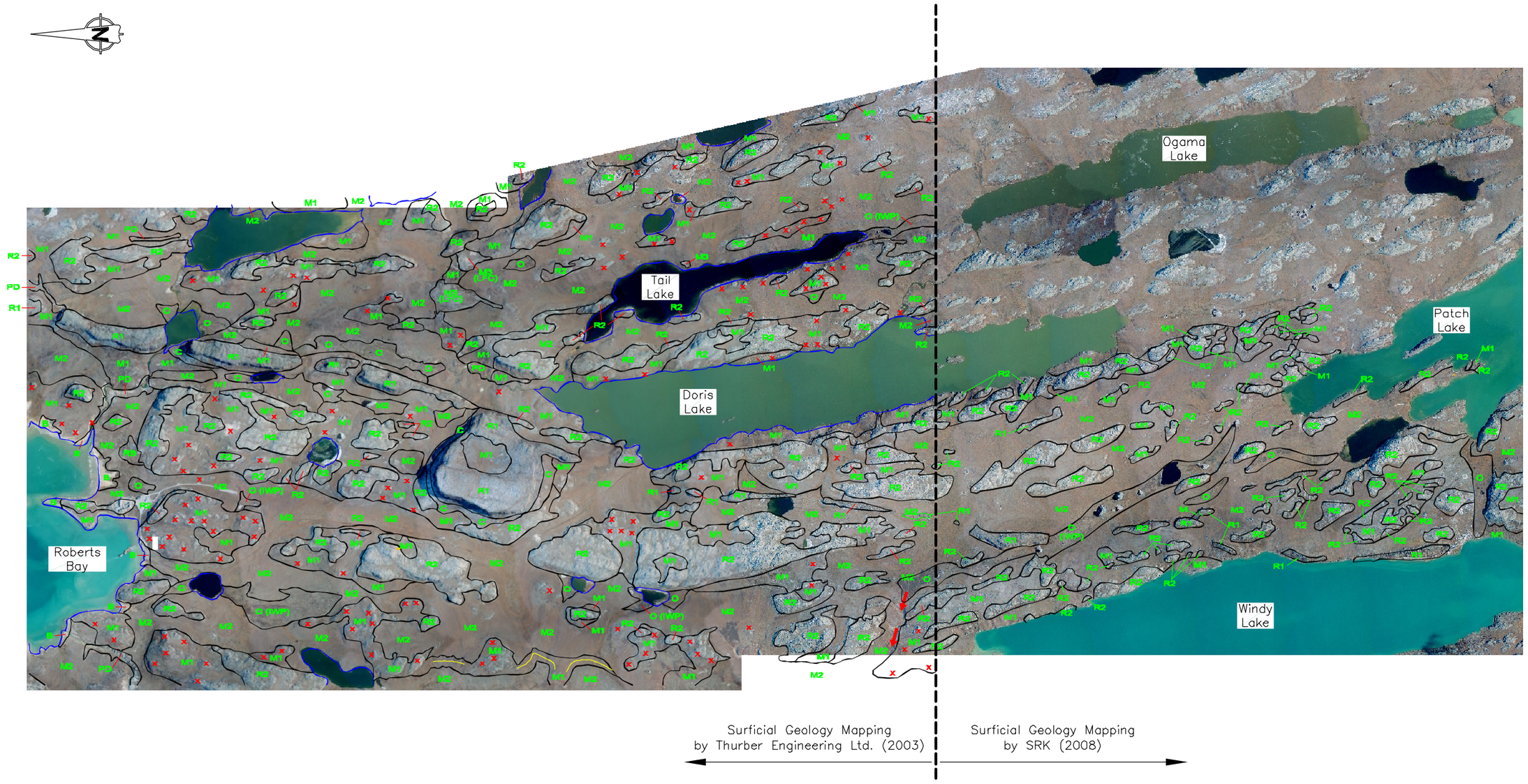
A 10 km all-weather road has been proposed to run form Doris Camp to Windy Camp as illustrated in Figure 1. A link road will join up with the Patch Lake Drill Shop and Tank Farm complex. To assist with the route selection, air photo analysis was required along the proposed road corridor.

2 Air photo Interpretation

The air photo interpretation conducted by Thurber Engineering was digitally overlaid on ortho-rectified air photos taken by Aero Geometrics on September 17, 2007 at an elevation of 5,000 ft (1524 m). Using the same soil mapping units as Thurber Engineering, SRK mapped the proposed road corridor as illustrated on Figure 1.

3 Conclusion

The air photo interpretation carried out confirmed that there are no anomalous surficial geology features, and that knowledge gleaned from regional information is appropriate for the proposed road corridor.



Note: Refer to Appendix C, Table 2 for a legend of the map units.

0 300 600 900 1200 1500 Metres

1:40,000

SRK Consulting
Engineers and Scientists
Vancouver B.C.

SRK JOB NO.: 1UN010.P01

FILE NAME: 1UN010_P01-4.dwg

HOPE BAY MINING LTD

Doris Camp - Windy Camp Access Road

Air Photo Analysis for the Project Area

DATE:	APPROVED:	FIGURE:
March 2008	LW	1

J:\01_SITES\Hope_Bay\ACAD\2008 Drawings\1UN010_P01-4.dwg

Appendix E
Thermal Analysis (SRK 2006)

SRK Consulting
Engineers and Scientists

Steffen, Robertson and Kirsten (Canada) Inc.
Suite 800 – 1066 West Hastings Street
Vancouver, B.C. V6E 3X2
Canada

vancouver@srk.com
www.srk.com

Tel: 604.681.4196
Fax: 604.687.5532

Technical Memorandum

To:	Brian Labadie	**Date:**	August 20, 2006
cc:	Project File	**From:**	Michel Noël/Maritz Rykaart
Subject:	Doris North Project - Thermal modelling to support design thickness for granular pads	**Project #:**	1CM014.008.420

1 Introduction

This technical memorandum presents the modelling that was carried out to determine the minimum thickness for granular pads used for surface infrastructure foundations at the Doris North Project. The granular fill material will consist of crushed rock, and will be placed directly onto the sensitive permafrost overburden soils during the winter.

The intent is to carry out no excavation of permafrost soils, except in areas where there is only a very shallow veneer of overburden covering competent bedrock, and then only for the most critical structures, i.e. the crusher and mill foundations, as well as the fuel tank farm and the airstrip. Therefore, all other surface infrastructure must be constructed on rockfill pads that will remain stable, but that will not result in undue damage to the permafrost environment. It is furthermore understood that upon closure, the pads will not be completely removed, thus it is not expected that the site be returned to its pre-mining state.

The thickness of the granular pads will be dependent on the required bearing capacity and on the thermal behaviour in relation with the permafrost. The thickness of the granular pads discussed herein was calculated using the modified Berggren equation developed by Aldrich and Paynter (1966).

2 Input Parameters

The granular pads will be fabricated from crushed basalt rock. The thermal properties were estimated using the method by Johansen (1975) and had the following properties:

- Porosity: 0.30
- Degrees of saturation: 60%
- Unsaturated thermal conductivity: unfrozen: 161 kJ m^{-1} day^{-1} $°C^{-1}$; frozen: 178 kJ m^{-1} day^{-1} $°C^{-1}$
- Unsaturated volumetric heat capacity: unfrozen: 2,230 kJ m^{-3} °C; frozen: 1,916 kJ m^{-3} °C

Climatic data was collected at the Doris North and the Boston Camp sites during exploration work. But because of limited data, the local climatic data was complemented using three regional weather stations operated by Environment Canada, namely Lupin, Ikaluktutiak (Cambridge Bay) and Kugluktuk (Coppermine) (AMEC 2003a, b). The climatic data collected at the Doris North and Boston Camp sites was then used to develop correlations for the Doris North site using the Environment Canada weather stations.

The correlated data from the Environment Canada weather stations over a 30 year period give the following values:

- mean annual ambient temperature: -12.1 °C
- amplitude of annual ambient temperature: 20.3 °C
- air thawing index: 748 °C-days
- air freezing index: -5,135 °C-days
- days with mean daily temperature above freezing: 108

The surface temperature was assigned a value of -6 °C. The ground temperature measured at the site outside the influence of water bodies averaged about -8 °C over a range of -10 to -6 °C (SRK 2005a, b).

3 Results

Using the method by Aldrich and Paynter (1966) with the input values listed herein, a pad thickness of about 2.1 m would be required to maintain the active zone within the granular pad, i.e. the original ground is below the active zone and remains permanently frozen. This recommended pad thickness can be reduced if the original ground does not contain massive ice within the active zone while having good draining capabilities (i.e. sand deposits). In this case, the thickness of the granular pad would then be controlled by bearing capacity requirements. On bedrock outcrops; the pad thickness would be determined by the grading requirements.

It should further be noted that the Doris North site ground surface is generally covered with hummocky vegetation or by muskeg where overburden is present. Such organic layer provides good insulation to the underlying permafrost but is sensitive to disturbance. The removal of the organic layer will increase the depth of the active layer. Basic thermal simulations indicate that the thermal value of the organic cover can be approximated by about 1 m of granular fill, i.e. if the organic layer was to be removed, it should be replaced by at least 1 m of granular fill to ensure that the active layer remains unchanged.

4 Design Recommendations

If the pad thickness is not sufficiently thick to ensure that the active layer remains within the pad fill material, then the depth to which the active layer does penetrate beneath the pad will consolidate when the soil thaws, which may lead to settlement and subsequent damage to the foundation pad and any associated infrastructure on the pad.

The extensive geotechnical investigations carried out at the Doris North site does confirm that the overburden soils are ice rich; however, these ice rich zones are generally not found within the active layer which ranges between 0.5 to 2 m thick. Therefore, having absolute design criteria that requires the active layer to remain within the construction pad is probably not necessary, since settlement is likely to be small. Furthermore such settlement is not likely to occur rapidly, but could take days, or more likely weeks and months to produce noticeable results. Such improvements could thus easily be managed and mitigated through the adoption of a regular monitoring and maintenance program.

Monitoring should include installation of thermistor cables to determine how deep the active layer penetrates beneath the pad, as well as visual observation of pads and road alignments. Mitigation will consist of a program of infill and levelling of pad and roadway surfaces using pre-stockpiled and graded fill material.

For the preliminary design stage of the Doris North Project, SRK recommended that MHBL adopt a minimum pad thickness of 2.5 m for structures that would be susceptible to damage from settlement, such as the mill and crusher foundations, and for less important structures such as roads, a pad

thickness of 2 m would be sufficient. This decision was made at the time with a limited understanding of the physical site conditions and therefore the highest margin of conservatism was adopted. Furthermore, MHBL did not wish to underestimate the potential costs associated with capital construction for the Project.

For the final detailed design stage, MHBL requested that SRK consider reducing the pad thickness requirement, taking into account the additional information that is available about the site physical conditions. Reducing the pad thickness requirement would not only result in a significantly lower amount of quarry development and thus a lower environmental impact, but could also offer some cost saving to the Project.

SRK would be satisfied that all non-critical pads be have a minimum overall thickness of 1.0 m. This thickness will ensure physical stability based on the expected loads, and also in some areas it will be sufficiently thick that the active layer will remain within the pad. In those areas that the active layer will extend beneath the pad, MHBL is advised that settlement will occur, and that such settlement will lead to the need to be monitored and repairs will have to be carried out to ensure safe and efficient operation. MHBL is also advised that in some instances settlement may lead to the temporary closure of roads or facilities until the necessary repairs have been completed.

For important structures, the minimum pad thickness should be 2.0 m. whilst this is probably sufficiently thick that the active layer would remain in the fill material, there does remain a small possibility for some settlement, so MHBL should put in place a monitoring and maintenance plan as described previously that includes these structures.

This reduced pad thickness will not result in any greater environmental impact on the permafrost environment, especially since the fill will not be removed at closure.

5 REFERENCES

AMEC. 2003a. *Draft Environmental Impact Statement, Doris North Project, Nunavut, Canada*. Report submitted to Miramar Hope Bay Limited, January 2003.

AMEC. 2003b. *Meteorology and Hydrology Baseline, Doris North Project, Nunavut, Canada*. Report submitted to Miramar Hope Bay Limited, August 2003.

Andersland, O.B. and Ladanyi, B. 1994. *An introduction to frozen ground engineering*. Chapman & Hall Inc., 352 pages.

Aldrich, H.P. and Paynter, H.M. 1966. *Depth of Frost Penetration in Non-uniform Soil*. U.S. Army Cold Reg. Res. Eng. Lab. Spec. Rep. 104.

Johansen, O. 1975. *Thermal conductivity of soils*. Ph.D. diss., Norwegian Technical Univ., Trondheim; also, U.S. Army Cold Reg. Res. Eng. Lab. Transl. 637, July 1977.

SRK Consulting (Canada) Inc. 2005a. Preliminary Surface Infrastructure Design, Doris North Project, Hope Bay, Nunavut, Canada. Report submitted to MHBL, Project No. 1CM014.006, October.

SRK Consulting (Canada) Inc. 2005b. Preliminary Tailings Dam Design, Doris North Project, Hope Bay, Nunavut, Canada. Report submitted to MHBL, Project No. 1CM014.006, October.

Appendix F
Quarry Rock Geochemistry Evaluation (SRK 2008)

SRK Consulting (Canada) Inc.
Suite 2200 – 1066 West Hastings Street
Vancouver, B.C. V6E 3X2
Canada

vancouver@srk.com
www.srk.com

Tel: 604.681.4196
Fax: 604.687.5532

Technical Memorandum

To:	Maritz Rykaart	**Date:**	April 3, 2008
cc:	File	**From:**	Dylan MacGregor
Subject:	Proposed Doris Camp to Windy Camp All-weather Road: Summary of quarry rock geochemistry and screening of regional outcrop geochemistry	**Project #:**	1CH008.000

1 Introduction

Construction of an all-weather road between Doris Camp and Windy Camp is being planned (Figure 1). Preliminary scoping assessments indicate that approximately 200,000 m^3 of quarry rock will be required for construction. This memorandum summarizes the existing quarry geochemical characterization and documents the available information for screening of other potential quarry locations along the preferred road alignment.

2 Background

Detailed studies of the geochemical characteristics of rock quarries at four locations were carried out in support of the Doris North Project EIS and Water Licence application. Rock at these four widely-separated locations consisted of mafic igneous lithologies (basalt and gabbro) that form part of a regionally-extensive mafic to ultramafic metavolcanic unit.

Detailed testing of samples collected through drilling and surface sampling showed that these mafic rocks were ideal for use as construction material. The samples tested were not potentially acid generating and had little potential to leach significant trace metals due to the low sulphide and trace metal content of the rock. In addition, the samples tested had a significant excess of calcium and magnesium carbonate minerals beyond the quantity required to neutralize any acidity that could be generated by oxidation of the contained sulphide minerals.

In summary, the low sulphide and metal content and the abundant neutralizing capacity in the form of calcium and magnesium carbonate minerals led to the conclusion that the rock at the four tested locations was ideal for use as construction material. One of these quarries was subsequently developed during the 2007 construction season.

3 Regional geochemistry

3.1 Review of exploration data

As part of exploration efforts to understand the geology of the Hope Bay area, extensive regional mapping and geochemical analyses of exposed bedrock outcrops have been carried out. The results from these efforts were reviewed as part of the geochemical screening of outcrop locations along the proposed Doris Camp to Windy Camp road corridor.

Bedrock geology mapped in outcrop along the corridor is shown in Figure 1, along with three of the previously evaluated quarry locations and the proposed Doris Camp to Windy Camp road alignment. The most extensive bedrock unit is a magnesium (Mg) tholeite basalt that contains visibly-abundant calcium and magnesium carbonates.

Results of historical whole rock analysis of 95 exploration samples indicate that the regional bedrock has a median carbonate content of 15% (with a range of 3 to 45% in the 95 samples tested). Samples were collected from a range of locations along the proposed road, as illustrated in Figure 1, and demonstrate the widespread distribution of elevated carbonate contents in the magnesium tholeite basalts and other rock units.

3.2 Historical quarry assessment

During an earlier phase of evaluation, a limited amount of geochemical characterization was carried out at potential quarry locations from Windy Camp to Boston Camp. One of the assessed locations covered the outcropping basalt east of Windy Camp (see Figure 1). Three chip samples were collected and sent for ABA analysis. Results showed that the samples contained very low sulphur content and abundant neutralization potential, which resulted in all three samples having NP/AP ratios greater than 10 (Rescan 2001).

These historic ABA results from the south end of the proposed road corridor are in agreement with the assessment that the magnesium tholeite basalt is non-acid generating over a large area, and that it is ideal construction rock for use in infrastructure development.

4 Conclusions

The magnesium tholeite basalt rock outcrops along the Doris-Windy corridor are geochemically ideal for use as construction rock. The extensive historical testing carried out at Quarry #2, Quarry #3 and Quarry #4 showed that rock at these locations was not potentially acid generating and that there was little risk of metal leaching.

A regional assessment based on a limited amount of historical information indicated that this magnesium tholeite basalt unit is both regionally extensive and geochemically appropriate for use in construction. It is expected that confirmatory geochemical characterization at other magnesium tholeite basalt outcrops within the project area would further demonstrate the suitability of those rocks for use in construction. An appropriate confirmation testing protocol is provided below.

4.1 Confirmation Testing Protocol

Geochemical characterization of potential construction rock is required in advance of quarry development. The following outlines SRK's recommendations for sampling and subsequent geochemical confirmation analysis:

1. Drill 2 boreholes at each candidate quarry location.
    a. Final collar locations are to be determined based on site conditions; locations should be selected to be representative and to cover each half of the proposed quarry footprint.
    b. Boreholes should extend roughly 1 m beyond the projected quarry base. For planning purposes, SRK assumes that boreholes will extend to approximately 10 m below ground surface.
2. Samples should be collected continuously over the entire length of each borehole. Collect a 1 kg composite sample over each 1.5 m interval, and bag and label as appropriate. Labels should include a quarry location designation and a depth interval over which the sample was collected.
3. Samples should be logged according to Hope Bay Mining protocols.
4. Send samples for the following analyses:
    a. Trace metals by Aqua Regia digestion followed by ICP-MS finish
    b. ABA testing, including:

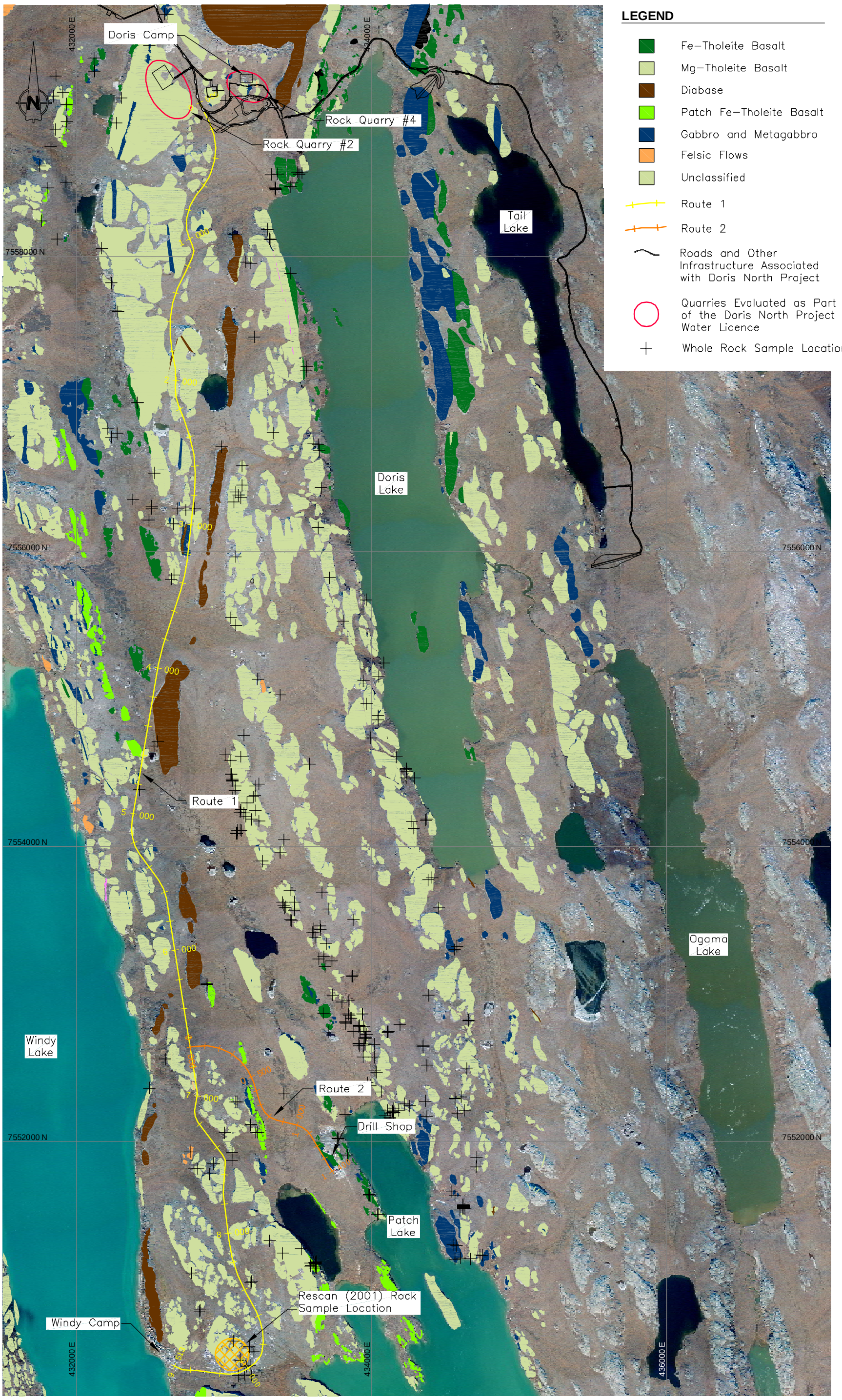
i. Paste pH
ii. Fizz test
iii. Total sulphur by Leco furnace
iv. Sulphur as sulphate
v. Standard Sobek NP
vi. CO_2 by Leco furnace

5 References

Rescan Environmental Services Ltd. 2001. 2000 Supplemental Environmental Baseline Data Report, Hope Bay Belt Project. *Prepared for* Hope Bay Joint Venture, March 2001.

SRK Consulting (Canada) Inc. 2007. Geochemical Characterization of Quarry Materials, Doris North Project, Hope Bay, Nunavut, Canada. *Prepared for* Miramar Hope Bay Limited, October 2006.

J:\01_SITES\Hope.Bay\!ACAD\2008 Drawings\1UN010_P01-1.dwg



LEGEND

- Fe-Tholeite Basalt
- Mg-Tholeite Basalt
- Diabase
- Patch Fe-Tholeite Basalt
- Gabbro and Metagabbro
- Felsic Flows
- Unclassified
- Route 1
- Route 2
- Roads and Other Infrastructure Associated with Doris North Project
- Quarries Evaluated as Part of the Doris North Project Water Licence
- Whole Rock Sample Location

0 200 400 600 800 1000 Metres

1:25,000

SRK Consulting
Engineers and Scientists
Vancouver

SRK JOB NO.: 1UN010.P01

FILE NAME: 1UN010_P01-1.dwg

HOPE BAY MINING LTD

Doris Camp - Windy Camp Access Road

Outcrop Geology for the Project Area

DATE:	APPROVED:	FIGURE:
March 08	MR	1

Appendix G
Stream Flow Hydrology (SRK 2008)

SRK Consulting
Engineers and Scientists

SRK Consulting (Canada) Inc.
Suite 2200 – 1066 West Hastings Street
Vancouver, B.C. V6E 3X2
Canada

vancouver@srk.com
www.srk.com

Tel: 604.681.4196
Fax: 604.687.5532

Memo

To:	Maritz Rykaart	**Date:**	April 3, 2008
cc:	File	**From:**	Lowell Wade
Subject:	Regional Hydrological Analysis of Streams Located Along the Proposed Doris Camp to Windy Camp All-Weather Road	**Project #:**	1CH008.000

1 Introduction

A 10 km all-weather road has been proposed to run form Doris Camp to Windy Camp as illustrated in Figure 1. A 1 km all-weather branch road will link the main road to the Patch Lake Drill Shop and Tank Farm. Along the main route three potential stream crossings have been identified, and along the branch route one potential stream crossing has been identified. The stream crossings were identified using airphoto interpretation using orthorectified airphotos taken by Aero Geometrics on September 17, 2007. The airphotos were flown at an elevation of 5,000 ft (1,524 m).

Since it is not known whether these streams contain fish habitat, SRK proposes that the precautionary principal be adopted and therefore the base assumption is that each stream does contain fish habitat. Therefore, stream crossings must be designed to ensure that this fish habitat is not disturbed in any way.

This memo presents a hydrological analysis for each of the streams, to facilitate appropriate stream crossing design.

2 Regional Analysis

Baseline hydrology for the Doris North Project, spanning back as far as 1993, includes peak flow and associated drainage areas for the Doris Lake outflow, Ogama Lake outflow and Tail Lake outflow (Golder 2007). Of these three drainage areas, the Tail Lake catchment (A_{TL}) most closely resemble the small catchment areas (A_n) measured for the four identified streams along the proposed all-weather routes, as demonstrated in Table 1 and illustrated in Figure 1.

Table 1. Results of Regional Analysis

Station	Drainage Area (km^2)	Measured Discharge ($Q_{TL\text{-}peak}$ = m^3/s)	Regional Analysis ($Q_{n\text{-}peak}$ = m^3/s)
Tail Lake Outflow (A_{TL})	4.40	0.11	-
Thumb Lake Inflow (A_1)	0.76	-	0.03
Stream (A_2)	0.22	-	0.01
Stream (A_3)	0.20	-	0.01
Stream (A_4)	0.16	-	0.01

Regional analysis can be applied to determine peak discharge from each of the four stream catchments ($Q_{n\text{-}peak}$) using the recorded peak discharge for Tail Lake ($Q_{TL\text{-}peak}$), i.e:

$$\frac{Q_n}{Q_{TL-peak}} = \left(\frac{A_n}{A_{TL}}\right)^{\alpha} \qquad \text{Eqn. (1)}$$

Where: α = 0.782
Q_n = Peak stream flow (m^3/s)
$Q_{TL\text{-}peak}$ = Tail Lake peak discharge
A_n = Stream drainage area (m^2)
A_{TL} = Tail Lake drainage area (m^2)

3 Peak Flows

The 24-hour duration storm event, with a recurrence interval of 1:100 years at Hope Bay is 65 mm. Table 2 summarizes the peak flows associated with this storm event for each of the four stream crossings assuming no flood attenuation and 100% runoff. Both of these assumptions are excessively conservative; however, even considering this the peak flows are extremely low and thus construction of a clear-span structure to pass these peak flows would entail very small structures.

To illustrate this, an equivalent pipe culvert size was calculated using the calculated peak flow, assuming a flow velocity of 1.5 m/sec. These equivalent sizes, assuming the pipe culvert is only half-full are listed in Table 2.

Table 2. Results of Peak Flow Analysis

Station	Drainage Area (km^2)	Calculated Peak Flow (m^3/s)	Equivalent Pipe Culvert Size (Diameter in m)
Thumb Lake Inflow (A_1)	0.76	0.57	0.97
Stream (A_2)	0.22	0.17	0.29
Stream (A_3)	0.20	0.15	0.26
Stream (A_4)	0.16	0.12	0.20

4 Conclusion

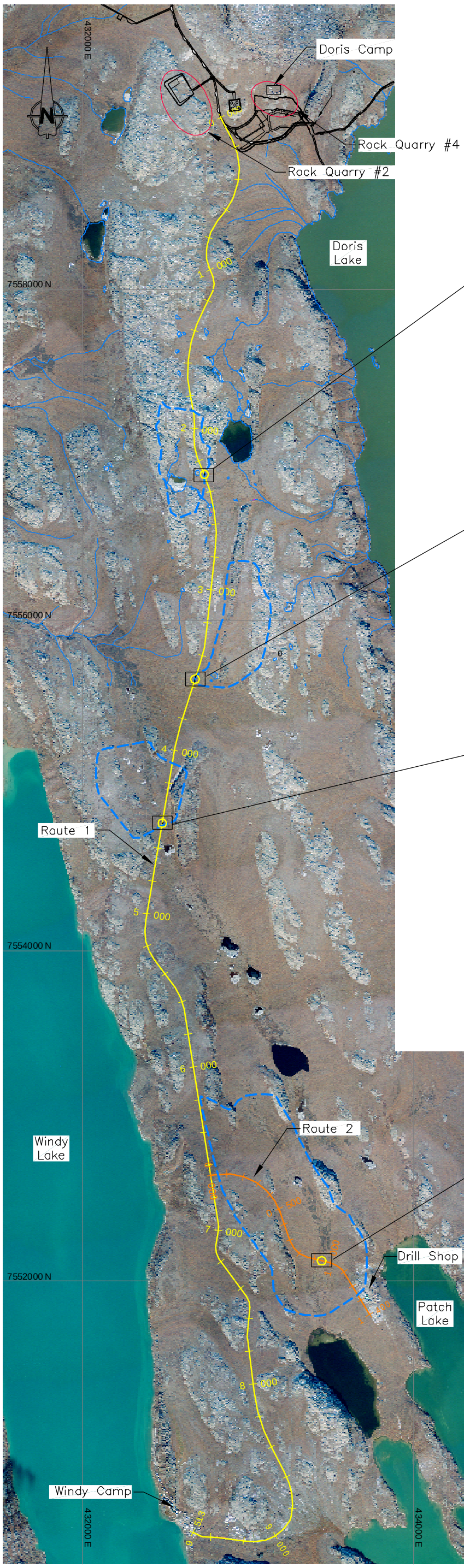
Regional analysis was used to evaluate peak flows from four streams identified along the proposed Doris Camp to Windy Camp alignment. These flows are small, and range between 0.01 and 0.03 m^3/sec.

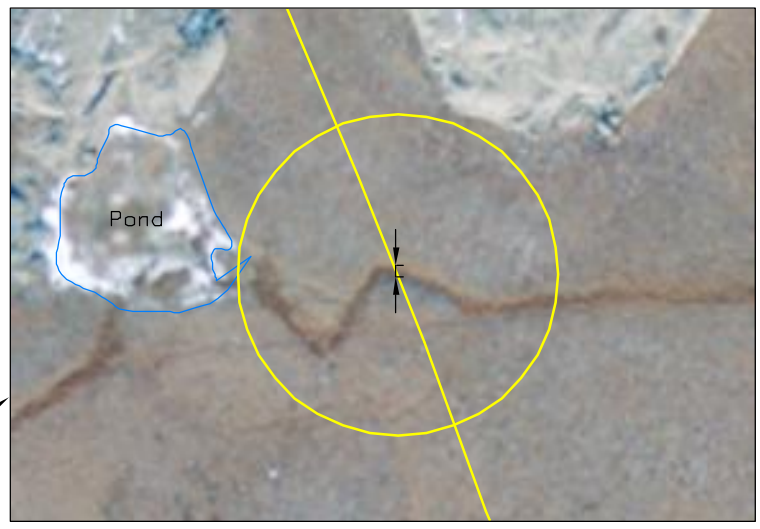
Peak flow analysis based on the 24-hr duration, 1:100 year recurrence interval storm event suggest flows between 0.57 and 0.12 m^3/sec. These flows assume zero attenuation and 100% runoff. These flows are very low and can be accommodated by pipe culverts between 0.97 and 0.20 m in diameter, assuming the flow depth is only the half-width of the culvert.

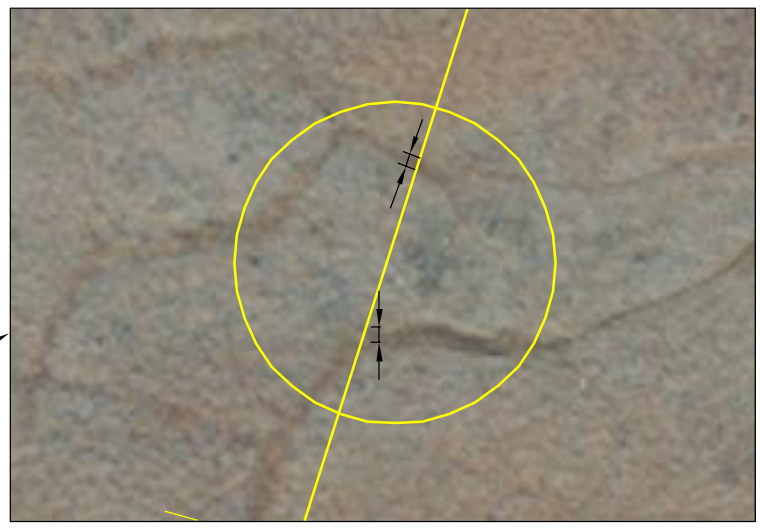
5 Reference

Golder Associates Ltd. 2007. Revised Doris North Project Hydroclimatic Parameter Re-evaluation, 2007. Report prepared for Miramar Hope Bay Ltd., April 2007. Project No. 06-1373-026.4000

J:\01_SITES\Hope Bay\!ACAD\2008 Drawings\1UN010_P01-2.dwg







0 10 20 30 40 50

1:1250

Legend

- Route 1
- Route 2
- Roads and Other Infrastructure Associated with Doris North Project
- Quarries Evaluated as part of the Doris North Project
- Interpreted Watershed Boundary
- Possible Stream Crossing Location

Notes

1. Road alignment will be adjusted in the field to adjust to the length of stream crossing.
2. All stream dimensions are measured perpendicular to channel.
3. Some streams may have more than one channel.

0 200 400 600 800 1000 Metres

1:25,000

SRK Consulting
Engineers and Scientists
Vancouver

SRK JOB NO.: 1UN010.P01

FILE NAME: 1UN010_P01-2.dwg

HOPE BAY MINING LTD

Doris Camp - Windy Camp Access Road

Possible
Stream Crossing Locations

DATE:	APPROVED:	FIGURE:
March 08	MV	1

Appendix 2

Technical Field Memorandum:
Doris to Windy Road Crossings Photographs, Golder Associates

TECHNICAL FIELD MEMORANDUM

#300, 10525 – 170 Street
Edmonton, Alberta, Canada
T5P 4W2

Golder Associates Ltd.
Telephone No.: 780-483-3499
Fax No.: 780-483-1574

DATE: 2 April 2008

Proj No. 07-1373-0019-1600

TO: Michael Myer and Chris Hanks, Hope Bay Mining Ltd.
Maritz Rykaart, SRK Consulting (Canada) Ltd.

FROM: Gary Ash

RE: Doris to Windy Road Crossing Photographs

Background:

Hope Bay Mining Ltd is proposing to build an all-weather road between Doris Camp and Windy Camp in the Hope Bay Belt. The road would comprise two sections as follows: Route 1, an approximately 10 km section between Doris Camp and Windy Camp, and Route 2, an approximately 1 km section branching off of Route 1 to the Drill Shop at Patch Lake.

Route 1 will cross several small topographical lows and three small streams with more defined channels. Route 2 crosses a small channel just north of Patch Lake.

The following photographs document the surrounding terrain and the physical conditions of two of the crossing locations.

Source of the Photographs

To help document the channel characteristics at the proposed road crossing sites, Golder Associates Ltd. field staff reviewed air and ground-level photographs taken during other components of the environmental baseline studies in the region. Based on this review, low-level aerial photographs of the north crossing on Route 1 and the crossing on Route 2 were located. Ground level photographs taken about 300 m downstream of the Route 2 crossing were also available. The dates of the photos are as follows:

- Photo 1: Route 1 North Crossing – 16 July 2007
- Photo 2: Route 2 Crossing from the air – 4 July 2007
- Photo 3: Route 2 Crossing from the air – 6 September 2007
- Photo 4: Route 2 Crossing – channel about 300 m downstream – 6 September 2007
- Photo 5: Route 2 Crossing – downstream channel – 6 September 2007

Conclusion

Based on the review of the available information, the four small streams crossed by the all-weather road would provide very limited, if any, fish habitat. This is based on the small headwater drainage areas of the streams, the distance to downstream water bodies that could overwinter fish, the small size and braided nature of the channels through tundra vegetation, and the ephemeral nature of the streams (i.e., flow primarily during snowmelt or high precipitation events, and freeze solid in winter). If any of the streams do support fish, it is highly likely that the only species taking advantage of the habitat would be ninespine stickleback.

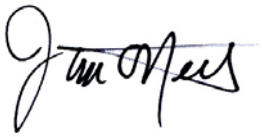
GOLDER ASSOCIATES LTD.

Prepared by:

Gary Ash
Senior Fisheries Scientist, Principal

Rob Stack
Fisheries Scientist

Reviewed by:



James P. O'Neil
Senior Fisheries Biologist, Principal

Doris to Windy Road Crossing Photographs

Photo 1 Route 1 North Crossing

Photo 2 Route 2 Crossing

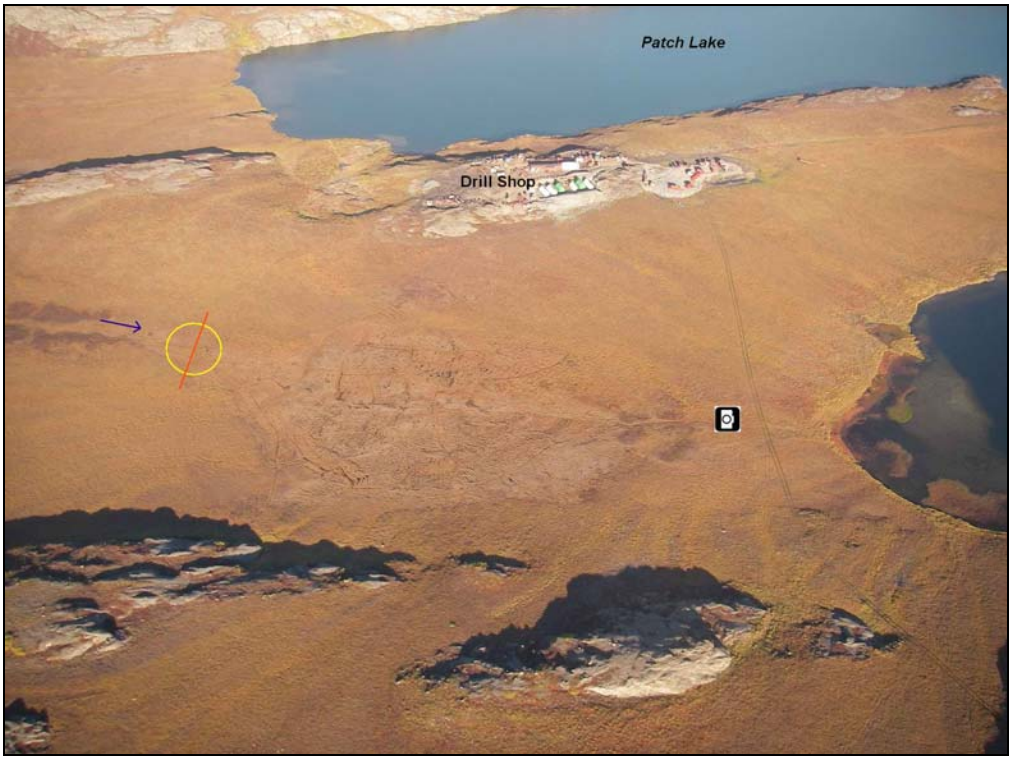


Photo 3 Route 2 Crossing - Camera Symbol Indicates Location of on the Ground Photos

Photo 4 Route 2 Crossing - Channel Approximately 300 m Downstream of Crossing Location

Photo 5 Route 2 - Channel at a Location Near the Above Photo

Appendix 3
List of Potentially Applicable Legislation to Windy Camp Road Project

List of Potentially Applicable Legislation to Windy Camp Road Project

Federal

- *Arctic Waters Pollution Prevention Act (Arctic Waters Pollution Prevention Act Regulations)*
- *Canada Shipping Act*
- *Canada Water Act*
- *Canadian Environmental Protection Act*
- *Explosives Act (Explosives Regulation)*
- *Fisheries Act*
- *Migratory Birds Convention Act(Migratory Birds Regulations)*
- *Nunavut Act (Nunavut Archaeological and Paleontological Sites Regulations)*
- *Nunavut Land Claim Agreement Act*
- *Nunavut Waters and Nunavut Surface Rights Tribunal Act (NWT Waters Regulations)*
- *Species at Risk Act*
- *Transportation of Dangerous Goods Act (Transportation of Dangerous Goods Regulations)*

Territorial

- *Apprenticeship, Trades and Occupations Certification Act (Apprenticeship, Trade and Occupations Certification Regulations)*
- *Boilers and Pressure Vessels Act*
- *Electrical Protection Act (Electrical Protection Regulations)*
- *Emergency Medical Aid Act*
- *Environmental Protection Act (Nunavut)*
- *Environmental Protection Act (Spill Contingency Planning and Reporting Regulations)*
- *Explosives Use Act (Explosives Use Regulations)*
- *Fire Prevention Act (Fire Prevention Regulations)*
- *Gas Protection Act (Gas Protection Regulations)*
- *Hospital Insurance and H & SS Administration Act*
- *Mine Health and Safety Act (Mine Health and Safety Regulations)*
- *Pesticide Act (Pesticide Regulations)*
- *Public Health Act (Camp Sanitation Regulations, Communicable Disease Regulations, Eating or Drinking Places Regulations)*
- *Scientist Act*
- *The Safety Act (General Safety Regulations)*
- *Transportation of Dangerous Goods Act (Transportation of Dangerous Goods Regulations)*
- *Wildlife Act (Bird of Prey Regulations, Certification and Disposal of Wildlife Regulations, Polar Bear Defence Kill Regulations, Wildlife Licences and Permits Regulations)*
- *Workers' Compensation Act*