Water License Pre-Hearing Technical Meeting Information Supplement

Doris North Project
Nunavut, Canada

Submitted to the Nunavut Water Board by:

Miramar Hope Bay Ltd.

Prepared by:

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June 2007

The following supplemental information is provided in response to the Table of Issues generated during the Doris North Pre-Hearing Technical Meeting held in Cambridge Bay on June 11th and 12th, 2007.

Sheet #1 refers to the first Table of Issues and Information Requests generated in response to the submission made to the Water Board on June 08th, addressing Project Modifications/Changes arising from detailed engineering.

Sheet #2 refers to the second Table of Issues and Information Requests generated in response to submissions made to the Water Board by the registered interveners, resulting from their technical review of the Doris North Water License Application.

Miramar Hope Bay Ltd. (MHBL) has prepared the following supplementary information in response to this Table of Issues and requests for additional information, with the objective of seeking resolution of all major issues with the intervening parties ahead of the Water License Public Hearing.

Sheet #1 – Information Requirements Relating to the Proposed Project Modifications/Changes

Item #1 – Increased Electrical Generating Capacity

No additional information required

Item #2 – Increased Annual Fuel Consumption

Item #2a – Air Emission Dispersion Modeling

No additional information required for water license process

Item #2b – Fuel Storage Capacity and Handling Procedures

SNC-Lavalin recommended to MHBL that the amount of on-site fuel storage capacity should be increased from a 12 month to a 14 month supply, to ensure continuity in operation and allow for contingency in the event of a colder winter or other change that results in higher fuel consumption. Consequently MHBL has requested authorization from the Nunavut Water Board to add an additional fuel tank and containment system to the May 2007 Water License Application. This storage tank and the lined secondary containment berm will be constructed on a bedrock foundation sited within the footprint of Quarry 1 at Roberts Bay. This facility is designed to accommodate a single storage tank with a 5.0 million litre capacity (reduced from the 5.7 million litre capacity quoted in

MHBL's letter of June 08th) and will be sited approximately 150 m back from Roberts Bay at its closest point. The proposed Roberts Bay fuel transfer station covered by the NIRB Project certificate will be relocated to be sited adjacent to this new fuel storage tank so that all fuel trucks would be loaded inside a bermed containment liner. The SNC-Lavalin drawing showing the layout and location of this proposed fuel tank storage facility and the proposed piping connection to the jetty are attached to this supplement as Figure 1.

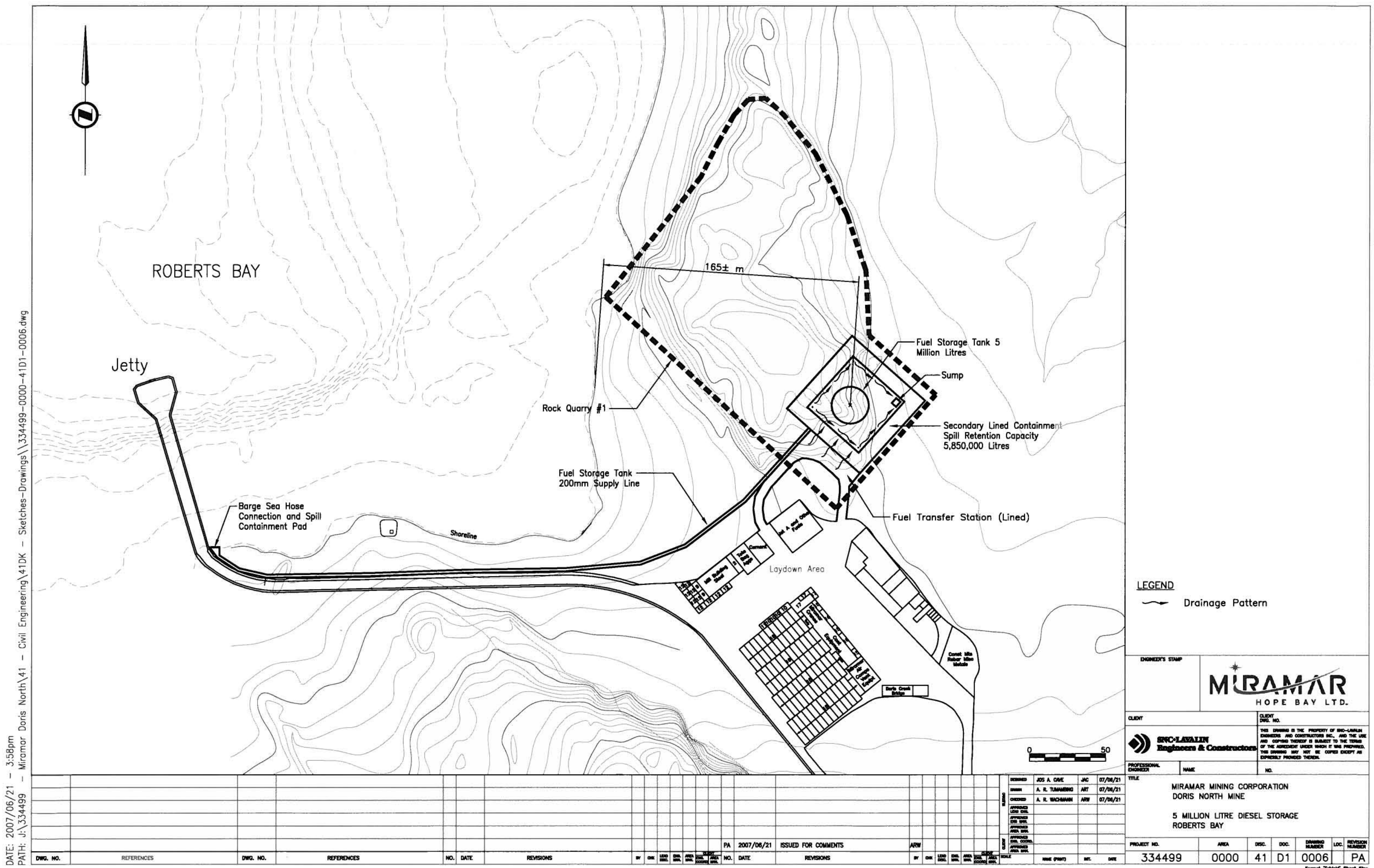
The lined and bermed secondary containment facility will have a capacity of 5.85 million litres (>110% of the tank useable capacity) and have a footprint of approximately 50 meters square (area of ~2,500 m^2).

The engineering specifications for this tank farm facility including the HDPE liner will be similar to the specifications provided by SRK Engineering for the Doris North plant site tank farm (see Drawings S-5 and S-06 in Supporting Document S4 to the April 2007 Revised Water License Application Support Document (included as Appendix A to this supplement). MHBL has commissioned detailed engineering drawings for this facility and will submit these under separate cover to the NWB as soon as they become available (prior to July 30th, 2007).

This 5 million liter capacity fuel tank facility will be constructed on a level precision blasted surface, on the exposed bedrock within the footprint of Quarry #1. Founding the tank farm on bedrock eliminates the risk of foundation settlement, which may lead to pipe rupture and fuel spills.

The tanks will be erected in an engineered containment area consisting of a HDPE lined pad having sufficient capacity to retain 110% of the volume of the largest single fuel tank. The base of the containment area will be graded to a corner sump location. Contaminated water will be treated through a filtration system to remove hydrocarbons before discharge onto the tundra. Any fuel spills will be pumped to appropriate containers for recovery or for disposal as a hazardous waste. The Doris North Emergency Response and Spill Contingency Plan (SD S10a to the April 2007 Revised Water License Application Support Document) will extend to this new facility.

Figure 1: Roberts Bay Fuel Tank Facility



Item #3 – Jetty Barge Anchoring Blocks

No additional information required

Item #4 – Doris Lake Fresh Water Intake

Based on a recommendation from SNC-Lavalin, MHBL has decided that the 4" HDPE DR 17 fresh water pipe intake to be sited on the bottom of Doris Lake feeding an on-shore wet well, proposed in the April Water License Application re-submission, be replaced with a floating barge system with an approximate in-lake footprint of 10 square metres. The floating pump house barge will be equipped with an aerator bubble system to keep the barge from freezing solidly in place. SNC-Lavalin feels that the floating barge system is more suitable for the small volume of water to be drawn from Doris Lake and easier to install and maintain. SNC-Lavalin cites successful use of similar pumping systems at other sites in the North. In this way the entire system can be fabricated off-site and shipped as a module for direct placement. This modification will remove any lake bottom impacts potentially associated with the HDPE pipe laid along the lake bottom and anchored in place with clean rockfill. There would be no change in the volume of water drawn from Doris Lake and the bubbling system will only affect the ice within 6 inches of the floating barge and thus does not create any new hazards to wildlife or humans traveling on the frozen lake in winter. This modification will remove any potential impact on fish habitat caused by a pipe on the lake bottom. Overall in MHBL's opinion the potential environmental effect from this change is positive as it eliminates any impact on the lake bottom. This style of pump intake is in line with that previously requested by DFO during the NIRB process.

The proposed floating pump house location is shown in Figure 2. The pump house barge will be anchored in Doris Lake at a point approximately 25 metres to the east of the Doris Lake float plane dock. The pump will be set to pump from a depth of approximately 3 metres. The lake at the proposed pump barge location is approximately 5 metres deep. The pump intake will be equipped with a screen that meets DFO guidance to prevent fish entrainment. The pump house will be connected to the shore by a 15 m long by 1.5 m wide pre-fabricated clear span walkway that ties the pump house to the shore. The fresh water pipeline will be cantilevered along the side of this walkway and then travel along the road right-of-way back to the fresh water storage tanks at the accommodation camp.

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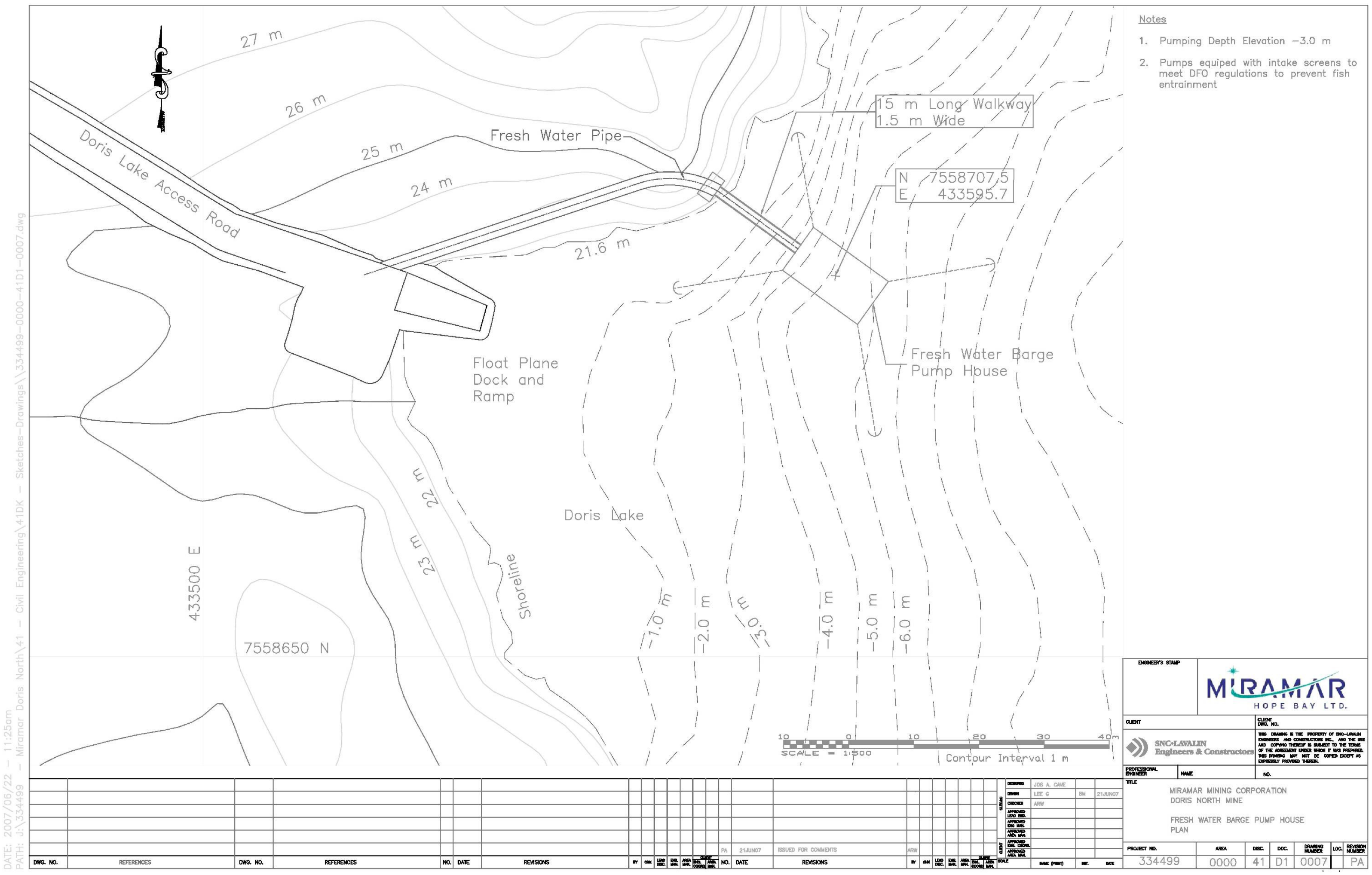
Figure 2: Doris Lake Freshwater Barge



Item #5 – Jetty – Access Road to Construct Shorefast Rock Spurs

Following ongoing discussion with DFO, MHBL will not construct the proposed 100 m long access road from the jetty road that was needed to construct the Shorefast rock spurs intended to be a component of the fisheries compensation measures for the Roberts Bay jetty. MHBL, with DFO agreement, propose to now construct these rock fill spurs at a new location to the west of the proposed jetty and farther offshore. The proposed location is shown in the two drawings (a bathymetry map and an aerial photo) included in Appendix B to this addendum. The total surface area of these rockfill spurs will still be around 600 m^2 to be sited within the footprint shown on these two drawings. It is proposed that these spurs will now be constructed in the winter of 2007-2008 (early in 2008) using an ice road to place the sized clean rock on the ice surface and then allowing the rock to melt through the ice to settle in place. The depth of water in this area is in the order of 1 to 3 metres. MHBL will approach the landowner (INAC), the KIA and Transport Canada to verify that this is an acceptable alternative to the original Shorefast spurs. A copy of a memorandum to DFO dated June 21, 2007 that describes the proposed timing of construction of these offshore spurs and the monitoring of the jetty after decommissioning has been include in Appendix B.

Item #6a – Roberts Bay Jetty Infill Area

The re-calculated aerial extent of the jetty infill at the ordinary high water mark taking into consideration settling is 0.1584 ha. The following is the information requested with regards to the jetty footprint (updated from October 2005 NNLP to reflect construction timing):

Table 1 "No Net Loss" summary of fish habitat within the proposed jetty - Doris North Project

Activity	Waterbody	Fish Species Present	Habitat Quality[1]	Description/Compensation	Area of Habitat Affected (ha)	Habitat Gain by Compensation (ha)	Net Gain in Fish Habitat (ha)
Jetty	Roberts Bay	Marine and Freshwater spp.	Good	Jetty: 103 m length; primarily 6 m width; 3:1 final side-slopes after settling Rock spurs (jetty): 8 spurs; each 5 m x 15 m Rock side slopes along jetty: 2168 m^2 below HWL Rock spurs (shoreline): 6 spurs, each 5 m x 20 m	0.1584 Based on HWL at 3:1 final slope	0.3368	+0.1784

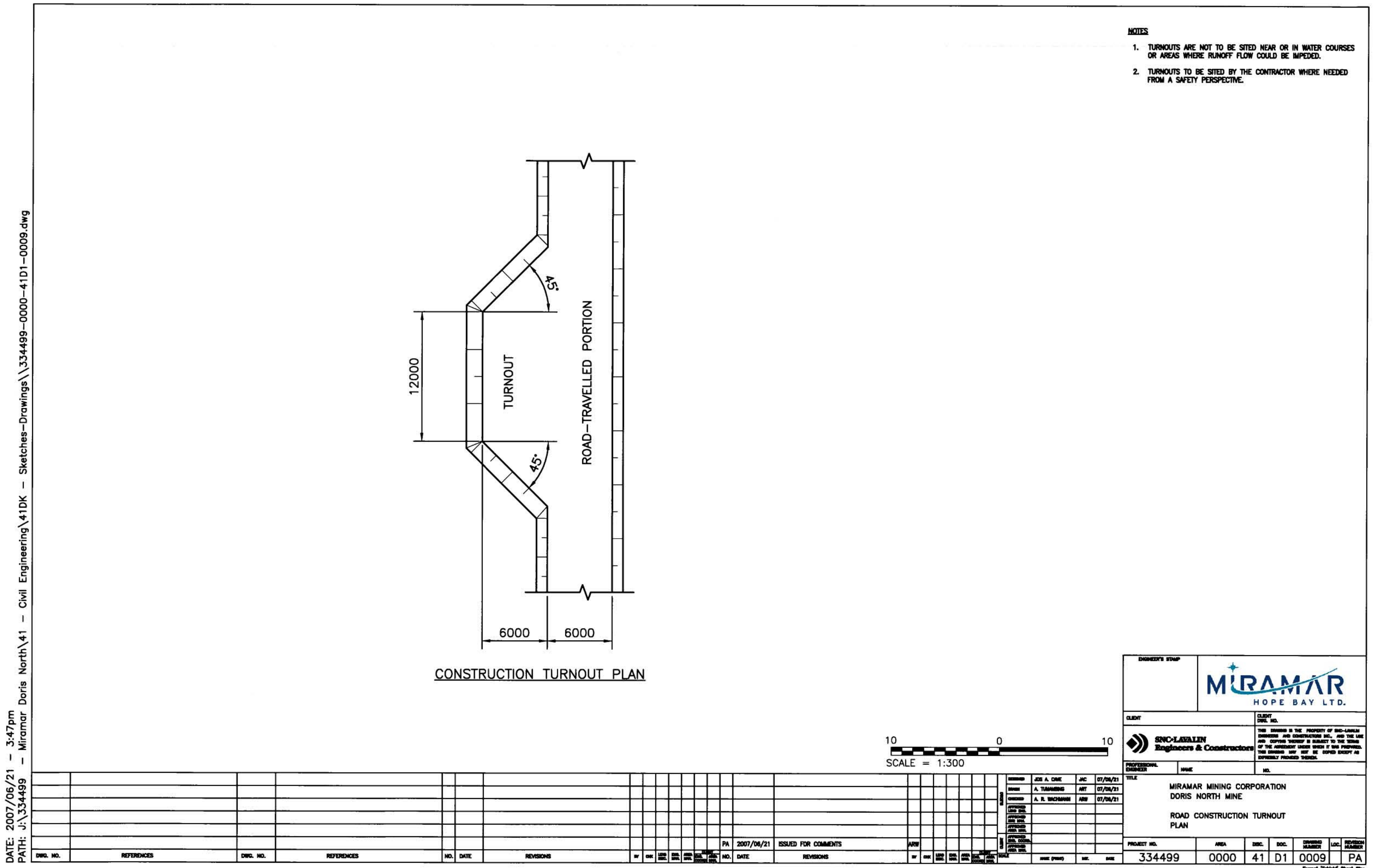
[1] Habitat quality ratings based on Rescan (2001).
Area values provided by SRK, June 2008

Fisheries compensation for loss of fish habitat associated with the footprint of the jetty will include the provision of additional reef habitat through the construction of under-water rock spurs perpendicular to the jetty and rock spurs along the shoreline at several locations along Roberts Bay. The key measures of enhancement success will be the establishment of primary and secondary productivity on the enhancement structures (i.e., which provide food source for fish), as well as the documentation of the use of the structures as rearing and feeding habitat for fish. The follow-up study design will be based on a Control/Impact design similar to that described above for monitoring enhancement structures in Doris Lake. Fish sampling methods would include snorkeling, minnow traps and other trapping methods, and possible use of underwater video and hydro acoustic gear to monitor fish presence along the enhanced and reference sites. This monitoring will be conducted beginning the summer following the year of mine construction (i.e., monitoring in summer of 2008 and in Year-2 of operation (summer of 2010 and in Year-2 of active post-closure (i.e., year prior to jetty lowering to below water).

Item #6b – Roberts Bay Access Road Construction Turn Outs

The current access road design calls for a single lane road between Roberts Bay and the plant site with passing turnouts sited at 1 km intervals. This remains unchanged, however SNC-Lavalin has pointed that in constructing a single lane road, a number of construction turnouts will be required to allow the construction dump trucks to safely turn around to dump their loads. The contractor will install these turnouts where they are needed for safe turning of the trucks. None of these turnouts will be constructed in or adjacent to water courses or areas where drainage flows could be impeded by these turnouts. This is a safety requirement and a change in the road design has been submitted to the NWB. It is estimated that approximately 35 of these turnouts will be needed to allow for safe construction of the Roberts Bay access road (turnouts will not be needed for the widened airstrip portion of the road). Each turnaround will be approximately 6m x 12m (72 sq m). The total additional surface footprint from these turnouts will be approximately 0.25 hectares which is still significantly less than if the width of the road had been increased to a double lane road. In MHBL's opinion these additional road turnouts will not have a significant environmental impact and thus this change is seen as being neutral. Attached as Figure 3 is an engineered drawing from SNC-Lavalin showing a typical road construction turnout.

Figure 3: Construction Road Turnouts



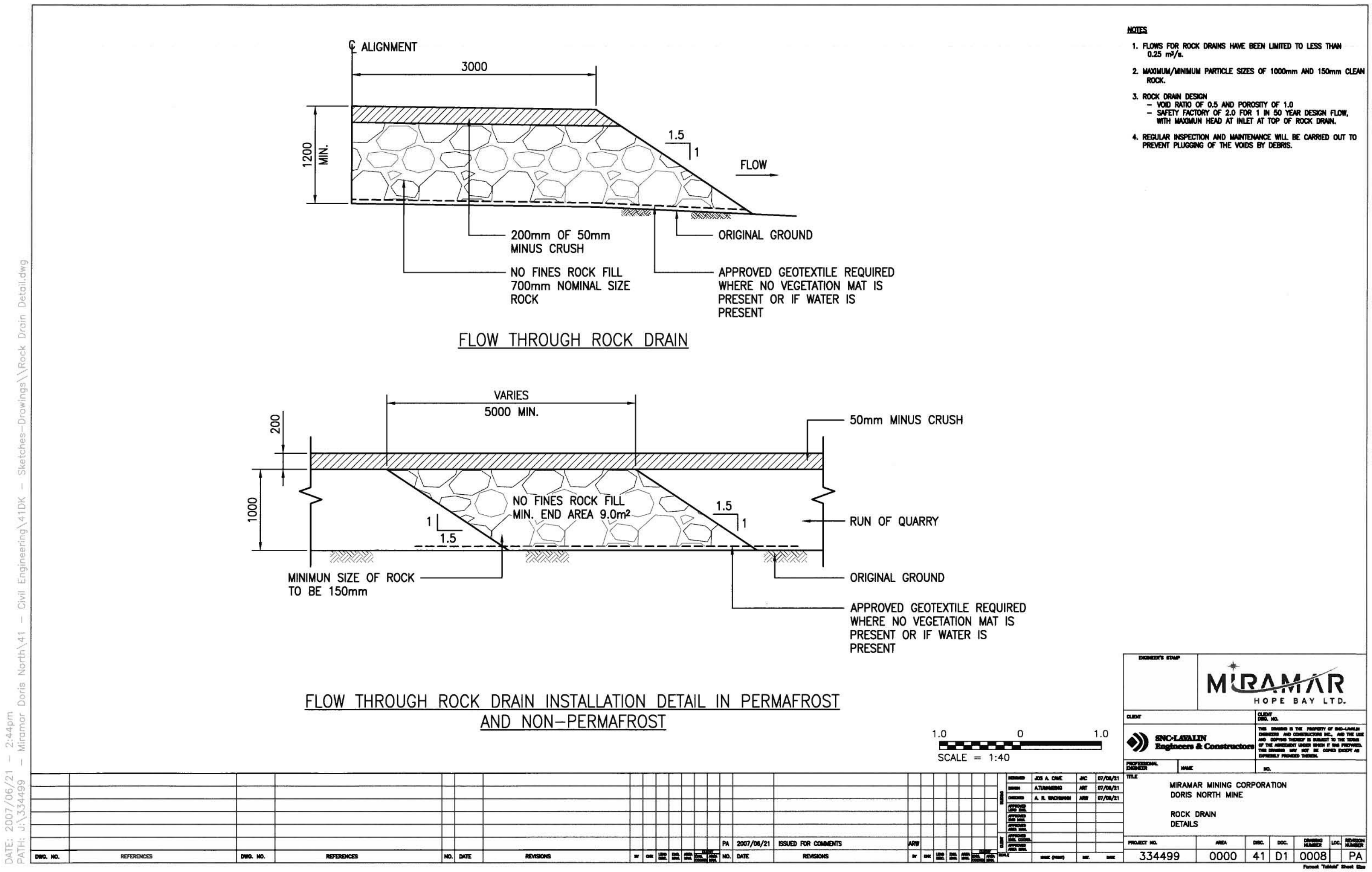
Item #7 – Replacement of Culverts by Coarse Rock Drains

Based on a recommendation from SNC-Lavalin, MHBL proposes that all culverts, planned where the site roads cross low flow (less than 0.25 m^3/s) ephemeral drainages that have no fish access potential, be replaced by rock drains. This recommendation is based on SNC-Lavalin's experience at other Northern sites where typically the culverts remain frozen after the freshet flow commences in the spring turning the culverts into flow obstructions until they can be thawed using applied heat. SNC-Lavalin proposes that these rock drains consist of coarse rock that has been screened to remove fines. In their experience, these rock drains perform better in the North at passing the spring freshet flows. These will only be used where the drainage pathways have no defined stream and thus no potential for fish access and where flow is expected to be less than 0.25 m^3/s. SNC-Lavalin has prepared a typical rock drain design and specification which is attached as Figure 4. This design is based on an approved GNWT Highway design used on SNC-Lavalin's design build contract for NWT Highway 3 near Yellowknife. SRK have reviewed this design and provide the following conclusion:

> "The presence of the rock drains is not expected to affect the thermal performance of the road and/or pads in any way. If the rock drains do not function as planned and result in pooling MHBL will remove the problem rock drains and replace with a working culvert."

In MHBL's opinion this replacement of culverts by rock drains for the low flow ephemeral crossings has a neutral overall environmental impact as these ephemeral drainages have no fish passage potential.

Figure 4: Typical Rock Drain For Roads



Item #8 – Underground Mine Ventilation Service Raise Road

Construction of the Doris North underground mine requires the construction of three ventilation raises that will come to surface (See Section 4.8.1 in the FEIS). The first raise is to be located at a distance of approximately 500 m down ramp from surface where a temporary ventilation raise/escape way (Vent #1) will be driven to surface. At the top of the vent raise, a large diameter low pressure 45 kW (60 HP) main fan will be installed to force 47 m^3/s (100,000 cfm) up the main ramp. As the ramp development reaches the northern and southern extents of the mine, two additional ventilation raises/escape way (Vent #2 and Vent #3) will be driven to surface. The temporary raise (Vent #1) will then be sealed off and the two new raises (Vent #2 and Vent #3) will each have a low pressure large diameter 45 kW (60 HP) fan mounted on top of them.

An 800 m long x 6 m wide service road will have to be constructed to allow maintenance access for these fans at Vent Raise #1 and #2. The road will run to the northeast of the mine portal along the east side of the mesa as shown in the attached Figure 5. This new road will add an additional 0.48 hectares of surface disturbance to the overall project footprint of 62 hectares. Raise #3 will be accessed from the main road going to Tail Lake. This service road will see minimal traffic (estimated at 1 vehicle trip per day) but will also allow for a secondary egress route from the mine for mining personnel in the event of an underground emergency that may block safe access up the ramp. This road was inadvertently overlooked by MHBL during the assessment phase although the ventilation fans were included in the assessment. The detailed road layout is shown on the SR Drawing S-27 – Ventilation Raise Access Road Layout (Figure 6). The three stream crossings shown on the SRK Drawing are all ephemeral drainage runoff paths and do not represent year round streams and thus do not allow for fish access. MHBL proposes that rock drains be installed at these three points to allow unimpeded passage of surface runoff through these drainage pathways.

The construction and operation of this road is not expected to have any significant environmental impact. It will not impede water flow, will not impact any fish habitat, will not hinder wildlife access and will not significantly increase noise levels due to the expected minimal traffic. The road will ensure that service access to vent raises #1 and #2 during mine operations is restricted to the road and does not create further ground disturbance on the surrounding tundra.

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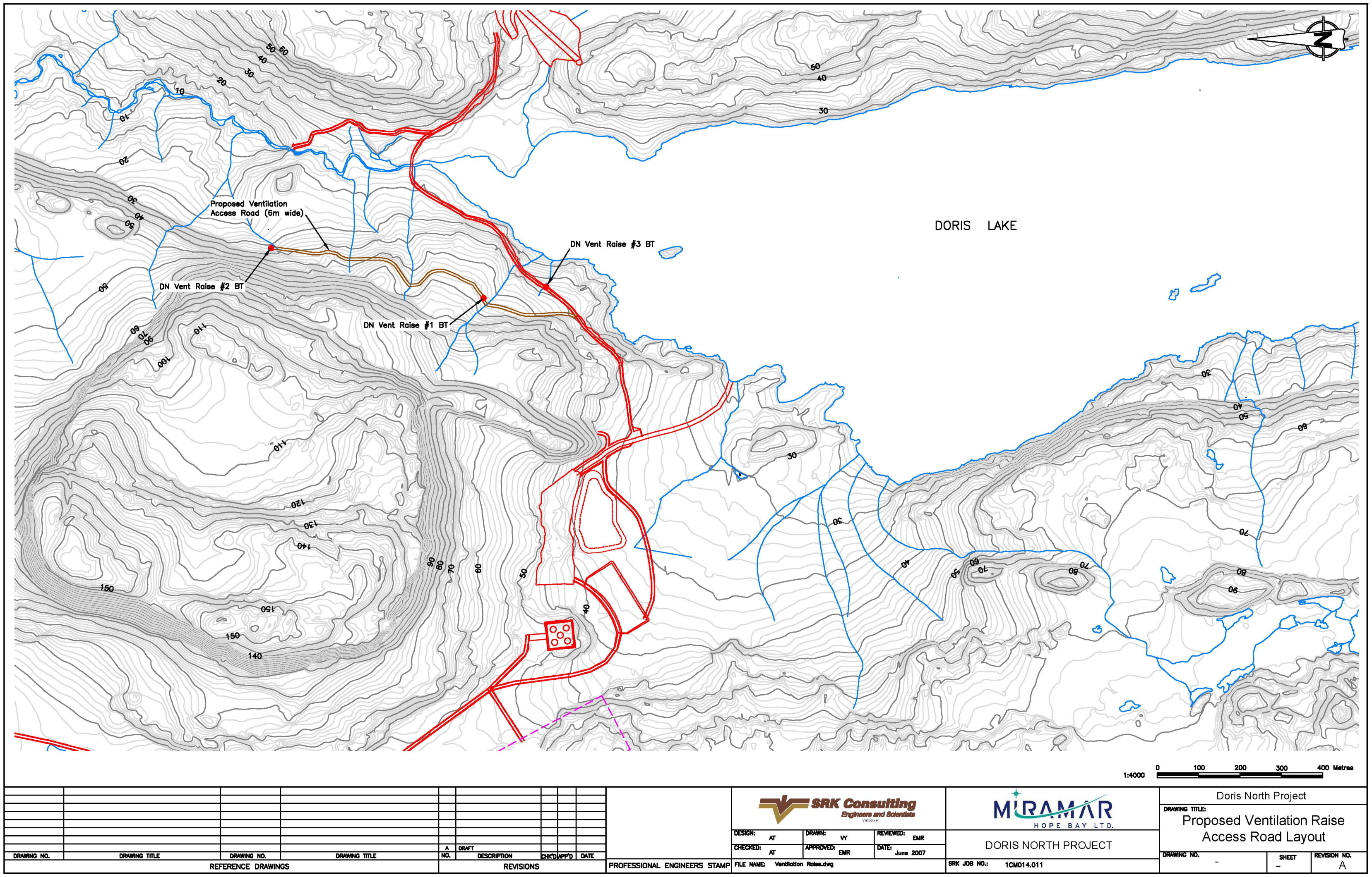
Figure 5: Ventilation Raise Access Road



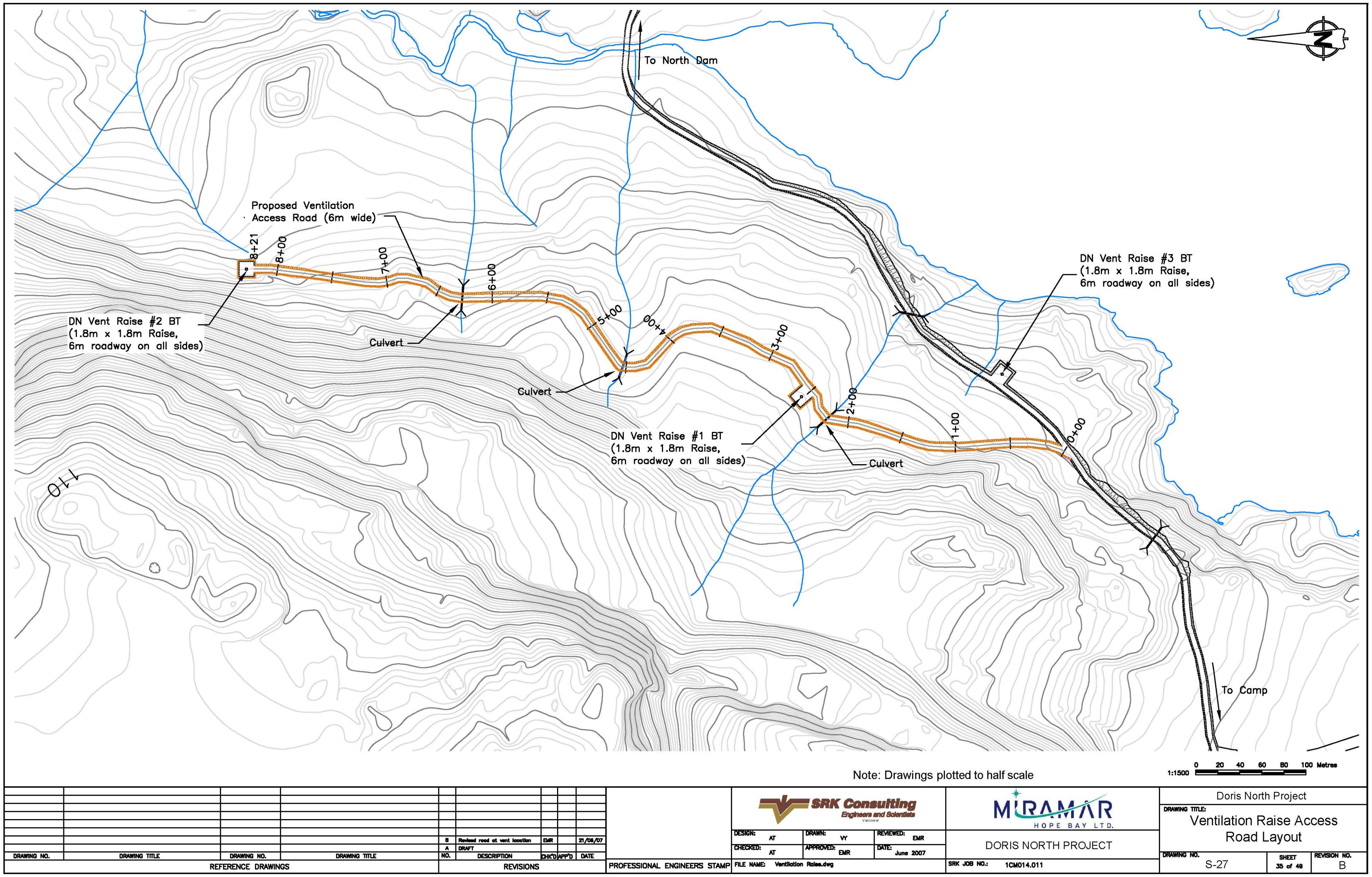


Figure 6: Ventilation Raise Access Road Layout

Item #9 – Cyanide Destruction Methodology

Further to the information on the CyPlus SO_2-Air cyanide destruction testwork that was provided to the Water Board in the letter submitted by MHBL on June 08, 2007 addressing Project Modifications and Changes: MHBL has arranged for CyPlus to courier the residual solutions to the Cantest Laboratory in Vancouver (the former BC Research lab) for the following analysis:

Cyanide Leach Residue Solution (prior to CN Destruction)

pH, ICP-MS Scan for Total Metals, Hg by CVAA, SO4, Total Phosphate and TDS (we do not have sufficient volume of solution to run the CN species and so will have to rely on the CyPlus analysis as quoted in their report)

Treated CN Leach Residue Solution (after CN Destruction)

pH, Total CN, WAD CN, CNO, SCN, SO_4, Chloride, Total Ammonia, Nitrate, Nitrite, Alkalinity, Total Phosphate, Total Dissolved Phosphorous, Organic Carbon, Total Dissolved Organic Carbons, ICP-MS Scan for Total Metals, Hg by CVAA, Hardness and TDS.

Ageing Test – 500 mL of slurry – let it sit exposed to air at room temperature for one month the filter and analyze the clear solution for pH, ICP-MS Scan, Hg by CVAA, Total Ammonia, and Total Phosphate.

CN Leach Residue Solids (after CN destruction)

Modified ABA using the Sobek Method, Sulphur Speciation, Inorganic CO_2 (Carbonate NP), Peroxide Siderite Correction for NP ABA Procedure, Static NAG testing, an ICP for total metals (strong acid digestion) and a BC SFE test with ICP for total metals on the leachate.

The samples are at the lab now. Results will be forwarded to the Water Board under separate cover as they become available. This is expected to be ahead of the July 30th date for final submissions for the public hearing process.

Item #10 – Sewage Treatment Plant Process Design Change

Based on a recommendation from SNC-Lavalin, MHBL has proposed that the Doris North packaged sewage treatment plant (STP) be changed from a rotary biological contactor type of plant as described in the April 2007 Water License application to a SaniBrane Membrane bio reactor similar to the units installed at the Snap Lake and Diavik Diamond Mine Projects. These newer membrane bioreactor sewage treatment systems are reported to be easier and cheaper to maintain and operate in northern climates and achieve better treatment levels than the rotary biological contactors. A flowsheet for the proposed Doris North

Membrane Bio-reactor STP is presented in Figure 7. The STP would come to site pre-constructed inside two 12m (40') long shipping containers. A plan view of this STP arrangement is presented in Figure 8. Cross-sectional plans for the two containers are presented in Figure 9 and 10, respectively.

A membrane bioreactor (MBR) combines one of the oldest and most mature wastewater treatment technologies with the very newest. It is an activated sludge treatment plant combined with an extremely effective clarifier. The basic operating theory behind membranes is conventional biological treatment combined with a semi-permeable barrier that precludes mixed liquor suspended solids (MLSS) from being discharged from the biological reactor. This semi-permeable barrier is generally an engineered plastic such as PVDF or PVC, perforated with innumerable tiny holes less than one micron in diameter – smaller than the size of the MLSS. Clear, treated liquid is drawn through the openings, either by gravity or by using a pump. Normally, such a semi-permeable barrier would plug immediately after being placed in the MLSS tank, but proper design prevents solids from accumulating on the membrane surface and "blinding" the holes. Generally speaking, there are two wastewater membrane configurations. Hollow-fibre designs resemble spaghetti strands with hollow centres. Flat-plate designs consist of plates with membrane fabric on each side. SaniBrane® designs are strictly flat-plate, which allows optimum air-scouring to keep the membrane surfaces clean.

At Snap Lake the SaniBrane Membrane Bioreactor sewage treatment plant is reported to be achieving BOD levels below the 5 mg/L detection level, less than 2 mg/L Total Suspended Solids and fecal coliform concentrations less than the 15 F.C./100 mL detection limit. In MHBL's opinion this change in sewage treatment plant technology is neutral from an environmental impact assessment point of view and does not significantly alter previous assessment predictions related to wastewater treatment at the Doris North Project.

As part of this change/modification all sewage sludge will now be filtered, bagged, dried and then incinerated on site rather than being pumped to the tailings containment area for co-disposal with the tailings. The treated grey water will still report to Tail Lake as previously planned. The volume of dried sludge to be incinerated is small and is not expected to have any significant impact on air quality emissions from on-site camp incinerator.

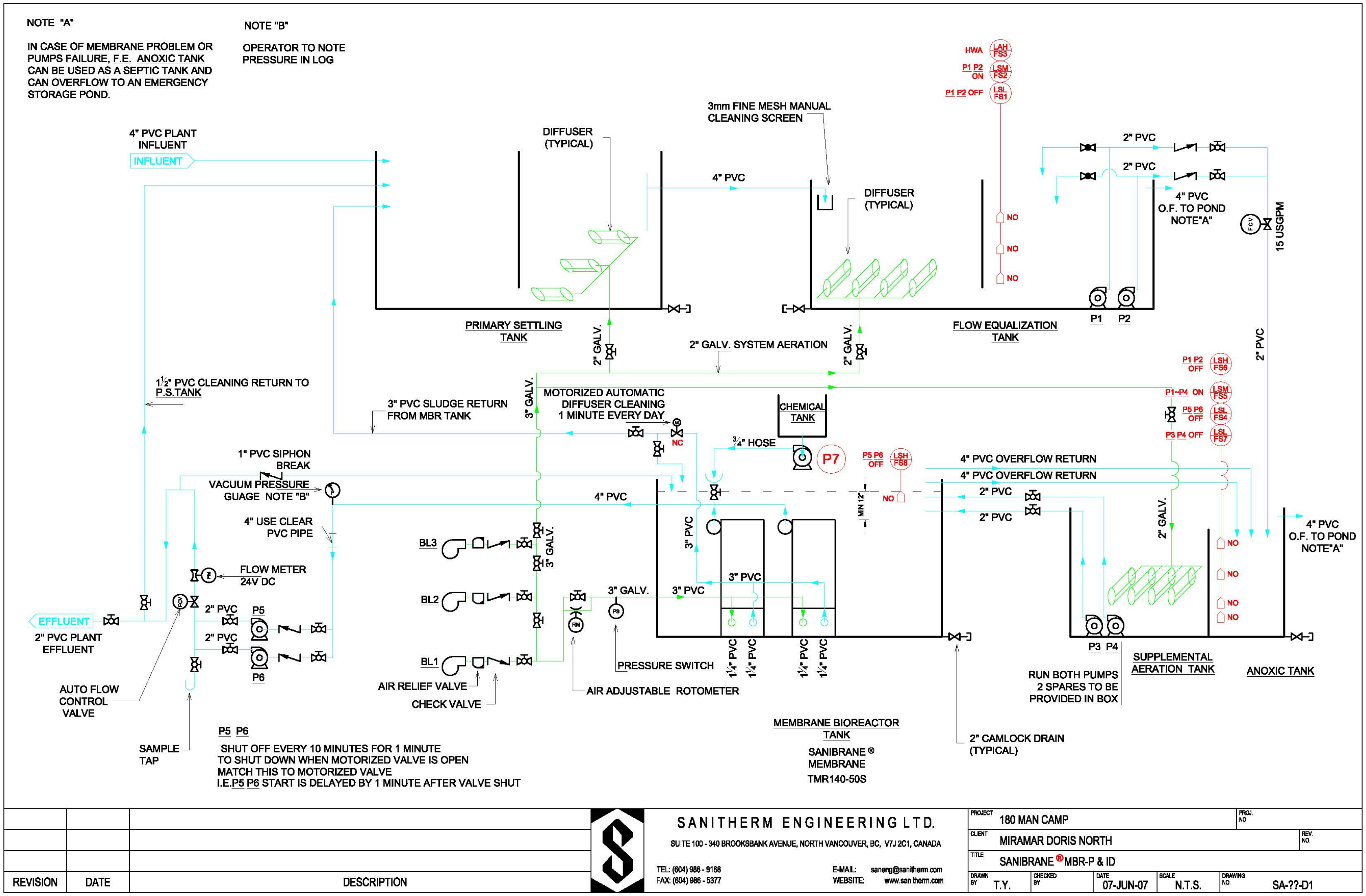


Figure 7: Sanibrane STP Flowsheet

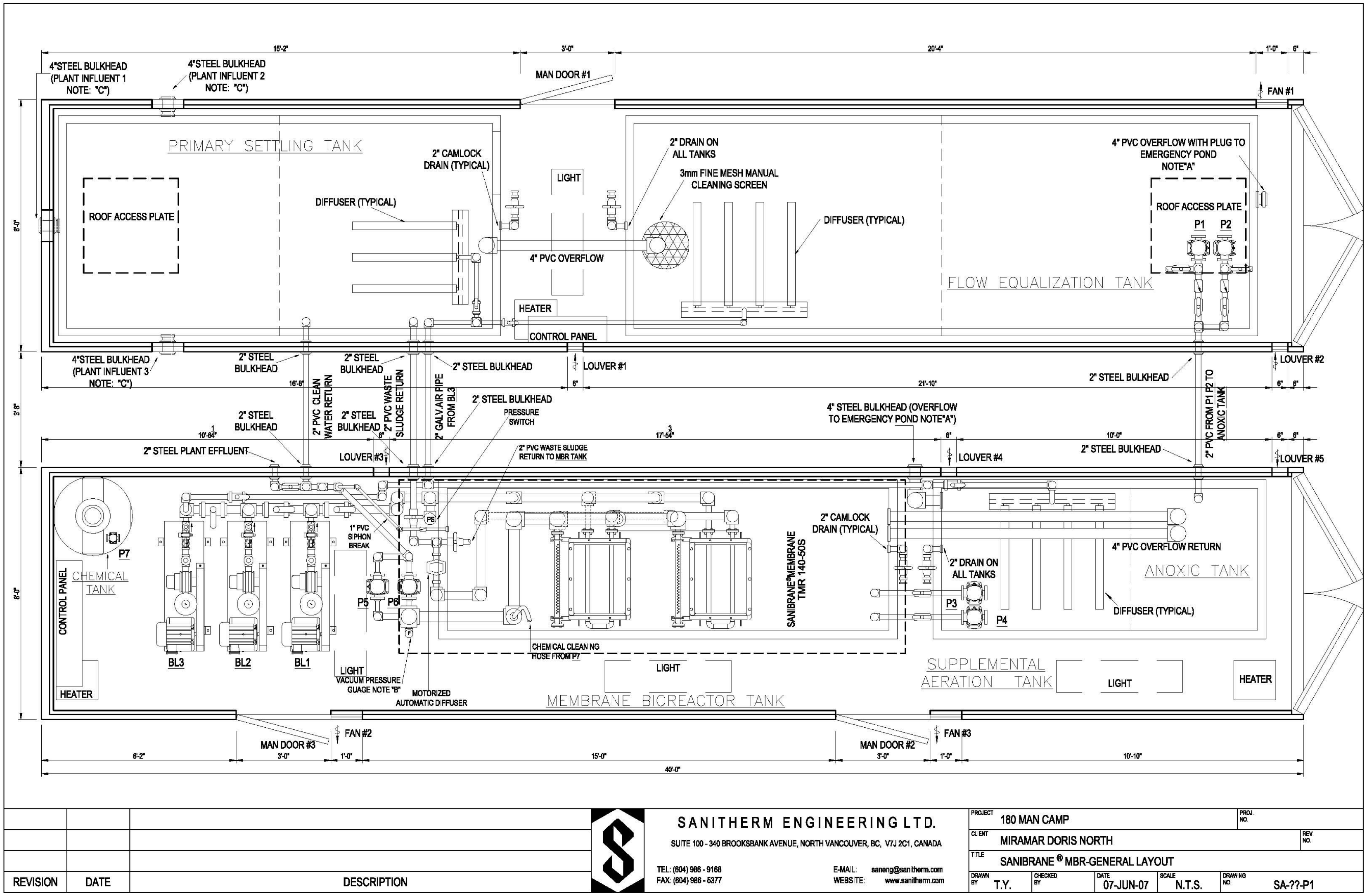


Figure 8: Sanibrane STP Plan View

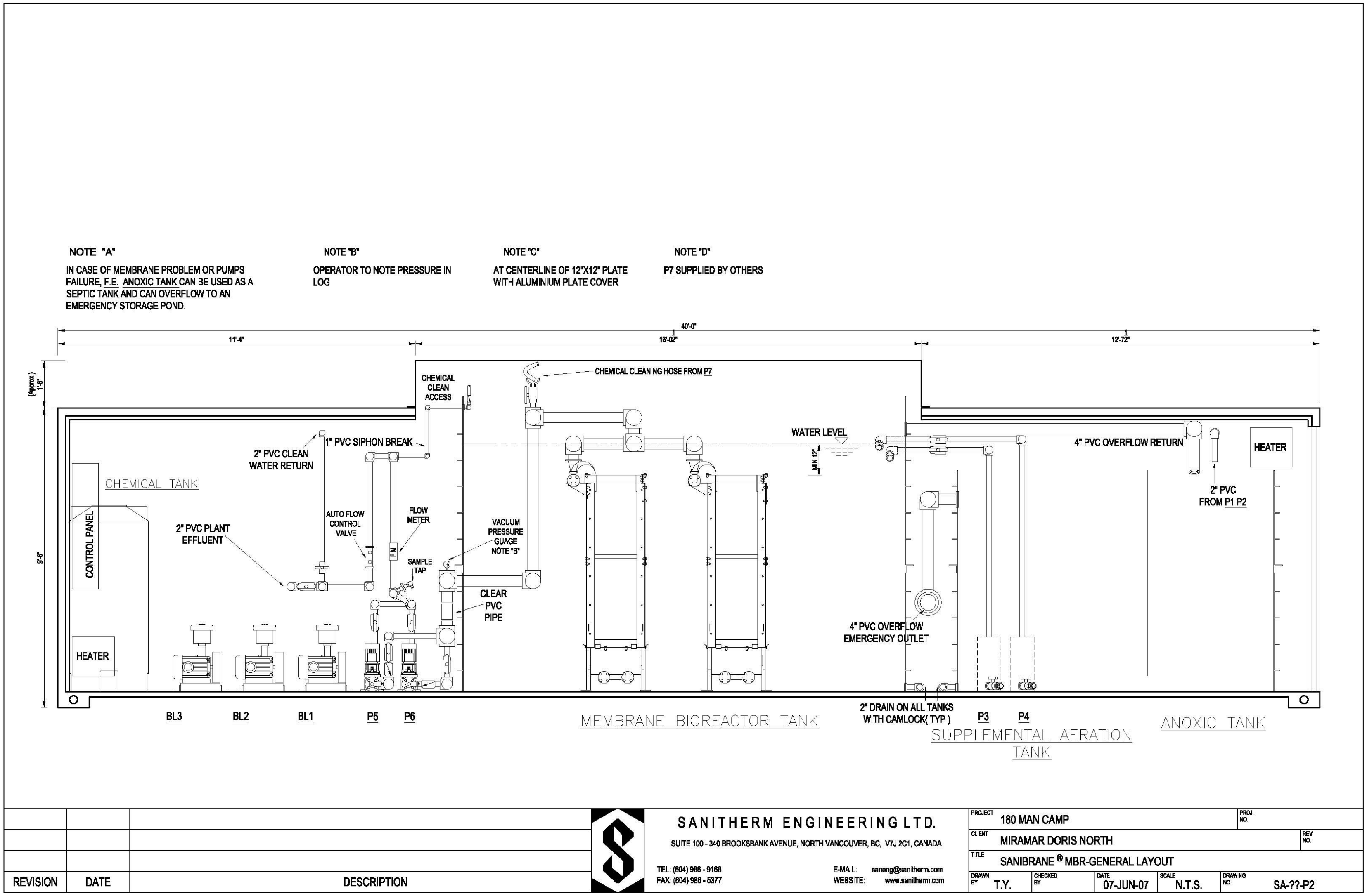


Figure 9: Sanibrane STP Cross Section

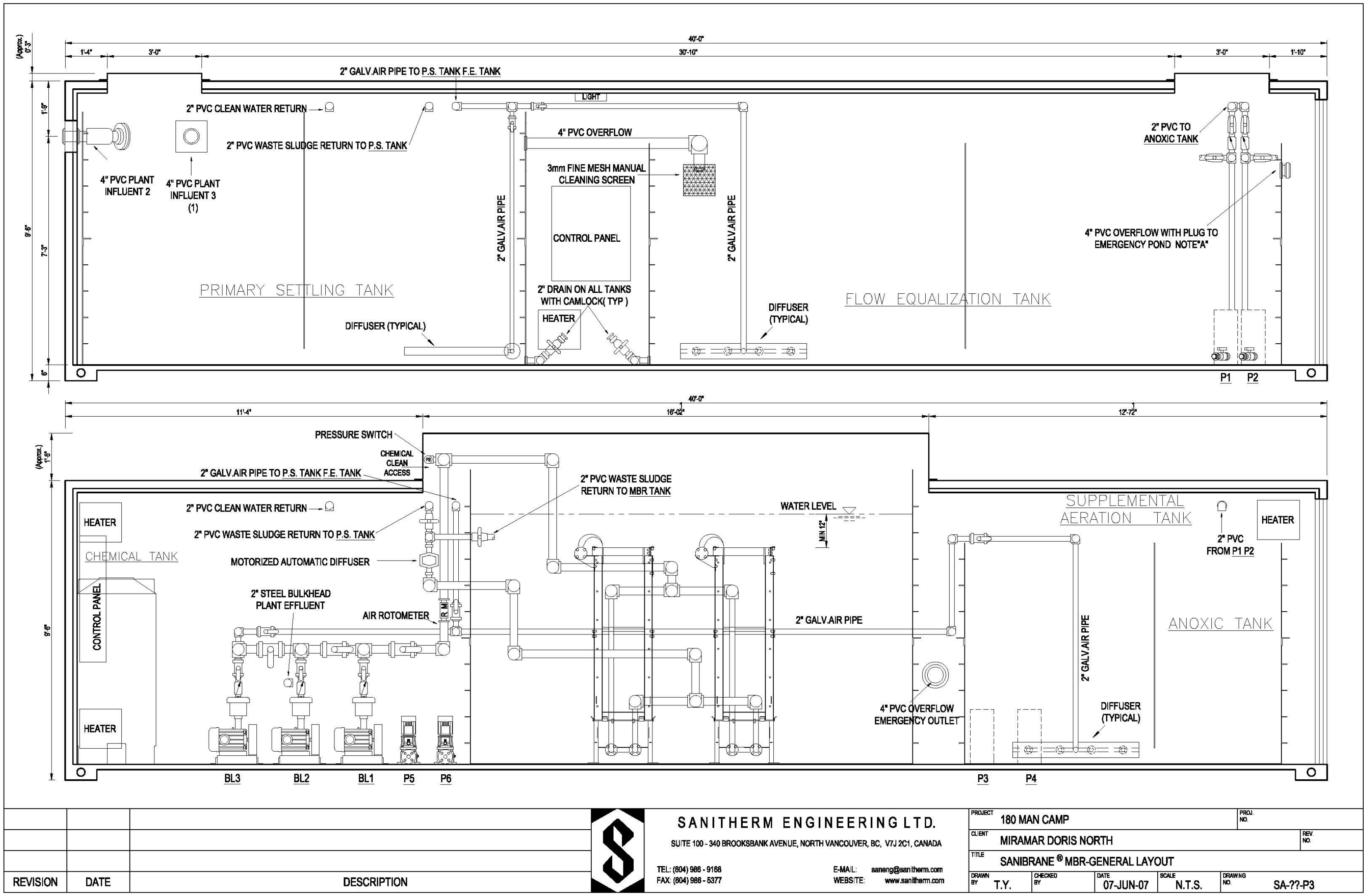


Figure 10: Sanibrane STP Cross Section

Sheet #2 – Information Requirements Relating to Revised Water License Application Review

Item #1 – Relationship of Mine Workings to Doris Lake Talik

A copy of the October 2005 SRK report entitled "Groundwater Assessment Doris North Project, Hope Bay, Nunavut, Canada" has been attached as Appendix C. This was originally included in the 2005 Final Environmental Impact Statement (FEIS) submitted to the NIRB in October of 2005. This report provides information on the location of the Doris North underground mine workings in relation to the Doris Lake talik. The Doris North deposit that is covered by the NIRB certificate and the current water license application is referred to in this report as the higher grade Doris Hinge Zone (see Figure 1) and does not include the Doris Connector and Doris Central ore zones.

Item #2 – Road Fill Thickness and Permafrost Effects from Rock Drains

The Doris North FEIS stipulated that roads and non-critical pads would be constructed using 1.5 m thick rock fill. Critical structures such as the airstrip and important foundations would be constructed on rock fill pads of at least 2.0 m thick. These thicknesses were based on thermal modeling that indicated that a pad thickness of at least 2.0 m was required to ensure that the active layer will remain in the rockfill pad and thus zero settlement would be expected. The 1.5 m thick roadways were expected to undergo some settlement, which would be managed through a regular maintenance program. Long-term permafrost degradation was not expected, especially since the roadway will not be removed from the tundra at closure.

MHBL wishes to reduce the amount of quarry rock to be used in construction and as a result has opted to limit the road and pad thickness of non critical structures to 1. 0 m and critical structures to 2.0 m. SRK carried out additional thermal analysis to illustrate what effect this reduced fill thickness would have on the permafrost and on the structures. The results of this thermal modeling are presented in the table below. The modeling clearly illustrates that using a freezing limit of -2^{o}C (assuming saline pore water), a pad thickness of 2.0 m will result in zero settlement, whilst a fill of 1.0 m will reduce the active layer thickness from 1.0 m (if no pad was constructed) to 0.6 m. This 0.6 m would be subject to settlement; however, since this falls within the original active layer the settlement is expected to be small and manageable through a process of normal maintenance management. In any effect, this is a negligible difference from that reported for the 1.5 m fill thickness in the FEIS.

Fill thickness (m)	Depth below grade -2 °C contour (m)	Distance from elev. 100m (m)	Distance from original active zone (m)		Depth below grade 0 °C contour (m)	Distance from elev. 100m (m)	Distance from original active zone (m)
No fill	**99.0**				**99.1**		
1	99.4	-0.6	0.4		99.7	-0.3	0.6
1.5	99.7	-0.3	0.7		100.0	0.0	0.9
2	100.0	0.0	1.0		100.4	0.4	1.3
2.5	100.2	0.2	1.2		100.7	0.7	1.6

The presence of the rock drains are not expected to affect the thermal performance of the road and/or pads in any way. If the rock drains do not function as planned and result in pooling MHBL will remove the problem rock drain and replace with a working culvert.

Item #3 – Project Construction Timeline – Gantt Chart

A copy of a GANTT chart is attached as Appendix D showing the current detailed construction timeline for the Doris North Project. This schedule is a "living document" and is subject to change as conditions vary in relation to equipment and material deliveries, permit and authorization completion dates and weather conditions. It does however provide a roadmap showing the planned sequence of site construction.

Item #4 – Schedule of Submission of Revised Management Plans

A copy of a GANTT Chart is attached that shows the proposed schedule for completion and submission of the next generation of revisions to the environmental management plans for the Doris North Project that were submitted with the May 2007 Water License Application support documentation. MHBL committed to update each of these plans during the approximately one year time period between the issue of the Water License and the start of milling operations (October 2008) so that the plans reflect the most recent information and site experience.

Doris North – Planned Schedule for Next Updates to Environmental Management Plans

ID	Task Name		Qtr 1, 2008			Qtr 2, 2008			Qtr 3, 2008			Qtr 4, 2008		
		Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Revise Emergency Response and Contingency Plan		January 1, 2008											
2	Revise Air Quality Management Plan									August 1, 2008				
3	Revise Noise Abatement Plan								July 1, 2008					
4	Revise Waste Rock Storage Plan					April 1, 2008								
5	Revise Hazardous Materials Management Plan							June 1, 2008						
6	Revise Explosives Management Plan			February 1, 2008										
7	Revise Landfill Management Plan						May 1, 2008							
8	Revise Landfarm Management Plan							June 1, 2008						
9	Revise Tailings Management Plan										September 1, 2008			
10	Revise Water Management Plan						May 1, 2008							
11	Revise Quality Assurance/Quality Control Plan				March 1, 2008									
12	Revise Mine Closure and Reclamation Plan											October 1, 2008		
13	Revise Monitoring and Follow-Up Plan				March 1, 2008									

Item #6 – Figure 3.6 in Main Text – Plant Site Drainage Pathways

Figure 3.6 "Water Flow Patterns at the Camp and Mill Pad Area (Including the Temporary Waste Rock and Ore Stockpiles)" in Section 3 (Page 167) of the April 2007 Revised Water License Application Support Document has been revised to show that all storm water and snowmelt drainage from the Ore Stockpile and the Temporary Waste Rock Stockpile are collected within the Pollution Control Pond and then pumped to Tail Lake via the mill tailings pump box. The revised Figure is attached to this addendum as Appendix E. This same figure appears as Figure 6.1 in the April 2007 Water Management Plan for the Doris North Project (SD S10j Page 23). Both figures should be replaced by the revised figure attached here as Appendix E. Through this revision MHBL is committing to collect all storm water and snowmelt from the ore and temporary waste rock stockpile areas as well as the crushing plant and mill yard areas and direct this water into the pollution control pond. SRK has confirmed that the pollution control pond as designed still has capacity to contain the 1:100 year storm event of 24 hour duration plus an additional freeboard of 0.3 m for this larger drainage area.

Item #7 – Construction Contractor Environmental Specification Insert

Appendix F contains a copy of the "Engineering Specification – Environmental Protection" dated May 07, 2007 that is to be included in all construction tender documents for the Doris North Project. This specification sets out the minimum environmental requirements governing each contractor's on-site performance and provides copies of all the relevant environmental management plans, applicable regulations and guidance documents on an attached CD ROM. This is intended to provide each potential site contractor with a clear understanding of the environmental constraints imposed on their potential activity at the Doris North Project should they decide to place a bid on available work packages.

Item #8 – Protocol for Landfilling Demolition Debris at Closure

Section 6.1.1 of the April 2007 Mine Closure and Reclamation Plan (SD S10l – page 81) is amended as follows to address landfilling of demolition debris at final closure:

At final closure MHBL proposes to dispose of all non-hazardous demolition debris in the operational phase landfill to be sited within Quarry 2. This site will be used for the disposal of all non-hazardous debris generated by the demolition of all non-salvageable equipment, buildings and other materials from the Doris North Project site.

Materials destined for burial in the demolition landfill will be dismantled as safely and efficiently as possible and stacked in a stockpile within the plant site area.

The materials will then be cut by flame, hydraulic shears or saw, into manageable sizes for safe transport and placement in the demolition landfill.

The demolition debris will be sorted into common types of material and then placed into landfill cells and compacted using a bulldozer. For example sheet steel from the external building walls will be separated from structural steel. The sheet steel will be placed together in the landfill and then compacted using a bulldozer to minimize the void space left in the landfill. Demolition debris is typically bulky in nature and thus segregation by debris type will help in effective use of the landfill space and aid in compaction. For example keeping structural steel together but separate from wall and roof panels will aid in compaction by preventing the non-compressible materials from intermixing with the compressible materials to minimize the void spaces left in the landfill pile. Compaction of the compressible debris will entail having the dozer compact demolition debris at frequent intervals (daily during periods of demolition) to compress the bulky material to maximize utilization of the landfill space.

Once all demolition activity is complete the dozer will be used to compact the landfill debris to the greatest extent possible and to shape the pile where practical prior to placement of the final landfill cover. The final cover will consist of quarried non-acid generating rock that will be set aside prior to the end of active mining operations for this purpose. The minimum depth of the proposed final cover will be 3 m, however additional quarried rock will be required to infill voids and indentations in the final cover. Consequently for planning purposes the following volumes of quarried rock will be set aside during the construction period (from Quarry 2) for the purpose of capping the landfill once demolition is complete:

Estimated volume required for infill and levelling of the landfill:	10,000 m^3
Estimated volume required for the 3 meter final cover:	30,000 m^3
Total estimated volume for landfill closure:	40,000 m^3

This assumes a 100 m by 100 m surface area with 2:1 (H:V) side slopes.

The objective is to ensure that large voids within the demolition debris are filled and that buried material will not protrude from the closed out landfill cap as a result of future frost heaving.

Item #9 – Estimated Volumes of Demolition Debris

The volume of demolition debris to be placed in the landfill at final closure is estimated at 40,000 m^3 which will result in a layer of approximately 3.5 m in height over a surface area of 100 m by 100 m.

Source of Demolition Debris	Estimated Tonnes	Estimated Truckloads	Estimated Volume (m3)
UG Mining Equipment (23 vehicles)	200	12	2,058
Surface Vehicles (21 vehicles)	200	12	2,058
Mill Building and Equipment	2,000	100	17,150
Maintenance Shop	800	40	6,860
Powerhouse	80	4	686
Camp and Offices (42 trailers)	480	24	4,116
Sewage Treatment Plant + Incinerator Units	20	1	172
Pumphouse	20	1	172
Boneyard Equipment	100	5	858
Reagent Storage Containers (20 containers)	200	10	1,715
Explosives Magazines (20 containers)	200	10	1,715
Fuel Tank Farm	100	5	858
Piping and Power Cables	20	1	172
Miscellaneous	20	10	1,715
Estimated Totals	**4,440**	**235**	**40,303**

MHBL would also like to use the Doris North Project landfill to dispose of the final non-hazardous non-salvageable demolition debris generated from the final reclamation of the Windy and Boston exploration camps once these facilities are no longer required. MHBL estimates that the additional volume of non-hazardous waste generated from the reclamation of these two sites at 8,500 m^3.

Boston Exploration Camp	50	5,000
Windy Exploration Camp (including Patch Lake)	40	3,500

The Doris North landfill has capacity to accommodate this additional 8,500 m^3 of non-hazardous waste. This would ensure that all of the non-hazardous demolition waste is maintained in one common area facilitating post closure monitoring. MHBL requests that the NWB include authorization for this activity within the Doris North Water License.

Item #10 – Estimate of Landfill Cap Volume Requirements

The estimated volume of quarried rock to be set aside during the construction period (from Quarry 2) for the purpose of capping the landfill once demolition is complete is 40,000 m^3 as follows:

Estimated volume required for infill and levelling of the landfill: 10,000 m^3
Estimated volume required for the 3 m final cover: 30,000 m^3
Total estimated volume for landfill closure: 40,000 m^3

This assumes a 100 m by 100 m surface area with 2:1 (H:V) side slopes

Item #11 – Use of Oil Adsorbents in Landfarm Sump

Section 4.3 and 4.5 of the April 2007 Landfarm Management Plan (SD S10h – pages 11 and 13) will be amended to incorporate the following water management procedures:

The landfarm design incorporates a separate area of approximately 12.5 m^2 for the temporary storage of hydrocarbon contaminated snow over the winter months. In the spring the snow will melt and drain through the internal berm to report to the landfarm sump. This internal berm will not be lined and thus it will be sufficiently porous enough to allow the snowmelt water to drain to the landfarm pollution sump.

Contaminated snow may contain high concentrations of petroleum hydrocarbons and, therefore, free phase petroleum hydrocarbons may be observed during the spring melt of this snow. Free phase petroleum product could cause heavy loading in the sump discharge adsorption treatment system, causing filters and absorbent materials to become inefficient/ineffective (spent) sooner than expected. To avoid this, adsorbent pads will be placed on the top of the sump during the spring melt and renewed as needed to remove this free phase petroleum hydrocarbon before the sump water is treated through the adsorbent treatment discharge system. The adsorbent pads will be collected after use, placed in drums, labeled as hazardous waste and then shipped off site for disposal/treatment at a licensed disposal site.

After the visible free phase petroleum hydrocarbon has been removed from the surface of the landfarm sump using adsorbent pads, the water collected in the landfarm sump will be pumped to a portable head tank and then treated through an F1 “Flow and Plug” Oil Adsorption System (Model F11-C-180-TM-Cx2 as supplied by Terry Ruddy Sales of Edmonton Alberta). The water will be drawn from several inches below surface to avoid entraining any residual free phase petroleum hydrocarbon floating on the sump surface.

This adsorption treatment system is a portable unit set up on standard pallets so that they can be moved to the landfarm facility as and when needed. The system consists of a self priming electric positive displacement pump, a particulate filter, a drum containing TM-100 oil adsorbing media and two activated carbon media containers connected in series. The unit operates at 20 to 30 lpm (5 to 7 gpm). The unit is designed so that the TM-100 oil adsorbing media will blind off when it reaches its absorbent capacity. The unit will be moved into location soon after the spring snowmelt so that the landfarm can be drained of standing water to prevent saturation of the contained soil undergoing remediation. The unit will then be moved back into the landfarm whenever the sump fills to keep the soils unsaturated.

Item #12 – Disposal of Incinerator Ash

Section 4.1 (page 9) of the April 2007 Landfarm Management Plan (SD S10h) and Section 2.4.11 (page 109) of the Revised Water License Support Document is amended to reflect the following change in the planned management of ash from the kitchen waste incinerator:

Organic garbage from the camp kitchen and dormitory areas will be burned in a purpose built incinerator to limit the potential for food wastes to attract wildlife. MHBL intends to take the ash from the kitchen incinerator, place it into drums and then mix it into the filtered cyanide leach residue (after cyanide destruction), which will then be trucked into the underground mine to be placed as backfill. In this manner the ash will be stored within the permafrost where it cannot come into contact with water, thus preventing the release of any soluble contaminants from this ash into the surrounding receiving waters. During the mine life, any water coming from the backfilled stopes will be collected and transferred to Tail Lake via the mill. However it is expected that this filtered backfill will freeze within days of being placed underground and then no longer come into contact with water. It is estimated that approximately 5 m^3 per year of incinerator ash will be blended with the filtered cyanide leach residue each year.

This procedure will be transferred from the Landfarm Management Plan into the Hazardous Materials Management Plan when these plans are next updated (in 2008).

Item #13 – Removal of Doris Lake Floating Dock Bollards

Section 6.1.5.5 (page 92) of the April 2007 Mine Closure and Reclamation Plan (SD S10l) is amended to reflect MHBL's commitment to completely remove the permanent bollards used to anchor the floating float plane dock on Doris Lake at closure.

The floating boat and float plane dock on Doris Lake will be removed. The wood pontoon structures will be removed and disposed of in the site landfill. The mooring bollards used to anchor the floating dock in place will be removed from the lake bottom and disposed of in the landfill. A 0.1 metre of clean rockfill will be paced over the holes left in the bottom of the lake after removal of these bollards. The rock fill approach ramp and laydown area will be reclaimed in the same manner as the site roads. Prior to final grading, all anchor points, attached cables, wood cribbing, *etc.* will be removed.

Item #14 – Baseline Information on pH of Tundra Standing Water

The following information on the pH of standing water on the tundra was collected by Golder Associates for MHBL on June 22nd and 23rd, 2007. The pH measurements were taken using a calibrated field pH meter from pools of standing water from sites around the Doris North Project site to provide a baseline of pH values prior to the start of construction.

Tag	Location	Date	pH
Site 1	East of Patch outflow, west of P.O. Lake	22-Jun	5.37
Site 2	East of Patch Lake, west of P.O. connector	22-Jun	6.09
Site 3	N.E. of Patch Lake on ridge, west of Ogama inflow	22-Jun	6.17
Site 4	North of Patch Lake, west of Doris Lake	22-Jun	6.51
Site 5	North of Windy Lake, south of Glenn Lake	22-Jun	6.72
Site 6	N.E. of Windy Lake, south of Glenn	22-Jun	6.76
pH01	S.E. of Doris falls	23-Jun	6.67
pH02	S.E. of Doris falls	23-Jun	7.11
pH03	S.E. of Doris falls	23-Jun	7.69
pH04	200 m north of Quarry 1 on peninsula	23-Jun	7.56
pH05	20 m S.E. of Quarry 1	23-Jun	7.30
pH06	300 m S.E. of Quarry 1	23-Jun	6.98
pH07	300 m N.E. of Little Roberts Lake	23-Jun	6.64
pH08	400 m S.E. of Quarry 1	23-Jun	6.13

Item #15 – Internal Monitoring of Cyanide Bleed Solution

In the April 2007 Water License Application re-submission, MHBL proposed a Surveillance Network Program for the Doris North Water License that included a monitoring point to measure the quality of water being sent into the Tailings Impoundment Area (TIA) from the mill. This SNP point will monitor the combined mill tailings stream so that any adverse water quality trends in the water discharged with the tailings into the TIA can be caught and mitigation measures taken. In addition to the SNP points to be set by the NWB in the water license, MHBL will sample and measure parameters in the barren bleed solution and at a number of points within the milling process to facilitate daily metallurgical balance calculations that will be needed to optimize the gold recovery process. Typically these internal monitoring points are intended for internal control of the milling process and are not part of the SNP. As part of these internal monitoring points, MHBL will be sampling the barren bleed solution on a daily basis to establish the amount of gold lost through this stream and to control and optimize the operation of the cyanide destruction process. MHBL believes that these are internal control points and should not be included in the water license SNP, since these samples are not of effluent that will be discharged into the environment.

Item #16 – Discharge Standards for Sewage Discharge During Construction

MHBL proposes that the water license contain the following discharge standard for the treated grey water discharged onto the tundra from the sewage treatment plant during the construction phase:

	Maximum Average Concentration
Total Suspended Solids	100 mg/L
BOD_5	80 mg/L
Faecal Coliform	10,000 CFU/100 ml
Oil and Grease	No Visible Sheen
pH	Between 6.0 and 9.5
Estimated volume of discharge	69 m^3/day.

This is the same discharge standard previously set by the Nunavut Water Board for the Boston Exploration camp in Water License NWB1BOS0106.

After the mill commences operation there will no longer be any separate discharge from this sewage treatment plant as all treated greywater will then be co-disposed in Tail Lake with the mill tailings.

The attached Figure 11 shows the general location of the proposed discharge point for treated greywater from the sewage treatment plant onto the tundra during the construction phase. The discharge point will be armoured with riprap (~300 mm sized rock) to prevent erosion of the tundra (see Drawing G-05 in SD S4 for Riprap gradation specifications).

During the construction phase, the treated greywater will be sampled at the sewage treatment plant discharge pump box feeding the land application discharge piping. This would be the water license compliance point (essentially the end-of-pipe). Additional monitoring relating to sewage treatment during the construction phase will include:

- Daily visual monitoring of the land application point to ensure that erosion protection is working and that the outflow is not causing erosive damage;

- Monthly monitoring of water quality in Doris Lake near the freshwater intake to verify that treated sewage is not reaching Doris Lake.

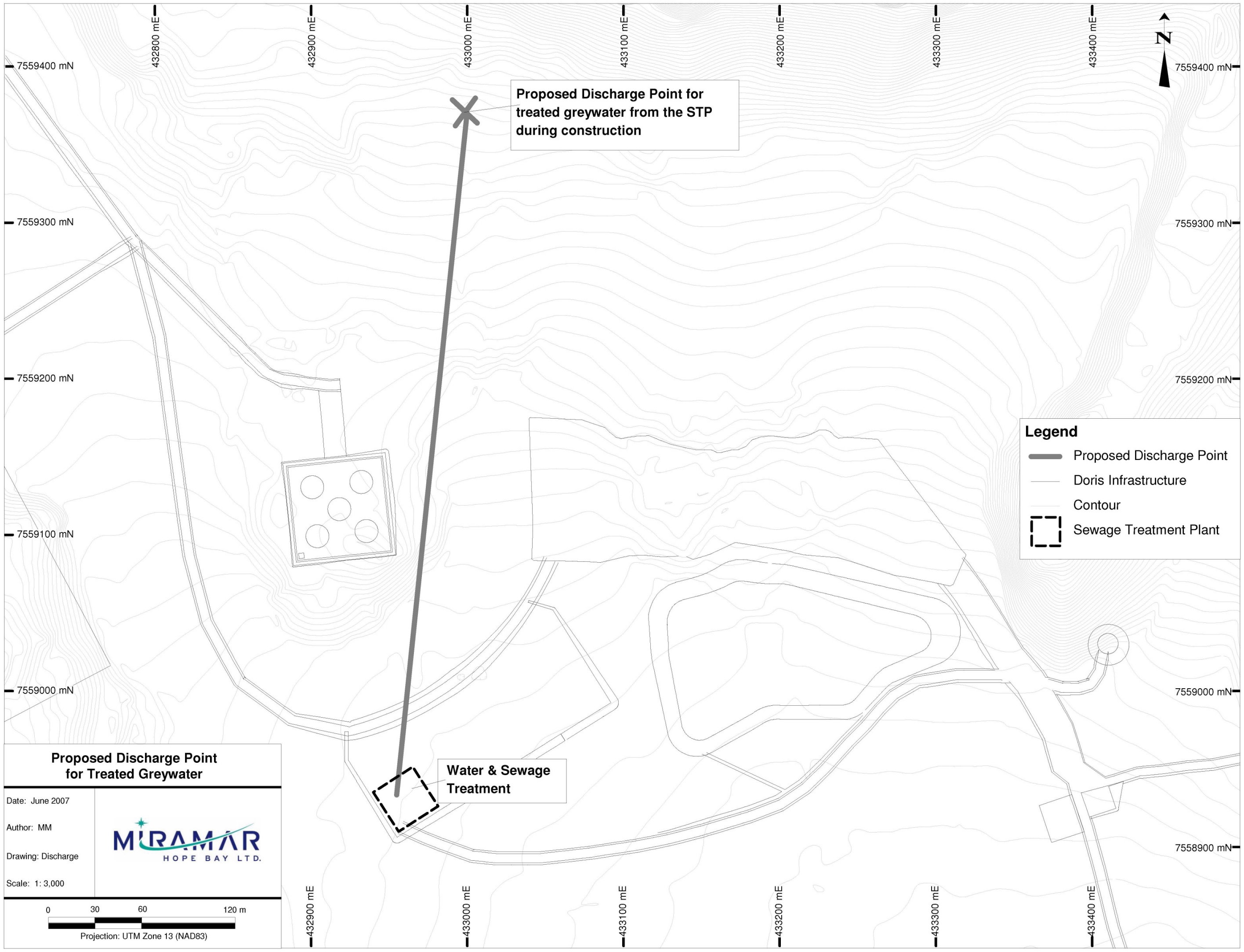


Figure 11: Proposed Discharge Point for Treated Greywater

Item #17 – Effects of Water Withdrawal on Doris Lake Level

A copy of the Golder 2005 report entitled "Doris Lake Water Level Effects Analysis" is attached as Appendix G to this addendum. This report was submitted to NIRB as a supporting document to the FEIS in October of 2005 and specifically addresses the potential effects on water levels in Doris Lake from the planned water use withdrawals from the lake for the Doris North Project. A water balance showing the proposed fresh water withdrawals is incorporated in this analysis. There have been no changes in the planned rate of fresh water use for the Doris North Project since this report was completed.

Item #18 – Revise Table 6.4 to show MMER allowable pH Range

Table 6.4 in the April 2007 Revised Water License Application Support Document and Table 5.3 in the Monitoring and Follow-up Plan has been revised to include the pH range and the non-acutely lethality as required for meeting MMER requirements.

Table 6.4: End-of-Pipe Discharge Standard for all discharges from Tail Lake

Parameters	Units	Maximum Authorized Monthly Mean	Maximum Average Allowable Concentration at the Tail Lake Discharge End-of-Pipe	Maximum Allowable Concentration in a Grab Sample at the Tail Lake Discharge End-of-Pipe
pH	s.u.	6.0 to 9.5	6.0 to 9.5	6.0 to 9.5
Arsenic	mg/L	0.5	0.75	1.0
Copper	mg/L	0.3	0.45	0.6
Cyanide	mg/L	1.0	1.5	2.0
Lead	mg/L	0.2	0.3	0.4
Nickel	mg/L	0.5	0.75	1.0
Zinc	mg/L	0.5	0.75	1.0
Total Suspended Solids	mg/L	15	22.5	30
Radium 226	Bq/L	0.37	0.74	1.11
Non-acutely lethal	%	100	100	100

Notes: All concentrations are total values

Non-acutely lethal means survival of at least 50% of rainbow trout subjected to 100% concentration effluent for a period of 96 hours.

Item #19 – Provide Errata Correcting Conversion Factor for Ammonia

Table 6.5 in the April 2007 Revised Water License Application Support Document and Table 5.2 in the Monitoring and Follow-up Plan has been corrected to reflect the total ammonia-N concentration. (Previously the value for ammonia was incorrectly shown. Note however that the table referenced in the footnote is reproduced from the CCME guidelines which show ammonia concentrations).

Table 6.5: Proposed WQ Standard in Doris Creek at SNP Point below the waterfall

Parameter	Units	MMER Criteria	CCME Guidelines	Average Allowable Concentration at the SNP Point in the Doris Outflow Creek below the waterfall whenever water is being discharged from Tail Lake
pH			6 to 9	6 to 9
TSS	mg/L	15		15
Free CN	mg/L		0.0050	0.01
Total CN	mg/L	1		0.01
Total Ammonia-N[1,3,4]	mg/L		1.27[1]	1.27[1]
Nitrate	mg/L		2.9	2.9
Nitrite	mg/L		0.02	0.05
Total Metals				
Aluminium Al	mg/L		0.10	0.10
Arsenic As	mg/L	0.5	0.005	0.01
Cadmium Cd	mg/L		0.000038	0.000038
Chromium Cr	mg/L		0.0010	0.0010
Copper Cu	mg/L	0.3	0.0020 to 0.0040[2]	0.00
Iron Fe	mg/L		0.30	0.30
Lead Pb	mg/L	0.2	0.0020	0.002
Mercury Hg	mg/L		0.00010	0.00010
Molybdenum Mo	mg/L		0.073	0.073
Nickel Ni	mg/L	0.5	0.025	0.025
Selenium - Se	mg/L		0.0010	0.0010
Zinc Zn	mg/L	0.5	0.030	0.03

Notes:

1) At pH 7.5 and 20 °C; Total ammonia concentration discharge standard to vary with pH and temperature as per the table below

2) The Guideline is for Chromium (VI) and not for total chromium

3) Ammonia, Nitrate and Nitrite in units of nitrogen equivalency

4) Where CCME guideline is dependent on other water quality values the mean values of these parameters were used to calculate the guideline for the Doris North Project

Ammonia Concentration Guidelines (CCME for the protection of Freshwater Aquatic Life)

Temp (°C)	pH							
	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5
0	231	73.0	23.1	7.32	2.33	0.749	0.250	0.042
5	153	48.3	15.3	4.84	1.54	0.502	0.172	0.034
10	102	32.4	10.3	3.26	1.04	0.343	0.121	0.029
15	69.7	22.0	6.98	2.22	0.715	0.239	0.089	0.026
20	48.0	15.2	4.82	1.54	0.499	0.171	0.067	0.024
25	33.5	10.6	3.37	1.08	0.354	0.125	0.053	0.022
30	23.7	7.50	2.39	0.767	0.256	0.094	0.043	0.021

All reported total ammonia concentrations are reported in mg/L NH_3; measurements of total ammonia in the aquatic environment are often also expressed as mg/L total ammonia-N. The present guideline values (mg/L NH_3) can be converted to mg/L total ammonia-N by multiplying the corresponding guideline value by 0.8

Item #20 – NNLP for Jetty – Revision of Table 18 and Proposed Monitoring

The re-calculated aerial extent of the jetty infill at the ordinary high water mark taking into consideration settling is 0.1584 ha. The following is the information requested with regards to the jetty footprint (updated from October 2005 NNLP to reflect construction timing):

"No Net Loss" summary of fish habitat within the proposed jetty footprint - Doris North Project

Activity	Waterbody	Fish Species Present	Habitat Quality[1]	Description/Compensation	Area of Habitat Affected (ha)	Habitat Gain by Compensation (ha)	Net Gain in Fish Habitat (ha)
Jetty	Roberts Bay	Marine and Freshwater spp.	Good	Jetty: 103 m length; primarily 6 m width; 3:1 final side-slopes after settling Rock spurs (jetty): 8 spurs; each 5 m x 15 m Rock side slopes along jetty: 2168 m^2 below HWL Rock spurs (shoreline): 6 spurs, each 5 m x 20 m	0.1584 Based on HWL at 3:1 final slope	0.3368	+0.1784

[1] Habitat quality ratings based on Rescan (2001).
Area values provided by SRK, June 2008

Fisheries compensation for loss of fish habitat associated with the footprint of the jetty will include the provision of additional reef habitat through the construction of under-water rock spurs perpendicular to the jetty and rock spurs along the shoreline at several locations along Roberts Bay. The key measures of enhancement success will be the establishment of primary and secondary productivity on the enhancement structures (i.e., which provide food source for fish), as well as the documentation of the use of the structures as rearing and feeding habitat for fish.

The follow-up study design will be based on a Control/Impact design similar to that described above for monitoring enhancement structures in Doris Lake. Fish sampling methods would include snorkeling, minnow traps and other trapping methods, and possible use of underwater video and hydro acoustic gear to monitor fish presence along the enhanced and reference sites. This monitoring will be conducted beginning the summer following the year of mine construction (i.e., monitoring in summer of 2008 and in Year-2 of operation (summer of 2010 and in Year-2 of active post-closure (i.e., year prior to jetty lowering to 1 m below the average water level).

Item #21 – NNLP - Roberts Lake Outflow Fish Passage Implementation Update

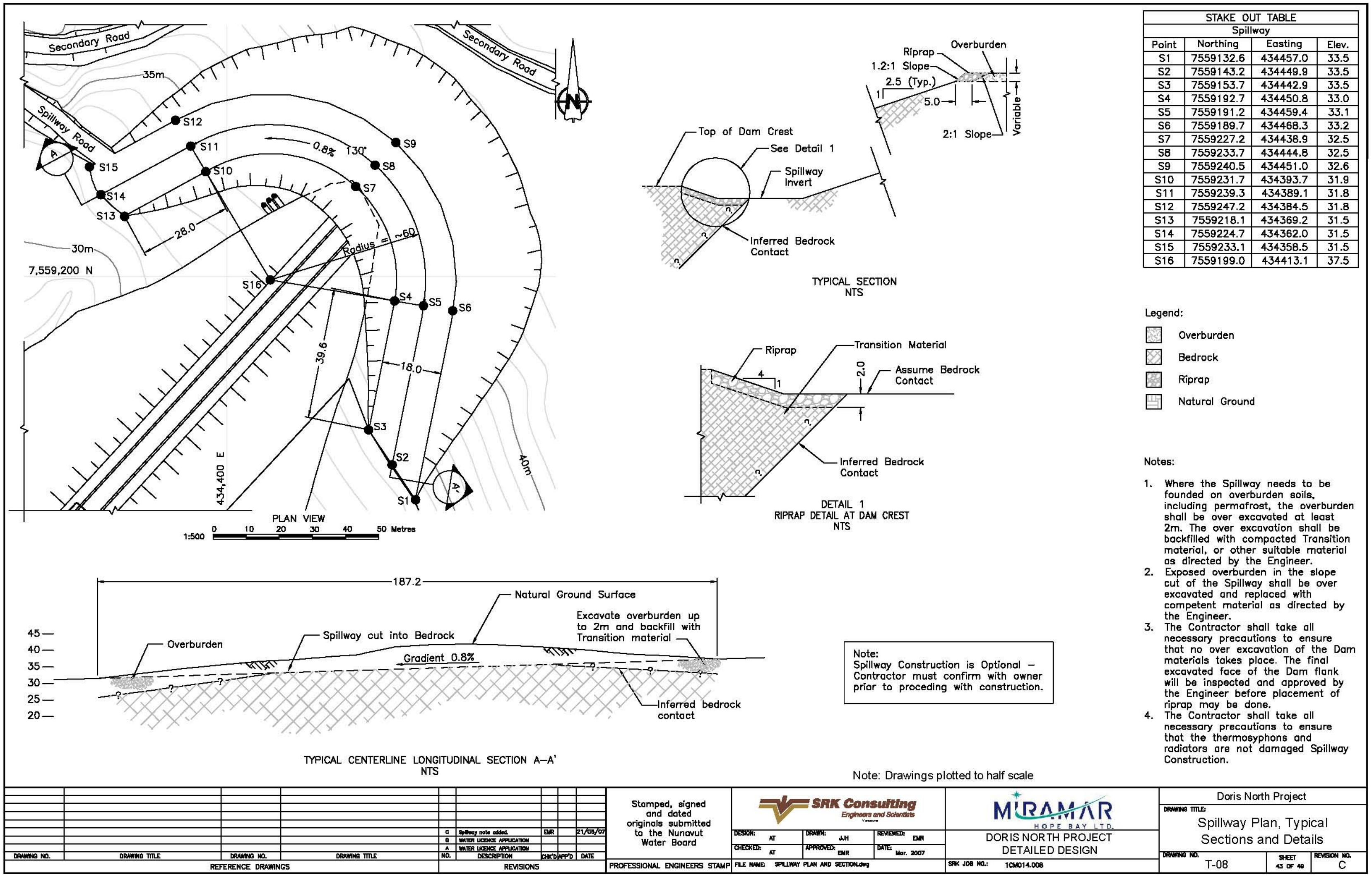
MHBL and its consultants have been in discussion with DFO over the methodology to be employed to complete the fish passage through the boulder garden at the outflow from Roberts Lake as part of the No Net Loss Fish Compensation Plan for Tail Lake that has been approved in principle by DFO. This construction activity will be completed using small hand tools and methods that can be serviced by helicopter or float plane. It is not planned to use heavy equipment for this activity nor construct permanent road access. MHBL has committed to DFO to develop a detailed construction plan in the summer of 2007 (following the July site visit for Nathan Schmidt) to describe the construction method, specific boulders to be broken and moved, and deposition locations for the broken boulders. It is anticipated that some boulder fragments will be left in the fish way to provide roughness while eliminating blockages due to interstitial flow during low flows. The remainder of the rock will be deposited in the downstream channel to provide in-stream cover. The plan will include an assessment of the anticipated disturbance caused by methods used to break the boulders. If blasting is required at the Robert's Lake outflow, it will be carried out in accordance with DFO Blasting Guidelines and if the guideline cannot be met, a Fisheries Act Section 32 Authorization will be obtained.

Item #22 – NNLP – Roberts Lake Tributary Enhancement Implementation Update

MHBL and its consultants have been in discussion with DFO over the methodology to be employed to enhance fish habitat in Tributary E14 to Roberts Lake. The intent is to hand excavate and shape access on an appropriate section on this or an adjacent tributary to provide access to additional in-stream pool habitat. Before finalizing the design, an additional site reconnaissance and detailed survey of the Roberts Lake tributaries will be undertaken during a field visit scheduled for July 9 - 14. These will provide the basis for detailed design drawings that will be prepared to support applications for a Fisheries Act Section 35(2) Authorization for this specific compensation measure. These design drawings will be submitted to DFO and the Water Board by 15 September 2007.

Item # 23 – MHBL to Add Note to Drawing and Specification to Clearly Indicate that Spillway Construction at North Dam is a Contingency Measure

A note has been added to SRK Drawing T-08 (Spillway Plan, Typical Sections and Details) to indicate that the spillway is an optional construction item at this point and is not needed until Tail Lake approaches the Full Supply Level. A copy of this revised drawing is added here as Figure 12.



STAKE OUT TABLE Spillway			
Point	Northing	Easting	Elev.
S1	7559132.6	434457.0	33.5
S2	7559143.2	434449.9	33.5
S3	7559153.7	434442.9	33.5
S4	7559192.7	434450.8	33.0
S5	7559191.2	434459.4	33.1
S6	7559189.7	434468.3	33.2
S7	7559227.2	434438.9	32.5
S8	7559233.7	434444.8	32.5
S9	7559240.5	434451.0	32.6
S10	7559231.7	434393.7	31.9
S11	7559239.3	434389.1	31.8
S12	7559247.2	434384.5	31.8
S13	7559218.1	434369.2	31.5
S14	7559224.7	434362.0	31.5
S15	7559233.1	434358.5	31.5
S16	7559199.0	434413.1	37.5

Figure 12: Spillway Plan and Section

Item #24 – MHBL to Provide Supplemental Design Info on Dam & Freeboard in the Form of a Table

The following table was created by SRK to provide the design information for the Doris North Tailings Containment Area dams and freeboard in a single reference table:

Doris North Project				
Tailings Containment Area - Dam Design Freeboard Criteria				
Design Criteria	**North Dam**	**South Dam**	**Rationale**	**Reference[1]**
Crest Elevation	37.5 m	38.0 m	This is the final maximum crest height immediately after dam construction.	Section 5.4.1 & 5.4.2, Pages 17 & 18.
Thermal Freeboard Thickness	2.5 m	2.5 m	This is the amount of rock fill covering the frozen core which acts as a thermal blanked to protect the core from ambient effects.	Section 5.4.1 & 5.4.2, Pages 17 & 18.
Frozen Core and GCL Termination Elevation	35.0 m	35.5 m	This is the final height of the frozen core, as well as the height at which the GCL is terminated immediately after dam construction. The frozen core is the primary water retaining feature of the dam, and the GCL is the secondary water retaining measure. The dam is impervious u to this elevation.	Section 5.4.1 & 5.4.2, Pages 17 & 18.
Thickness of Overbuild Adopted to Allow for Settlement	0.5 m	1.0 m	This is an allowance for settlement which has been built into the dam design to compensate any settlement that may occur.	App B, Page ii
Estimated Time in Which Overbuild Settlement Allowance will Occur	7 yr	9 yr	Based on the predicted crest settlement rates as a result of creep deformation, this is the amount of time that it would take the dam to settle as much as the overbuild allowance. This timeframe was based on the actual expected life of the North Dam prior to breaching.	App B, Figure 24
Maximum Extreme Steady State Water Elevation	34.5 m	34.5 m	This is the height of the frozen core and the GCL assuming all the estimated settlement has taken place.	Calculated
Minimum Required Hydraulic Freeboard Height	0.5 m	0.5 m	This is the minimum total hydraulic freeboard required to ensure safe operation of the dam, and consist of the sum of the flood height and the wave run-up height.	Section 3.2.4 & 3.2.5, Page 9 & App. E.
Flood Height Over Spillway	0.2 m	0.2 m	This is the maximum height of flow over the spillway when in full flood conditions.	Section 3.2.5, Page 9
Wave Run-up Height	0.3 m	0.3 m	This is the maximum wave run-up height.	App. E
Adopted Final Hydraulic Freeboard Height	1.0 m	1.0 m	Best Practice guidelines for embankment dams suggest that the minimum hydraulic freeboard should be at least 1.0 m. This value was adopted; however, this does constitute a 2x safety factor over what is actually required.	Section 3.2.4, Page 9
Full Supply Level (FSL) & Spillway Invert Level	33.5 m	33.5 m	This is the maximum height of water in the dam before the spillway comes into operation.	Section 3.2.3, Page 9
Maximum Operating Water Level	33.7 m	33.7 m	This is the maximum height of water in the dam when the spillway is in full flood.	Calculated
Minimum Design Freeboard Height	0.8 m	0.8 m	Difference between top of core after settlement allowance and spillway under full flood conditions.	Calculated
Normal Design Freeboard Height	1.5 m	2.0 m	Difference between top of core without settlement allowance and spillway invert elevation.	Calculated
Maximum Design Freeboard Height	4.0 m	4.5 m	Difference between the dam crest and the spillway invert elevation.	Calculated
1. SRK Consulting (Canada) Inc. 2007. design of the Tailings Containment Area, Doris North Project, Hope Bay, Nunavut, Canada. Report submitted to Miramar Hope Bay Limited. March 2007. SUPPORTING DOCUMENT S1 to the NWB Application.				

Item # 25 – MHBL to Collect Additional Geotechnical Information during Construction

During construction MHBL will arrange for the collection of undisturbed samples of the foundation soils at both the North and South Dam locations. These samples will be appropriately preserved and sent to a qualified laboratory for confirmation testing of various deformation parameters, including thaw consolidation, creep tests at appropriate strain rates and temperatures, shear strength and triaxial compression. The testing results will be submitted to the NWB as part of the as-built information, provided the testing can be completed in the allotted time allowed by the NWB. If not a follow-up report will be submitted to the NWB when the testing has been completed.

Item #26 – MHBL to Provide Daily Inspection of Tail Lake Shoreline and Deploy Silt Curtains when Erosion Plumes Noted

The Shoreline Adaptive Management Plan calls for daily inspections of the shoreline to identify early signs of shoreline erosion. One of the triggers that will be used to actually identify that shoreline erosion is occurring is a visual observation of suspended matter in Tail Lake (and not a quantitative TSS measurement); i.e. visual monitoring along the shoreline of the lake for sediment clouds within the lake. Whenever significant sediment is observed, MHBL operational staff will immediately deploy a silt curtain around the area affected to contain the silt plume and implement the shoreline erosion mitigation measures as stipulated in the Shoreline Adaptive Management Plan.

Item #27 – MHBL to Provide More Detail on Design & Implementation on Shoreline Adaptive Management for Tail Lake

MHBL acknowledges that the proposed 0.5 m rock cover may not in all cases provide complete and adequate control against shoreline erosion. MHBL is however committed in accordance with their Shoreline Adaptive Management Plan to monitor and address all incidents of shoreline erosion on a case specific basis. Furthermore, in accordance with the Shoreline Adaptive Management Plan MHBL will involve the services of a suitably qualified geotechnical engineer to assist in the design of appropriate remediation measures for every incident.

Item #28 – Commitment that Shoreline Adaptive Management Plan Would Apply when Tail Lake Rises Above 29.2 m

MHBL confirms that the Shoreline Adaptive Management Plan is not limited to a water level of 29.2 m. If the water level in Tail Lake rises above this elevation the same principles still apply.

Item #29 – MHBL to Provide More Detail Information on Tail Lake Discharge Point at Top of Water Fall

MHBL has arranged for the project's consulting hydrologist and geotechnical engineer to visit the Doris North site in mid July. During that period the two consultants will inspect and photo document the waterfall in Doris Creek and select a suitable upstream discharge point and a downstream SNP monitoring point for use in monitoring water license compliance. Stream cross-sectional data at these two points will be collected at the same time. The following photos are provided to aid in visualizing the potential discharge point immediately upstream of the waterfall.

Photo Plate #1: Doris Creek Waterfall taken in Late Summer Looking Upstream Towards Doris Lake

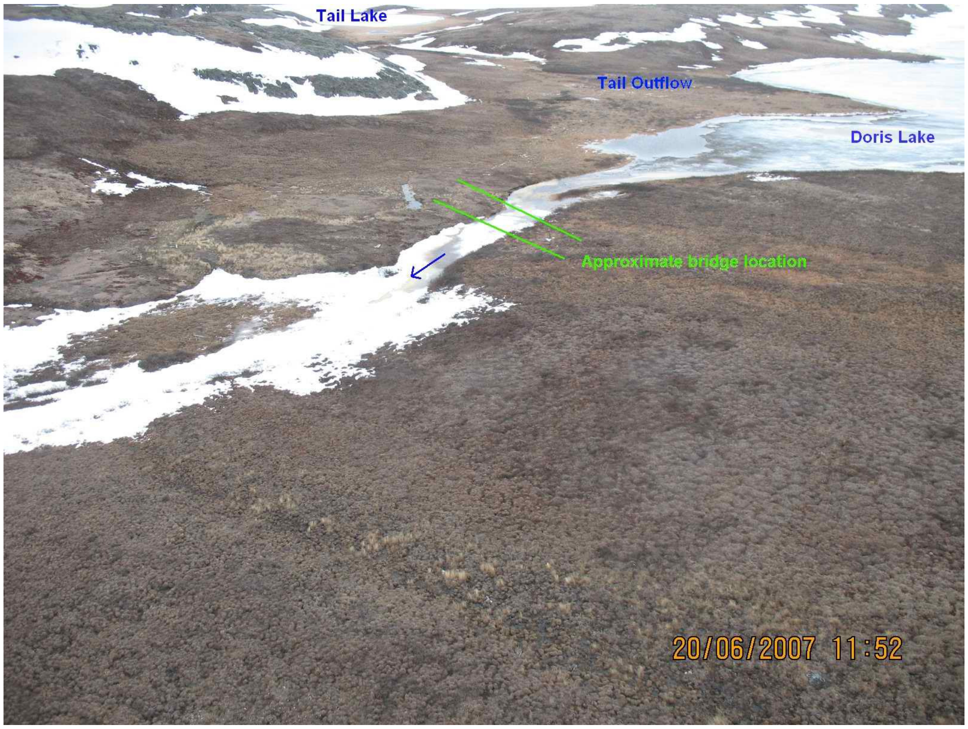


Photo Plate #2: Aerial view of Doris Lake Outflow taken on June 20th, 2007 looking southeast

Photo Plate #3: Aerial view of Doris Outflow upstream to Doris Lake towards the waterfall

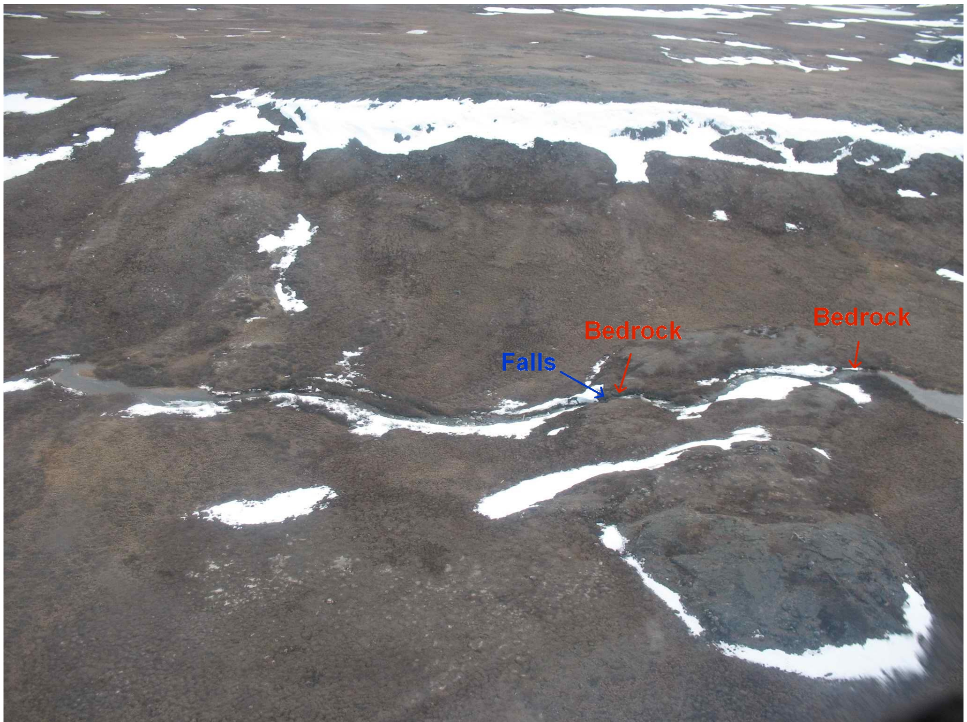


Photo Plate #4: Aerial photo (June 23rd, 2007) showing two points of bedrock upstream of the falls (potential discharge point candidates)

Photo Plate #5: Stream immediately upstream of the waterfall lip (discharge point candidate #1) – June 23rd, 2007 (looking south to Doris Lake)

Photo Plate #6: Stream immediately upstream of the waterfall lip (discharge point candidate #1) – June 23rd, 2007 (looking south to Doris Lake)

Photo Plate #7: Stream ~30 m upstream of the waterfall lip (discharge point candidate #2) – June 23rd, 2007 (looking south to Doris Lake)

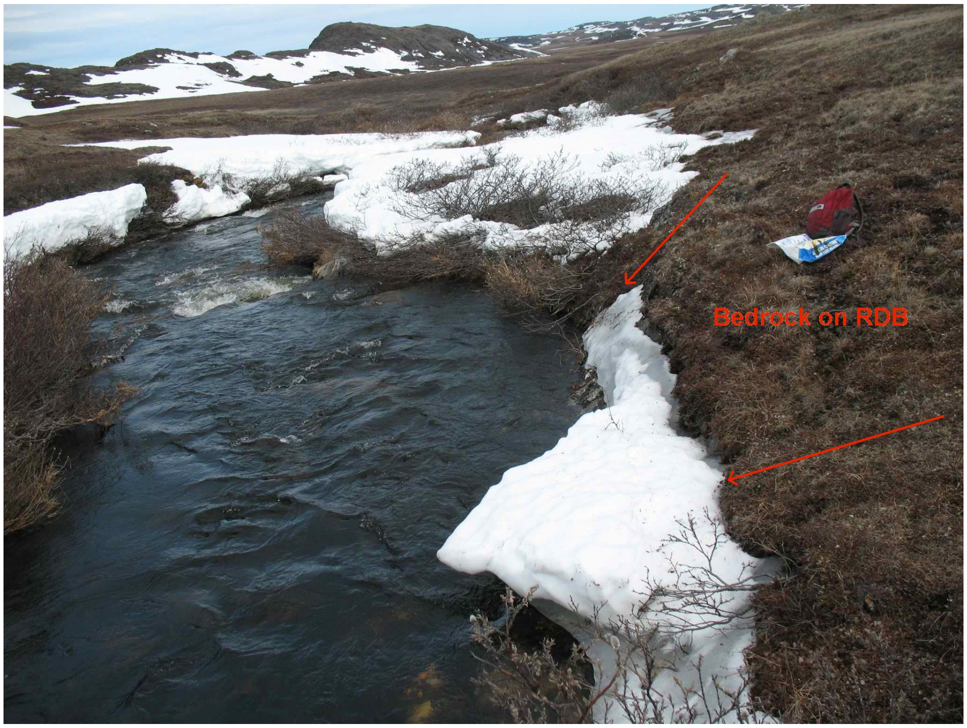


Photo Plate #8: Stream ~30 m upstream of the waterfall lip (discharge point candidate #2) – June 23rd, 2007 (looking south to Doris Lake)

On June 20th the Doris Outflow Creek was still ice covered. Although the creek was ice free by June 23rd the water was still high and fast flowing making a streambed assessment difficult. A visual inspection by a Golder field biologist highlights two potential discharge points where bedrock is evident on the stream bed. The first is immediately above the falls (Photo Plates 5 and 6). The second location is about 30 metres upstream of the falls (Photo Plates 7 and 8). The second location looks to be more stable than the spot above the falls, where the bedrock is so close to the edge that the configuration could change if blocks separate and tumble down. Both potential discharge locations should eliminate the possibility of stream bed erosion arising from the managed Tail Lake seasonal discharge. A further assessment of these two locations will be made in mid July

Item #30 – Guidance on Additional Content for Final Closure and Reclamation Plan

INAC to respond to this item

Item #31 – Information on Revegetation Progress in Nunavut Using Native Species

GN DoE to respond to this item

Item #32 – Include Chloride in Table 5.1 in Monitoring and Follow-up Plan

Table 7.2 in the April 2007 Revised Water License Application Support Document and Table 5.1 in the Monitoring and Follow-up Plan has been changed to include the monitoring of chloride at the appropriate SNP points.

Table 5.1: Proposed SNP Monitoring Stations, Sampling Frequency & Monitoring Parameters

SNP MONITORING STATIONS				
SNP #	**Description**	**Location Coordinates / notes**	**Frequency**	**Monitoring Parameters**
TL1	Tail Lake at the Reclaim Pump Barge - depth of 1.5 m below surface	UTM 13W 433799E 7558286N (Approx.)	Every second day for two weeks prior to discharge and for two weeks after discharge then reducing to once per week during remainder of annual discharge period	pH, TSS, TDS, Cl, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Orthophosphate-P, Total Phosphate-P, Total Al, As, Ca, Cd, Cr, Cu, Fe, Hg, K, Mo, Mg, Na, Ni, Pb, Se and Zn
			Prior to commencing discharge and then monthly thereafter during active discharge	Acute Lethality Test (Reference Method EPS 1/RM/13)
TL2	Doris Outflow Creek - upstream (at the flow monitoring station adjacent to the bridge)	UTM 13W 434071E 7559511N (Approx.) - same as the hydrological monitoring location	Every second day for two weeks prior to discharge and for two weeks after discharge then reducing to once per week during remainder of annual discharge period	pH, TSS, TDS, Cl, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Orthophosphate-P, Total Phosphate-P, Total Al, As, Ca, Cd, Cr, Cu, Fe, Hg, K, Mo, Mg, Na, Ni, Pb, Se and Zn
TL3	Doris Outflow Creek - down stream (~100 m downstream of the base of the waterfall	UTM 13W 434101E 7559781N (Approx.)	Every second day for two weeks prior to discharge and for two weeks after discharge then reducing to once per week during remainder of annual discharge period	pH, TSS, TDS, Cl, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Orthophosphate-P, Total Phosphate-P, Total Al, As, Ca, Cd, Cr, Cu, Fe, Hg, K, Mo, Mg, Na, Ni, Pb, Se and Zn
TL4	Tail Lake Discharge End-of-Pipe - taken at a valve at the discharge end of the transfer pump pipeline	To be confirmed	Weekly during periods of discharge	pH, TSS, TDS, Cl, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Orthophosphate-P, Total Phosphate-P, Total Al, As, Ca, Cd, Cr, Cu, Fe, Hg, K, Mo, Mg, Na, Ni, Pb, Se and Zn
			Monthly during active discharge	Acute Lethality Test (Reference Method EPS 1/RM/13)
TL5	Combined Tailings Discharged into Tail Lake (Water Component) - taken from a valve at the discharge end of the mill tailings pumps	To be confirmed	Daily initially, reduced to weekly after 3 months of operation	pH, TSS, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Total Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Mo, Ni, Se and Zn and Volume
TL6	Combined Tailings Discharged into Tail Lake (Solid Component) - taken from a valve at the discharge end of the mill tailings pumps	To be confirmed	Monthly on a composite sample taken from the TL6 weekly samples	Total Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Mo, Ni, Se and Zn and Tonnage
TL7	Filtered Cyanide Leach Residue sent UG as backfill	n/a	Monthly	Tonnage
TL8	Reclaim water pumped from Tail Lake to Mill Process water tank taken from a valve at the discharge end of the reclaim water pump	n/a	Monthly	pH, TSS, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Total Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Mo, Ni, Se and Zn
ST1	Discharge from Camp/Mill pad sedimentation pond taken from the pond at a depth of ~0.25 m	To be confirmed	Once before any discharge, daily when discharging onto the tundra	pH, TSS, Total Ammonia, Total Sulphate, Total CN, Total Oil and Grease, Al, As, Cu, Fe, Pb, Ni, and Zn
ST2	Discharge from Temporary Waste Rock Stockpile Pollution Control Pond taken from a depth of ~0.25 m	To be confirmed	Monthly during open water season	pH, TSS, Total Ammonia, Total Sulphate, Total CN, Total Oil and Grease, Alkalinity, Chloride, Al, As, Cu, Fe, Pb, Ni, and Zn
ST3	Discharge from Non-hazardous landfill pollution control sump taken from discharge of pump used to land apply this water	To be confirmed	Daily when discharging onto the tundra	pH, TSS, Total Ammonia, Total Sulphate, Total CN, Total Oil and Grease, Al, As, Cu, Fe, Pb, Ni, and Zn
ST4	Discharge from the landfarm sump taken from discharge of oil adsorption system	To be confirmed	Daily when discharging onto the tundra	pH, Total Suspended Solids, Total Oil and Grease, Benzene, Toluene, Ethyl benzene and Total Ammonia
ST5	Discharge from the fuel tank farm sump taken from discharge of oil adsorption system	To be confirmed	Daily when discharging onto the tundra	pH, Total Suspended Solids, Total Oil and Grease, Benzene, Toluene, and Ethyl benzene.
ST6	Discharge from the Roberts Bay fuel transfer station sump taken from discharge of oil adsorption system	To be confirmed	Daily when discharging onto the tundra	pH, Total Suspended Solids, Total Oil and Grease, Benzene, Toluene, and Ethyl benzene.
ST7	Freshwater pumped from Doris Lake taken from a valve on the discharge end of the fresh water pump	n/a	Monthly	pH, TSS, Free CN, Total CN, Total Ammonia-N, Nitrate, Nitrite, Total Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Mo, Ni, Se and Zn

Item #33 – Include Toxicity Monitoring Requirement to Table 5.1 in Monitoring and Follow-up Plan

Table 7.2 in the April 2007 Revised Water License Application Support Document and Table 5.1 in the Monitoring and Follow-up Plan has been changed to include the acute toxicity monitoring at the TL1 and TL4 SNP station (Water in Tail Lake and Discharge from Tail Lake). (See revised Table above).

Item #34 – More Detailed Information on Current Water Quality & Hydrology Monitoring Stations – Physical Parameters

A column has been added to Table 7.2 in the April 2007 Revised Water License Application Support Document and in Table 5.1 in the Monitoring and Follow-up Plan to provide the UTM coordinates of the proposed SNP sampling stations where they are known. The additional coordinates will be added to the next revision of the Monitoring and Follow-up Plan (July 30, 2007 as set out in Item 49 below).

Information on each of the hydrometric monitoring stations was provide in Appendix A to Supporting Document C1 to the October 2005 FEIS, entitled Doris North Project Aquatic Studies 2005 prepared for MHBL by Golder Associates. This information will be added to the next revision of the Monitoring and Follow-u Up Plan (July 30, 2007).

Item #35 – More Information on Construction Monitoring Program

Construction activities associated with the development of mine infrastructure have the potential to produce negative environmental impacts if the proper techniques are not implemented throughout all stages of development. Although activity specific method statements are available and accessible to the individuals directly conducting works in the field they are not always completely aware of, or informed as to, their proper implementation. As well, specific site conditions may warrant the alteration of techniques or materials, thereby lessening the impact on the environment. The role of the construction monitor will be to ensure that field workers understand and abide by the commitments made to governing bodies and regulatory agencies, openly communicate adaptive techniques for lessening or mitigating impacts, to document construction progress on a daily basis with photographs, and to directly communicate findings and resolutions to Miramar head office.

Construction monitoring will by its nature have to be adaptive in nature, that is daily monitoring and sampling activities will be driven by the type of construction activity being undertaken on that day and on the local conditions (weather, presence of water, presence of snow cover, etc.). There are however a number of monitoring activities that will take place during the construction period. These include but are not necessarily limited to the following types of monitoring:

- Blast vibration monitoring for quarrying activity carried out in close proximity to fish bearing waters;
- Monitoring of the performance of erosion protection measures employed by the construction contractor;
- Monitoring for sediment release from construction areas;
- Monitoring for wildlife interactions;
- Monitoring to ensure the protection of all migrating birds and their nesting sites;
- Follow-up geochemical sampling of quarried rock used in construction of site roads and pads to verify that the rock used is non-acid generating as predicted;
- Monitoring of the waste management practices employed by the contractors and their employees (food waste, hazardous wastes such as engine oil and filters, etc., non-hazardous wastes);
- Monitoring of contractor's activity to minimize ground impacts to the tundra, i.e., keeping vehicles off the tundra and on constructed roadways;
- Monitoring of dust generation and use of water by the contractor to manage dust emissions from crushing and construction activity; and
- Vegetation monitoring as discussed in Item #38 below

In addition to these types of construction monitoring, MHBL intends to continue its collection of baseline information on water quality, water quantity, climate conditions, air quality, noise monitoring, and wildlife within the Project area during the construction period (2007 and 2008).

Item #36 – Sedimentation Pond – Addition of Nitrite and Nitrate

Section 5.3.1 of the Follow-up and Monitoring Plan (page 35) and Section 6.2.1 (page 203) of the "Revised Water License Application Support Document" dealing with monitoring of the Camp/Mill Sedimentation Pond has been amended as follows to include nitrate and nitrite in the list of parameters to be monitored:

"During the spring melt, the water collected in the Camp/Mill sedimentation pond will be sampled by the on-site environmental personnel and analyzed for pH, TSS, Total Ammonia, Nitrate, Nitrite, Total Sulphate, Total CN, Total Oil and Grease, Al, As, Cu, Fe, Pb, Ni, and Zn."

Item #37 – Trigger to Re-Assess Water Quality Model – Use of CN Destruct Internal Sampling Data

In Section 3.6.5 (page 160) of the "Revised Water License Application Support Document" and in the Water Quality Model Supporting Document, MHBL committed to:

"As part of the control strategy, the actual water quality in Tail Lake will be compared with the predicted water quality on a monthly basis to assess the accuracy of the model. If significant deviation is noted, then the model will be recalibrated to the actual water quality observed in Tail Lake. The model will be rerun if there is a more than 20% deviation above the predicted concentrations for any of the critical or significant parameters (MMER, CCME). The model will then be rerun to assess potential implications on the discharge strategy and to determine future operational requirements. This comparison of actual water quality to predicted water quality in Tail Lake will be communicated to the NWB for inclusion in the public registry as part of the monthly Surveillance Network Program reporting. Model calibration would be required only if the model significantly underestimates solute concentrations in Tail Lake AND it is shown to potentially have a significant impact on the water management strategy."

MHBL confirms that all internal data collected including water quality data from the cyanide destruction circuit (the Barren Bleed to Tailings) will be available and used by MHBL staff and its consultants in re-calibration of the Tail Lake water quality model as indicated above.

Item #38 – Trigger Points for Dust Effects on Vegetation

While air quality issues are typically not included in the Water License process, MHBL has provided this information in response to the information request submitted by the GN-DoE. Miramar recognizes that construction and operations at the Doris North Gold Mine Project will result in the generation of dust that would be additional to natural dust levels in the north. Sources of dust would include very fine particles such as vehicle exhaust to large particles generated from roads and from vehicle traffic on roads, airstrips, blasting and rock quarries. Natural dust also occurs on the landscape from sources such as exposed bedrock, shorelines, eskers and soil.

In Nunavut, an ambient air quality guideline established under the Environmental Protection Act sets a standard respecting the maximum desirable levels of dust in ambient air in the NWT/Nunavut. Measured as total suspended particulate (TSP), the standards for dust over 24 hours are 120 micrograms per cubic metre (ug/m^3) and averaged over a year are 60 ug/m^3. There are also National Ambient Air Quality Objectives for TSP (24 hour average – 120 ug/m^3: Annual average -

70 ug/m^3); for PM_{10} (24 hour average – 25 ug/m^3) and for $PM_{2.5}$ (24 hour average – 15 ug/m^3).

Predictions regarding the effects of dust on vegetation and wildlife uptake of vegetation are speculative. There are two general questions pertaining to dust effects on vegetation, as follows:

1. What is the relationship between dust fall and uptake of metals into plant tissues (i.e., the dietary route of exposure for wildlife, and in particular, caribou)?
2. What are the effects of dust as a direct impediment to growth, reproduction and survival among the various species, and will this lead to a change in vegetation cover and species composition?

MHBL could find no published guidelines or objectives for dustfall or for metal levels in vegetation specific to Nunavut. Alberta has a published dustfall objective summarized as follows:

53 mg/100 cm^2/30 days in residential and recreational areas; and
158 mg/100 cm^2/30 days in commercial and industrial areas.

No published guidance on acceptable metal levels in vegetation were found applicable to Canada.

MHBL has committed to establish an air quality monitoring station at the Doris North Project once stable electrical power is available that will conduct ambient air quality monitoring for TSP, PM_{10}, $PM_{2.5}$ and dustfall. The station will be set up in close proximity to the proposed plant site pad.

In the summer of 2007, Miramar proposes to establish three sets of Permanent Sample Plots (PSPs) for vegetation on the Doris North Project site (Roberts Bay, along the Roberts Bay access road) and down wind (down wind along the prevailing wind direction) from the plant site (where the air quality monitoring station will be established). Each set of PSP's will consist of six sample plots, each a 5 m by 5 m square plot, in which vegetation species will be identified and the percent cover within the PSP boundary estimated for each species. The six PSP plots at each sample set location will be established at 0 m, 50 m, 100 m, 200 m, 800 m and 1600 m distance from the nominal dust generation source to sample along a theoretical dust fall gradient. Samples of the vegetation will be collected from each PSP plot and analyzed for total metals (36 element ICP). Samples of the vegetation will be collected in the summer of 2007, 2008, 2009 and 2010 at a consistent point in time (same month) so that the results are relatively comparable from one year to another and so that trends in metal levels can be tracked.

MHBL proposes that the trigger points for further action would be as follows:

1. Dustfall measurements at the air quality monitoring station that consistently average greater than 158 mg/cm^2/30 Total dustfall; or

2. A statistically significant increase in the average measured metal concentration from the 2007 baseline concentrations at the PSP plots.

If either of these trigger conditions is reached then MHBL would initiate a wider investigation of dust fall impacts on vegetation around the Doris North Project.

In the absence of specific dustfall or vegetative metal guidelines in Nunavut, MHBL is open to discussion with the landowner (the KIA) and the GN-DoE on the applicability of these proposed trigger points.

There are currently ongoing discussions in the Lac De Gras and MacKay Lake area in the Northwest Territories regarding a regional dust fall and vegetation study. Miramar will endeavour to stay abreast of the status and results of this study and incorporate any applicable results and recommendations into the Doris North dust fall monitoring program.

Item #39 – MHBL to Amend Seepage Monitoring to Include Advising Geotechnical Engineer of Record

Section 5.2.5 (page 33) of the Follow-up and Monitoring Plan dealing with monitoring of Dam Seepage has been amended as follows to include notification of the geotechnical engineer of record for the North and South Dams when seepage is noted:

"If evident, toe seepage at the North and South Dams will be sampled and monitored on a weekly basis. Water samples will be analyzed for tracer elements (such as ammonia and nitrate) to determine if the water is from Tail Lake or natural runoff / seepage form the surrounding area. If flows become significant, the seepage will be collected and pumped back to Tail Lake.

MHBL will inform the geotechnical engineer of record for the North and South Dam in writing (by email or FAX) whenever seepage flow from the dam is noted. The intent is to inform the geotechnical engineer of record for the two dams so that this engineer can assist and advise MHBL in monitoring dam stability implications where needed."

Item #40 – Selection of SNP Sampling Site at the Base of the Waterfall

MHBL has arranged for the project's consulting hydrologist and geotechnical engineer to visit the Doris North site in mid July. During that period the two consultants will inspect and photo document the waterfall in Doris Creek and select a suitable SNP monitoring point for use in monitoring water license compliance. The following photos were taken downstream of the waterfall in August of 2003.

Photo Plate #9: Doris Outflow, 20 August 2003. View of waterfall (4.3 m in height), located 400 m downstream of Doris Lake

Photo Plate #10: Doris Outflow, 20 August 2003. View of waterfall (4.3 m in height), located 400 m downstream of Doris Lake

The following photo was taken on June 20th, 2007. The site of the previous sampling water sampling point is shown.

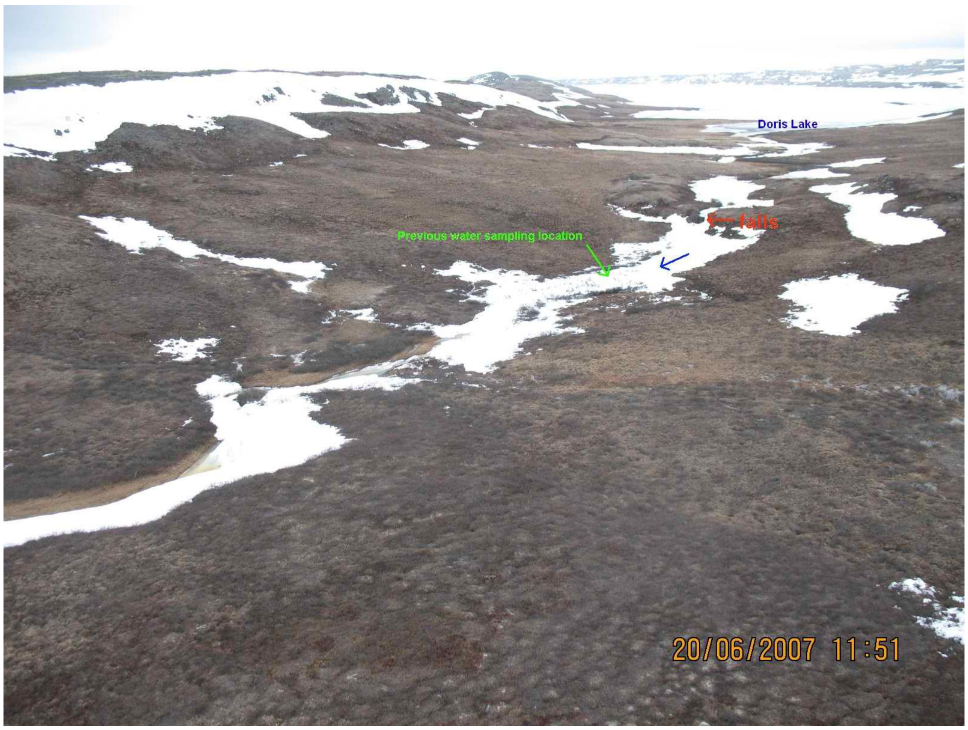


Photo Plate #11: Doris Outflow, 20 June 2007. View of waterfall looking towards Doris Lake – Previous Sampling Point located ~100 m below the base of the waterfall

The intent is to locate the SNP point at the first safely accessible spot downstream of the plunge pool below the falls. From a preliminary review this spot appears to be approximately 50 m below the base of the falls (photo plate #11). The potential for safely locating the SNP point here he will be assessed during the mid-July site visit.

The information on the selected final SNP site will be presented prior to the Water License hearing together with photo documentation of why this site was selected.

Item #41 – Correction of Reference to the Location of the SNP Station Downstream of the Waterfall

Section 5.2.4 (page 33) of the Monitoring and Follow-up Plan has been amended to change the reference to the location of the SNP point downstream of the waterfall from "30-50 m" to 50 m as follows:

"Doris Creek downstream of the waterfall will be monitored only during periods of active discharge. The sample location will be established at the first safely accessible spot downstream of the plunge pool below the falls. From a preliminary review this spot appears to be approximately 50 m below the base of the falls. The site will be selected to ensure that complete mixing of Tail Lake discharge and Doris Outflow creek has occurred. The sampling frequency would follow the frequency for the discharge pump intake and for Doris Outflow creek upstream of the weir, i.e., sampling will initially be undertaken every second day and then the frequency of sampling be decreased to a minimum of once per week after this initial two week period has passed. If water quality in Doris Outflow creek is changing at a significantly more rapid rate than predicted then MHBL will return the frequency of sampling to once every 24 hours until it can be shown that the water quality within Doris Outflow creek is not varying quickly on a day to day basis."

The distance reference has also been corrected in the Table of proposed SNP stations.

Item #42 – Contingency Plan Should the On-Site Lab Not Be Able to Respond

If the on-site environmental laboratory is unable to provide the key analytical data required to calculate how much water can be safely discharged from Tail Lake (e.g. due to equipment failure, staff shortage, material shortage or other cause), MHBL will terminate the discharge of water from Tail Lake until this key data can be obtained either through an accredited outside commercial lab or by repairing the cause preventing the data being obtained through the on-site laboratory. MHBL will maintain critical spare components on site to reduce this risk but it cannot be totally eliminated.

Item #43 – Update of Table 3.10 in Main Document to Identify Parameters Analyzed On-Site and Off-Site

Table 3.10 in the April 2007 Revised Water License Application Support Document and Table 5.8 in the April Monitoring and Follow-up has been changed to indicate what analytical parameters the MHBL on-site environmental lab will have the capacity to analyze.

Table 3.10: Parameters to be measured for effluent characterization and water quality monitoring

Category	Parameter	On-Site Analysis
Deleterious substances and pH[1,2]	Arsenic	Yes
	Copper	Yes
	Lead	Yes
	Nickel	Yes
	Zinc	Yes
	Radium 226	-
	Total cyanide	Yes
	Total suspended solids	Yes
	pH	Yes
Required Effluent Characterization and Water Quality Monitoring Parameters[2,3]	Aluminum	Yes
	Cadmium	Yes
	Iron	Yes
	Mercury[4]	-
	Molybdenum	Yes
	Ammonia	-
	Nitrate	-
	Alkalinity	-
	Total hardness	-
Required Additional Water Quality Monitoring Parameters	Dissolved oxygen[5]	Yes
	Temperature[5]	Yes
Site-Specific Parameters[6]	Chromium	Yes
	Manganese	Yes
	Selenium	Yes
	Total phosphorus	Yes
	Nitrite[7]	-
	Conductivity	Yes
	Calcium	Yes
	Chloride	-
	Magnesium	Yes
	Potassium	Yes
	Sodium	Yes
	Sulphate	Yes
	Dissolved organic carbon[5] Total organic carbon [5]	- -

Notes:
1. List of parameters regulated (deleterious substances and pH) as per Schedule 3 of the MMER; concentration limits specified in the regulation (Schedule 4).
2. All concentrations are total values; dissolved concentrations may also be reported; effluent loading (Section 20 of MMER) will also be calculated and reported.
3. List of parameters required for effluent characterization and water quality monitoring as per Schedule 5 of the MMER
4. Analysis of mercury may be discontinued if the concentration of total mercury in effluent is less than 0.10 μg/L in 12 consecutive samples of effluent.
5. In situ measured parameters only for water quality monitoring (in receiving waters).
6. These other parameters are potential contaminants or supporting parameters; analysis is optional and may be added based on site specific historical monitoring data or geochemistry data.

7. Nitrite will not be considered as a controlling parameter for the calculation of the ADVR and TDR unless actual concentrations significantly exceed the predicted values

However it is MHBL's intent to send all Water License compliance samples to a commercial accredited laboratory for analysis. The on-site lab is to be used by MHBL to provide the analytical data required for management control decisions.

Item #44 – Noted Inconsistencies in Management Plans

GN DoE to respond to this item

Item #45 – Amendment of Emergency Response Spill Contingency Plan to Show Detail of How Estimated Volumes of Material Spilled is Calculated

Section 4.7.1 of the Emergency Response and Spill Contingency Plan has been amended as follows to include having the Mine General Manager document how the estimated volume of a spill was calculated and the degree of uncertainty in relation to the estimate under the duties assigned to the Mine General Manager:

> "The Mine General Manager (or the designated Spill Response Coordinator) shall proceed immediately to the scene where he/she will make an assessment of:
>
> - Specific hazards of an imminent nature that may endanger life of humans or animals;
> - The type of material spilled;
> - The estimated quantity;
> - The potential for further spillage; and
> - Criteria and equipment required to contain and clean up the spill.
>
> In estimating the quantity spilled, the Mine General Manager should document how the estimate was made and the level of certainty of the estimate. This documentation should be retained for review during subsequent accident investigation procedures. Inaccurate estimates of spill volumes can result in under/over estimating the level of effort that will be required for recovery and clean-up. As a requirement during the initial spill response, the General Manager or his/her designate should oversee that the estimated volume of the spill is appropriately calculated with the information at hand that the estimate calculation is documented including how the estimate was made and the confidence in the accuracy of the estimate and the assumptions relied upon. The ability to make accurate estimates is best achieved by maintaining accurate and up to date records of the fuel or material stored within the storage tank or location. An estimate of the volume spilled can then be made by comparing the amount of material remaining in the original tank or location with the amount contained in the tank or facility inventory record. Any uncertainties

in the volume, location and type(s) of materials spilled should be documented in detail."

Item #46 – Application for a Hazardous Waste Generator Number

MHBL has made formal contact with the GN-DoE to apply for a Hazardous Waste Generator Number for its Doris North Project and is preparing the appropriate application form to obtain this registration number.

Item #47 – Update of Contact List in Emergency Spill Response Plan

MHBL has updated the contact list in the Doris North Emergency Response and Spill Contingency Plan to include the revised Environment Canada – Environmental Protection Emergency 24 hour Pager Phone Number, the contact info for the GN-DoE Manager of Environmental Protection and the INAC Manager of Field Operations in Iqaluit as follows:

Organization/Personnel	Contact Information
NT-NU 24 Hour Spill Report Line	867-920-8130 FAX: 867-873-6924 EMAIL: spills@gov.nt.ca
Environment Canada – Environmental Protection Emergency 24 Hr Pager	867-766-3737
GN – DoE – Manager of Pollution Control	Phone: (867) 975-7748 Fax (867) 975-7742
INAC – Manager of Field Operations (Peter Kusugak)	Phone: (867) 975-4295 FAX (867) 975-6445
RCMP	867-983-1111
Emergency Measures Organization Nunavut	867-979-6262 After hours 800-693-1666
Department of Fisheries and Oceans	867-979- 6274
Miramar Mining Corporation Head Office, North Vancouver #300 – 889 Harbourside Drive North Vancouver, BC, V7P 3S1	Phone: 604-985-2572 FAX: 604-980-0731 1-800-663-8780
General Manager, Environment – Corporate Office in North Vancouver – Larry Connell	Direct Line: 604-904-5579 Cell: 604-374-4142 Home 604-467-3717
Manager of Environmental Permitting & Compliance Monitoring – Corporate Office in North Vancouver, Terri Maloof	Direct Line: 604-904-5564 Cell: 604-836-4355
Exploration Manager – Corporate Office in North Vancouver – Darren Lindsay	Direct Line: 604-904-5563
President – Miramar Mining Corporation – Corporate Office in North Vancouver – Tony Walsh	Direct Line: 604-904-5590 Cell: 604-377-7780
General Manager, Northern Operations – Scott Stringer - Yellowknife	867-766-5311 FAX 867-873-6357
Purchasing Manager, Northern Operations in Yellowknife – Dave Jarvis	867-766-5304 FAX 867-873-8492
Site Superintendent at Windy Camp	604-759-2286 After Hours 604-759-2288
Geology Office at Windy Camp	604-759-2290 604-759-2292
Logistics at Windy Camp	604-759-2287 FAX 604-759-2283
Major Drilling at Windy Camp	604-759-2291 FAX 604-759-2284 After Hours 604-759-2289
Site Medic at Windy Camp	604-729-2285
Discovery Mining Services in Yellowknife – Rod Brown, Steve M., Chris	867-920-4600 FAX: 867-873-8332
Mine General Manager at Doris North	Not Yet Hired
Environmental Manager at Doris North	Not Yet Hired
Manager Community Relations in Kugluktuk – Alex Buchan	867-982-3200
Community Relations Coordinator – Natasha Neglak	867-983-7507
Kitikmeot Inuit Association Lands Manager	867-982-3310

Item #48 – Reference to New Regulations for Fuel Storage Facilities

MHBL has obtained information (the Regulatory Impact Analysis Statement) from Canada Gazette (April 04, 2007) on the new regulations for Fuel Storage Facilities referenced at the Water Board Technical Meeting on June 12th from Environment Canada; specifically "Storage Tank Systems For Petroleum Products and Allied Petroleum Products Regulations" which is to apply to storage tanks on federal and aboriginal lands. MHBL has requested a copy of these new regulations from Environment Canada and will incorporate this new reference in the Emergency Response and Spill Contingency Plan and in design considerations as applicable once available.

Item #49 – Update of the Follow-up and Monitoring Plan and the QA/QC Plan prior to Construction

MHBL commits to update the Follow-up and Monitoring Plan and the QA/QC Plan to edit out the inconsistencies noted by the technical reviewers. Both these plans will be updated and re-submitted to the Water Board ahead of the July 30th closing date for submission of materials to be relied upon at the Final Hearing. A further update of these two plans will occur prior to the start of operations as shown on the Gantt Chart attached to the next item.

Item #50 – Update of All Environmental Management Plans

A copy of a GANTT Chart is attached that shows the proposed schedule for completion and submission of the next generation of revisions to the environmental management plans for the Doris North Project that were submitted with the May 2007 Water License Application support documentation. MHBL committed to update each of these plans during the approximately one year time period between the issue of the Water License and the start of milling operations (October 2008) so that the plans reflect the most recent information and site experience.

Doris North – Planned Schedule for Next Updates to Environmental Management Plans

ID	Task Name	Date
1	Revise Emergency Response and Contingency Plan	January 1, 2008
2	Revise Air Quality Management Plan	August 1, 2008
3	Revise Noise Abatement Plan	July 1, 2008
4	Revise Waste Rock Storage Plan	April 1, 2008
5	Revise Hazardous Materials Management Plan	June 1, 2008
6	Revise Explosives Management Plan	February 1, 2008
7	Revise Landfill Management Plan	May 1, 2008
8	Revise Landfarm Management Plan	June 1, 2008
9	Revise Tailings Management Plan	September 1, 2008
10	Revise Water Management Plan	May 1, 2008
11	Revise Quality Assurance/Quality Control Plan	March 1, 2008
12	Revise Mine Closure and Reclamation Plan	October 1, 2008
13	Revise Monitoring and Follow-Up Plan	March 1, 2008

Item #51 – Compliance with NIRB Project Certificate Requirements

Condition	Description	Status
1	Condition does not relate to the NWB mandate.	
2	Condition does not relate to the NWB mandate.	
3	Condition does not relate to the NWB mandate.	
4	Condition does not relate to the NWB mandate.	
5	Condition does not relate to the NWB mandate.	
6	Condition does not relate to the NWB mandate.	
7	Condition does not relate to the NWB mandate.	
8	Condition does not relate to the NWB mandate.	
9	MONITORING: Fund and install an on-site laboratory for continuous and real-time monitoring of water quality contained within Tail Lake and Doris Creek after discharge. The laboratory shall be certified, with standards to include the calibration of water quality monitoring instruments. File proof of application to become accredited, upon the request of the Monitoring Officer.	The QA/QC Plan, Water Management Plan and Monitoring and Follow-Up Plan outline actions to be taken towards establishing the on-site laboratory prior to the commencement of operations. The plans will be revised in 2008. Proof of application for on-site laboratory accreditation to be filed with the NWB and the NIRB Monitoring Officer.
10	MONITORING: Ensure that the monitoring of Tail Lake and Doris Creek water quality, above and below the waterfall, be verified and reported to NIRB three times during discharge by an independent, third party laboratory. The sampling must be carried out independently or supervised in which case MHBL must provide the sampling and delivery of samples to the independent, third party laboratory, with copies of the results directly to the Monitoring Officer.	MHBL will comply with this condition upon commencement of operations (when tailings are first placed in the TCA). Actions for compliance are outlined in the Monitoring and Follow-Up Plan and Water Management Plan.
11	MONITORING: Monitoring information collected under this approval shall contain the following information: a. The person(s) who performed the sampling or took measurements; b. Date, time, and place of sampling or measurement; c. Date of analysis; d. Name of the person who performed the analysis; e. Analytical methods or techniques used; and f. Results of any analysis.	The monitoring information requirements will be included as outlined in the Monitoring and Follow-Up Plan and the Water Management Plan.
12	MONITORING: The results and records of any monitoring, data, or analysis shall be kept for a minimum of the life of the project including closure and post closure monitoring. This time period shall be extended if requested.	A Laboratory Information Management System (LIMS) will be implemented to record and manage monitoring data as outlined in the Monitoring and Follow-Up Plan and the Water Management Plan.
13	Collect additional water quality data for the 2006 field season and incorporate it into a revised water quality model to be submitted to the NWB as part of the water license application. MHBL will meet discharge criteria on a site specific basis set by the NWB where possible, for the protection of the receiving environment at the point of discharge.	Completed; 2006 field data was incorporated into a revised water quality model was incorporated into application when data becomes available. The water quality model has been designed to meet site specific criteria for the protection of the receiving environment.
14	Collect additional precipitation, evaporation and runoff data and incorporate it into a revised water balance as part of the water license application.	Completed; additional data has been incorporated into the revised water balance included with the Revised Water License Application Support Document.

Condition	Description	Status
15	MHBL shall not permit the water discharged into Doris Creek to exceed the criteria set by the NWB.	Compliance by ongoing monitoring during operations; actions for compliance are outlined in the Water Management Plan and Monitoring and Follow-Up Plan, both to be revised prior to the commencement of operations.
16	Take all reasonable steps to prevent any Tail Lake discharge in violation of the Project Certificate or regulatory approvals that may have any likelihood of negatively affecting the environment including wildlife, fisheries, aquatics, and human health. If such a situation is encountered, take immediate action to remedy the violation. If requested by the NWB, accelerate testing or monitoring to determine the nature of any such discharge and its impact or harm to the environment.	Compliance actions are outlined in the Water Management Plan and the Monitoring and Follow-Up Plan.
17	Report any upset, exceedances, or compliance problem not only to regulatory agencies as required by law, but shall also report the same to the Monitoring Officer.	Any upset, exceedance or compliance problem will be reported to regulatory agencies, the NWB and the NIRB Monitoring Officer.
18	Submit as part of the water license application, a program detailing the methodology for testing quarried rock for acid generation and metal leaching potential. The sampling, testing and analysis must be done by a professional geologist registered in Nunavut.	Completed; the report *Geochemical Characterization of Quarry Materials* (Supporting Document S7 to the Revised Water License Application Support Document) includes results of geochemical evaluation from the four proposed quarry locations, supplementary to previous studies into metal leaching and acid rock drainage characteristics of the proposed quarry rock.
19	Condition does not relate to the NWB mandate.	
20	Condition does not relate to the NWB mandate.	
21	Condition does not relate to the NWB mandate.	
22	Condition does not relate to the NWB mandate.	
23	Condition does not relate to the NWB mandate.	
24	Condition does not relate to the NWB mandate.	
25	Condition does not relate to the NWB mandate.	
26	Condition does not relate to the NWB mandate.	
27	Condition does not relate to the NWB mandate.	
28	Condition does not relate to the NWB mandate.	
29	Condition does not relate to the NWB mandate.	
30	Condition does not relate to the NWB mandate.	

Condition	Description	Status
31	A complete Closure and Reclamation Plan prepared in accordance with the NWB requirements shall be filed by MHBL.	The Closure and Reclamation Plan submitted as part of the Revised Water License Application Support Document will be revised to reflect NWB requirements after the Water License is issued.
32	Have a complete Environment, Health and Safety Management System in place which includes the following: Wildlife Mitigation and Monitoring Plan; Environmental Protection Plan; Emergency Response and Spill Contingency Plan; Occupational Health and Safety Plan; Reclamation Plan; Education and Orientation Plan; Human Resources Plan; Inuit Involvement Plan; Community Relations Plan; Monitoring and Follow-up Plan; and Auditing and Continuous Improvement Plan. When complete, these Plans shall be forwarded to NIRB's Monitoring Officer.	The current Environment, Health and Safety Management System was included with the Revised Water License Application Support Document as Supporting Documents S9 and S10a through m. The management plans will be revised in 2008 after the Water License is issued and on an annual basis thereafter.
33	Update the Hazardous Materials Management Plan as part of its water license application to further clarify issues, such as design and operation of the landfarm to remediate any hydrocarbon contaminated soils, the treatment of collected snowmelt and precipitation runoff collected within the diesel fuel tank farm containment berm to remove any oil prior to release.	The Hazardous Materials Management Plan was updated to further clarify issues and included as Supporting Document S10e to the Revised Water License Application Support Document. The plan will be revised in June 2008.
34	If it becomes necessary, MHBL shall give notice of any planned changes to the mine facility, including Tail Lake and its operation, to the regulatory authorities and the Monitoring Officer.	Notice regarding any planned changes will be given to the regulatory authorities, the NWB and to the NIRB Monitoring Officer.
35	Condition does not relate to the NWB mandate.	

APPENDIX A:
Fuel Tank Engineering Drawings

STAKE OUT TABLE			
Point	Easting	Northing	Elev.
F1	432905.6	7559193.4	51.5
F2	432917.5	7559194.6	51.5
F3	432909.9	7559148.8	51.0
F4	432921.9	7559150.1	50.7
F5	432885.4	7559143.0	50.7
F6	432944.6	7559149.2	50.7
F7	432892.2	7559084.5	50.7
F8	432950.8	7559090.0	50.7
F9	432892.0	7559086.4	50.7
F10	432894.0	7559086.6	50.7
F11	432894.2	7559084.7	50.7
F12	432888.8	7559080.3	51.7
F13	432881.9	7559145.8	51.7
F14	432947.4	7559152.7	51.7
F15	432954.3	7559087.2	51.7
F16	432891.6	7559083.8	50.7

Notes:

1. The fuel tank farm must be founded predominantly on bedrock. If, after excavation to the lines and grades indicated on this drawing, sufficient bedrock is not exposed, the Engineer will instruct the Contractor to lower the level of excavation.
2. The finished grade of the fuel tank farm excavation shall be at least 50.5 m, and undulations in the surface of the excavation cannot be more than 0.2 m.
3. A nominal leveling layer of Surfacing material shall be spread over the exposed bedrock surface before proceeding with the tank farm construction.
4. The bedrock cut highwall for the fuel tank farm shall be site fitted with the direction from the Engineer. The maximum highwall height shall be 5 m.
5. The Contractor shall over excavate overburden on the highwall crest to ensure slope stability. The Engineer will confirm the slope finishing details on site.
6. The Contractor shall take due care so as not to damage the liner during construction. Special temporary liner protection measures must be taken in the event that construction equipment must pass over a liner before the final protective cover has been placed. The Engineer is to be notified of these occurrences.
7. Modifications to the liner tuck trench shall be allowed if equipment access is a problem. The details of any such modifications must be presented to the Engineer for approval.
8. All pumps, piping, tanking and electrical work are excluded from this scope of work.
9. The Contractorshall be responsible to keep the fuel tank farm dry and free of snow and ice during the construction period.

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE	NO.	DESCRIPTION	CHK'D	APP'D	DATE
				B	WATER LICENSE APPLICATION			
				A	WATER LICENSE APPLICATION			
REFERENCE DRAWINGS				REVISIONS				

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

PROFESSIONAL ENGINEERS STAMP

SRK Consulting
Engineers and Scientists
Vancouver

DESIGN: AT	DRAWN: JJH	REVIEWED: EMR
CHECKED: AT	APPROVED: EMR	DATE: Mar. 2007
FILE NAME: TANK FARM_rev1.dwg		

MIRAMAR HOPE BAY LTD.

DORIS NORTH PROJECT
DETAILED DESIGN

SRK JOB NO.: 1CM014.008

Doris North Project

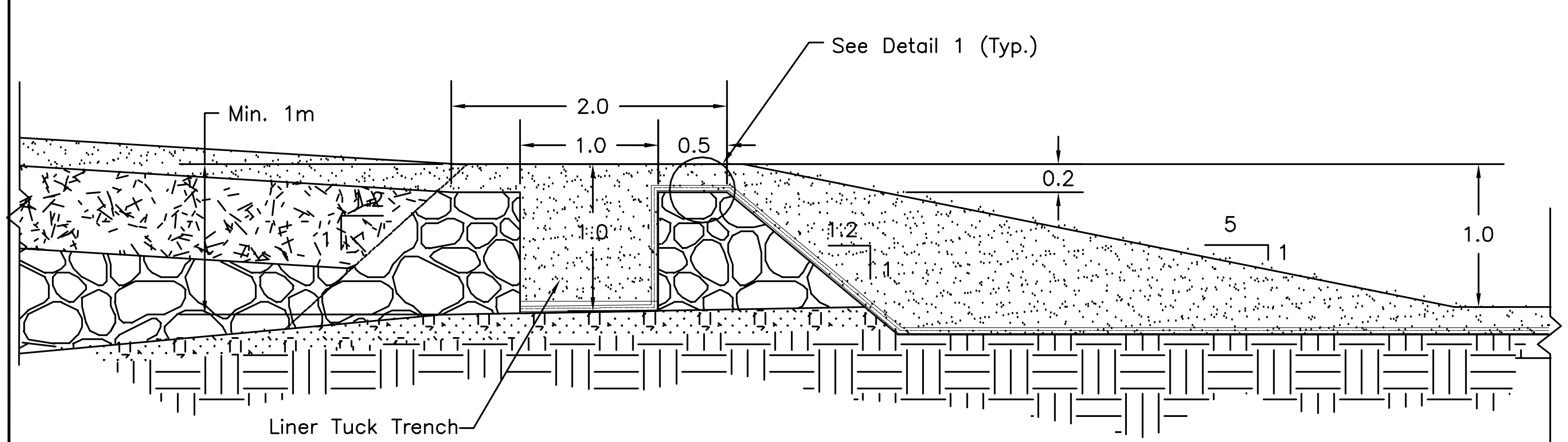
DRAWING TITLE:

Fuel Tank Farm Plan

DRAWING NO.	SHEET	REVISION NO.
S-05	13 OF 49	B

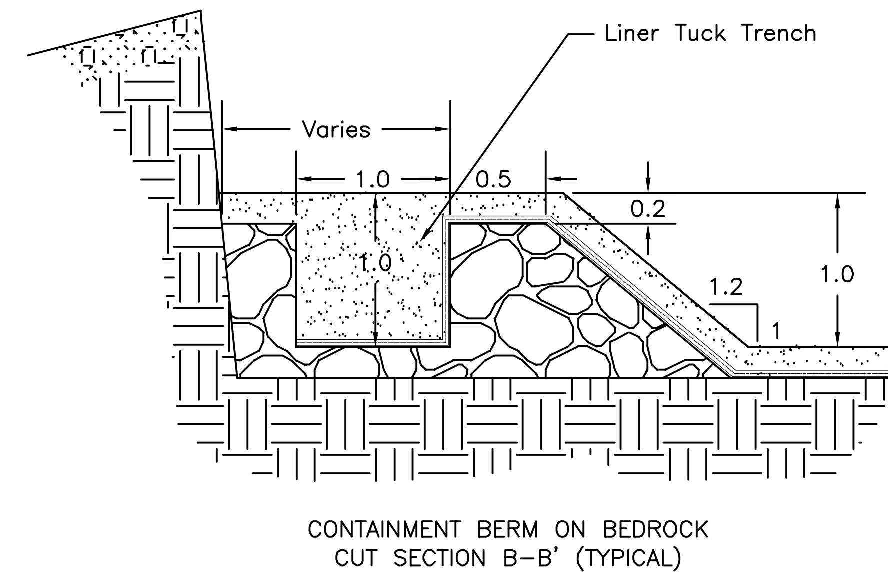
Legend:

- Overburden
- Natural ground
- Surfacing material
- Select Subgrade
- Run of quarry
- Drainage gravel



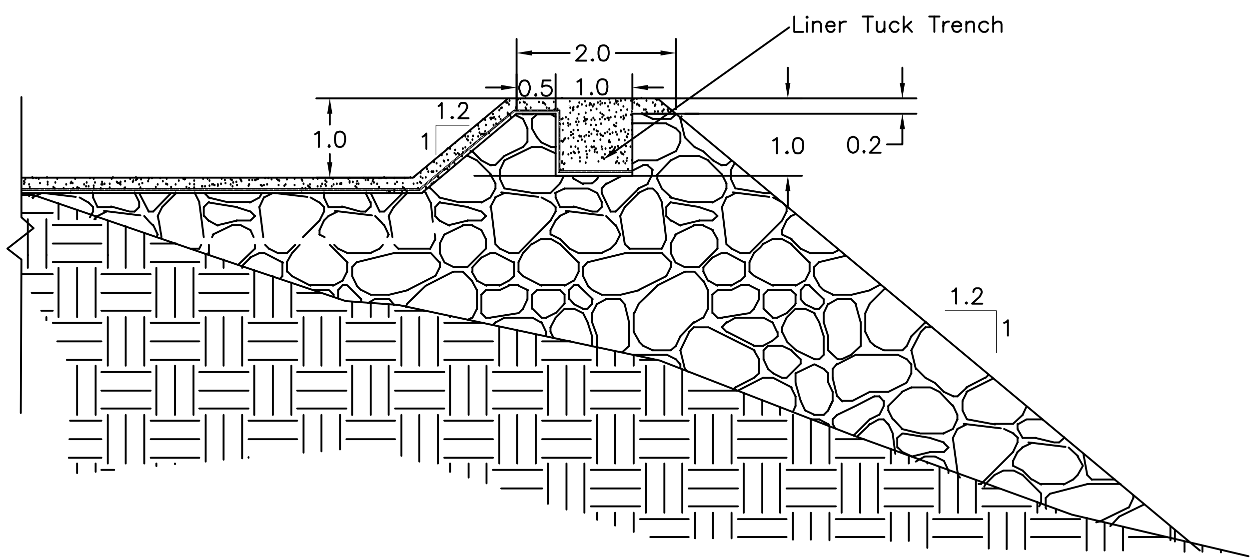
ACCESS RAMP
SECTION A–A' (TYPICAL)

0 40 80 120 160 200 cm
1:25



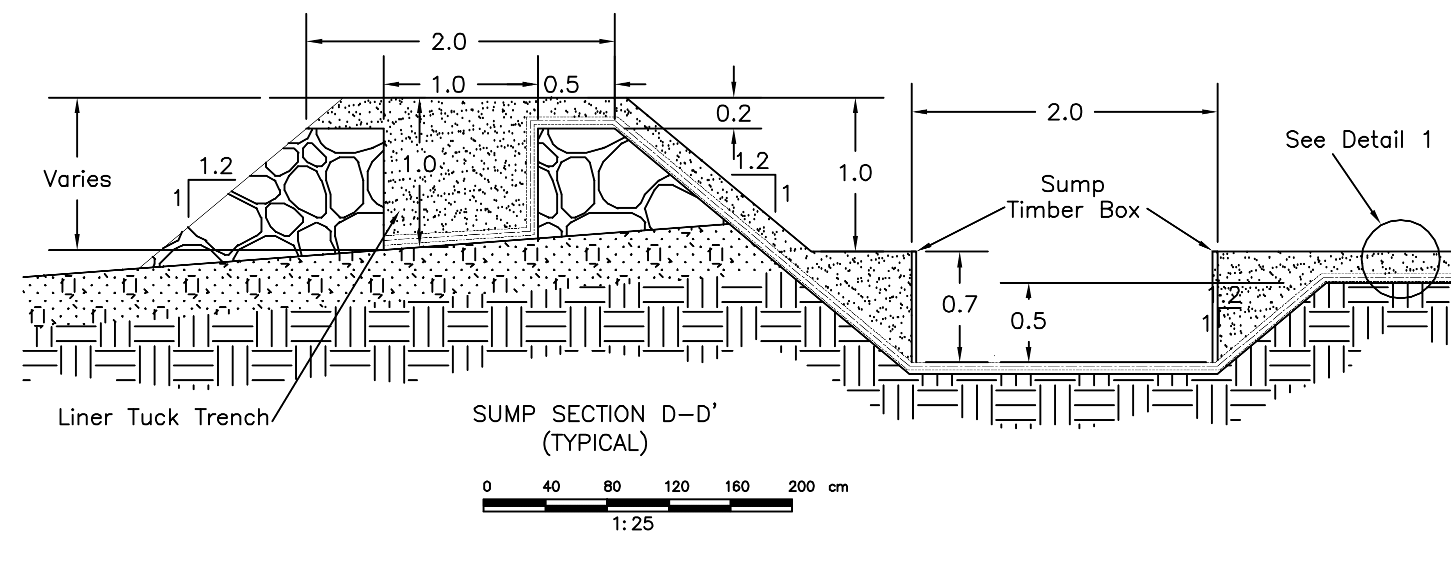
CONTAINMENT BERM ON BEDROCK
CUT SECTION B–B' (TYPICAL)

0 40 80 120 160 200 cm
1:25



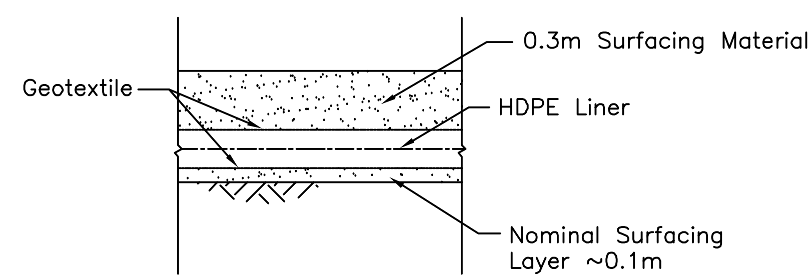
CONTAINMENT BERM ON FILL
SECTION C–C' (TYPICAL)

0 1 2 3 4 5 Metres
1:50



SUMP SECTION D–D'
(TYPICAL)

0 40 80 120 160 200 cm
1:25



Detail 1
NTS

Note: Drawings plotted to half scale

Notes:

1. A Specialist Contractor shall be responsible for the design, procurement and installation of all mechanical and/or electrical equipment at the fuel tank farm. The details of these elements are not indicated on the drawing.
2. The Contractor shall take due care so as not to damage the liner during construction. Special temporary liner protection measures must be taken in the event that construction equipment must pass over a liner before the final protective cover has been placed. The Engineer is to be notified of these occurrences.
3. Modifications to the liner tuck trench shall be allowed if equipment access is a problem. The details of any such modifications must be presented to the Engineer for approval.

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

REVISIONS

DRAWING NO.	DRAWING TITLE	DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

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

PROFESSIONAL ENGINEERS STAMP

SRK Consulting
Engineers and Scientists
Vancouver

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

FILE NAME: TANK FARM_rev1.dwg

MIRAMAR HOPE BAY LTD.

DORIS NORTH PROJECT
DETAILED DESIGN

SRK JOB NO.: 1CM014.008

Doris North Project

DRAWING TITLE:
Fuel Tank Farm Typical
Sections and Details

DRAWING NO. S-06
SHEET 14 OF 49
REVISION NO. B

APPENDIX B:
Fish Spurs

MEMORANDUM

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

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

DATE: 21 June 2007 Project No. 07-1373-0018

TO: Amy Liu
DFO Iqaluit

FROM: Gary Ash

RE: Miramar Doris North Project – Jetty Construction Timing and Monitoring

---

Following is the response to the outstanding questions discussed this morning relating to the DFO Fisheries Authorization for the Doris North jetty:

1) **Nearshore Habitat Compensation Structures Away from Jetty – Timing of Construction**
   The six nearshore structures will be constructed in winter of 2008 on ice, thereby eliminating the requirement for a separate access road. The construction period would be between 1 March and 15 June 2008, with the structures being in place after ice melt by 15 July 2008. Revised construction plans will be submitted by 15 September 2007, with the construction design to be developed in consultation with DFO Iqaluit habitat biologists.

2) **Monitoring of Jetty after Decommissioning**
   As indicated in the response to an Information Request by DFO during the NIRB process, MHBL has committed to monitoring the effects of the jetty on nearshore sediment transport during operation of the project and during closure to the point where the jetty is lowered. This will be accomplished through annual bathymetric surveys to determine the extent of sediment deposition adjacent to the jetty. If accumulations of deposited sediments are noted during the monitoring program, additional monitoring after lowering of the jetty will be conducted to determine if the nearshore sediment transport returns to pre-construction conditions.

   Monitoring surveys of the fish habitat compensation structures for the jetty will be conducted as laid out in the "No-Net-Loss" plan (revision 5) and provided to DFO in previous correspondence on 18 June 2007. It is expected that use the lowered jetty area would be similar to that observed during monitoring of the compensation structures during the operation and closure phases of the project. Additional monitoring to include investigation of fish use of habitat created by the lowered jetty will be incorporated into the monitoring program during two years post-lowering, when the fisheries crews are onsite to monitor other components of the compensation program. The use of the nearshore habitat compensation structures by fish also will be monitored at the same time as the jetty during two years post-lowering.

I trust this provides you with the additional information needed to process the Authorization. If you have any further questions, please contact me at 780-930-8666.

Golder Associates Ltd.

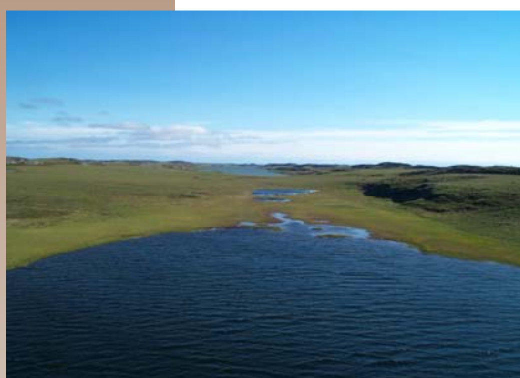
Gary R. Ash, M.Sc., P.Biol.
Senior Fisheries Scientist & Principal

APPENDIX C:
Groundwater Study – 2005 FEIS

Miramar
MINING CORPORATION

Groundwater Assessment

Doris North Project, Hope Bay Nunavut, Canada



Prepared for:

Miramar Hope Bay Limited
Suite 300, 889 Harbourside Drive
North Vancouver, BC
CANADA V7P 3S1

Prepared by:

SRK Consulting
Engineers and Scientists

Project No. 1CM014.006

October 2005

Groundwater Assessment, Doris North Project, Hope Bay, Nunavut, Canada

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SRK Project Number 1CM014.006

October 2005

Prepared by
Michael Royle, M.App.Sci., P.Geo.
Senior Hydrogeologist

Maritz Rykaart, Ph.D., P.Eng.
Senior Engineer

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List of Figures

List of Appendices

1 Introduction

SRK Consulting (Canada) Inc. (SRK) has been working with Miramar Hope Bay Limited (MHBL) since October 2001, on various aspects of the Hope Bay Doris North Project (from here on referred to as the Doris North Project).

In 2003 MHBL contracted SRK to conduct a preliminary desk study to evaluate the potential for groundwater inflow from the Doris Crown Pillar (SRK 2003a, also included as Appendix A). At that time, MHBL was considering developing the entire Doris North ore body, which includes the high grade Doris Hinge, as well as the lower grade Doris Connector and Doris Central portions (Figure 1). However, due to fact that the Doris Connector and Doris Central portions of the ore body are located beneath Doris Lake, and has a crown pillar of less than 100 m, MHBL opted to exclude development of these reserves from the Doris North Project.

The estimates of groundwater inflow presented in SRK (2003a) therefore does not apply to the Doris North Project, and as such MHBL contracted SRK to re-evaluate groundwater inflow potential to the Doris Hinge, as well as other potential groundwater flow paths that may exist on the Doris North site.

2 Background

This report presents the results of a desk study to evaluate groundwater flow potential on the Doris North Project site. A substantial volume of fieldwork has been completed during the development of the Doris North Project, including detailed characterization of the bedrock geology (Canada-Nunavut Geosciences Office 2002) and permafrost conditions (SRK 2003b; 2005a, b). Based on this information it is evident that the potential for groundwater movement is extremely small, primarily due to the following reasons;

- The site is underlain by cold (-8°C) permafrost, with an active zone of generally less than 1 m. Furthermore the geothermal gradient is approximately 11.4^{o}C/km, which suggests that the depth of permafrost is approximately 550 m.

- The general soil profile consists of less than 20 m of overburden soils (marine silt and clay) over competent in-tact bedrock, with few structural anomalies.

- To date, no groundwater has been encountered in any geotechnical drill holes completed under the supervision of SRK since 2003 (SRK 2003b, 2005a, b). Furthermore, discussions with the MHBL supervising geologists and a review of their drillers' logs in September of 2005 reveal that no circulation losses or "making water" was observed in any of the drill holes located on land during all of MHBL's exploration drilling.

For these reasons MHBL has not conducted a detailed geohydrological investigation of the project site. Based on technical review comments received during the Draft Environmental Impact Assessment review process, it became clear that a more thorough documentation of the factual information that lead to the conclusion that groundwater flow is not of concern for the Doris North Project is warranted. This report provides this factual information.

3 Areas of Potential Groundwater Flow

The Doris North site does have two features where, if permafrost is not present, there would be a potential for groundwater flow to interact with the Project. The first feature involves the possible hydraulic continuity within the continuous mineralized zone that stretches beneath Doris Lake. The portion of the Doris North mineralized zone that will be developed as part of the Doris North Project, i.e. the Doris Hinge, is part of a larger mineralized zone that includes the lower grade Doris Connector and Doris Central sections. This mineralized zone is oriented approximately north-south, with about one third located underneath Doris Lake (Figure 1). The Doris Hinge section itself is however not underneath the lake. The closest part of the proposed Doris North mine will be about 160 m north of the Doris Lake shoreline (as measured along the axis of the mineralized zone – outside of the mineralized zone, the mine is only 80 m from Doris Lake at its closest point).

Since it is known that large permanent bodies of water, such as Doris Lake, in a permafrost environment are underlain by talik, it is probably a reasonable assumption to assume that the Doris Connector and Doris Central zones are within such a talik. Since this section of the mineralized zone is connected to the Doris Hinge there could be a possible hydraulic continuity. Should this be the case, mining of the Doris Hinge could intercept groundwater which would have to be accounted for both in the Project water balance as well as in the mine standard operating procedures.

The second potential feature where groundwater may be of concern is a hydraulic continuity between Tail and Doris Lakes. Tail Lake is at a higher elevation (28.3 m) than Doris Lake (21.6 m), and as part of the Doris North Project, the water level in Tail Lake may be increased by as much as 5.2 m to an elevation of 33.5 m. This means the head differential between these two lakes could be as much as 11.9 m. Therefore, should there be structural features connecting these lakes, and should the taliks beneath Doris and Tail Lakes be interconnected, there is a possibility for this hydraulic head to cause groundwater flow from Tail Lake to Doris Lake.

4 Structural Geology

The Canada-Nunavut Geosciences Office produced a map, which demonstrates the major structure and alteration zones at the Doris North Project site (Canada-Nunavut Geosciences Office 2002). The information on this map, supported by MHBL's own geological drilling confirmed that there are no major fault or alteration zones that may act as conduits to groundwater flow from taliks. This map indicates only one major fault associated with the Doris north mineralized zone running NNE, as well as two lithologic contacts running north-south between Doris and Tail Lakes. The map also indicates one major fault transecting the very northernmost tip of Doris and Tail Lakes in an east-west direction. These features have all been reproduced on Figure 2.

5 Permafrost Conditions

The permafrost regime at the Doris North Project site has been well characterized and documented (SRK 2003b; 2005a, b). Figure 2 presents a location map of all the thermistors that has been installed and monitored at the Doris North Project site since 2003. The bulk of these thermistors are less than 20 m deep; however, three strings around Tail Lake (SRK-38, SRK-39 and SRK-40) are 50 m deep, and one string in the Doris Hinge (SRK-50) is 200 m deep. Two additional 80 m deep thermistors (TDD-261 and TDD 242) were installed in the Doris Hinge in 1997 (Golder 2001), as indicated in Figure 1.

At the Doris North site, the thermistor data shows an average ground temperature of -8^{o}C, with a range between -10^{o}C and -6^{o}C. Furthermore, based on the data from SRK-50, the geothermal gradient below a depth of 75 m is about 11.4^{o}C/km, which in turn implies a depth of permafrost of about 550 m.

At the Boston site, approximately 60 km south a deep thermistor (about 300 m) was installed in an inclined borehole (97NOD176), resulting in permafrost data to a depth of approximately 250 m. Based on data from this string spanning four years (1997, 1998, 2000 and 2001), the depth to permafrost at Boston is estimated to be about 2 m below ground. The depth of zero amplitude is estimated to be about 11 m below ground, and the temperature at the depth of zero amplitude is estimated to be about -9^{o}C. The geothermal gradient is estimated to be about 18^{o}C/km, at a depth below 75 m, and based on this; the depth of permafrost in the area of the drill hole is estimated to be about 563 m (Golder 2001).

6 Talik

MHBL did not carry out any site specific investigations to define the extent of the taliks beneath Doris and Tail Lakes, primarily as a result of the findings of the structural geology and permafrost conditions. MHBL did however contract SRK to evaluate the probable extent of these talik zones, based on the available database of thermal data, using thermal modeling. A detailed discussion of this modeling is presented in Appendix B.

Figure 2 in Appendix B demonstrates the results of the thermal model used to define the extent of talik beneath and between Doris and Tail lakes. As documented in Appendix B, the thermal modeling was done using the conservative assumptions of a warmer ground surface and geothermal gradient than measured for the site (i.e. -6^{o}C and 12^{o}C/km respectively). The impact of this is clearly seen by the fact that the thermal model predicts the permafrost to a depth of about 400 m, as opposed to a depth of about 550 m which is supported by measured data. Furthermore, as discussed in

Appendix B, Figure 3, the model is predicting significantly warmer temperatures at depth than has been measured on site. As an example, the model predicts a temperature of 0^oC at a depth of 200 m for SRK-50. The actual measured temperature at that depth is however -4^oC, clearly outside of any talik.

Based on the modelled results there is a zone of permafrost between Doris and Tail Lakes, at least 425 m wide, extending at least 130 m deep. Considering the fact that this permafrost is in competent in-tact bedrock, this is clear indication that the likelihood of groundwater flows between these two lakes are extremely low. Data from the two 50 m deep thermistor strings located between Doris and Tail Lakes (SRK-38 and SRK-40), further supports this conclusion.

A good analogy to illustrate this point is looking at the 425 m wide, 130 m deep zone of permafrost between Doris and Tail Lake as a "*cut-off wall*", similar to that used for conventional water retaining structures. Using a simple D'Arcy calculation with a total head differential of 11.9 m (6.7 m + 5.2 m), an assumed hydraulic conductivity of 1×10^{-7} m/sec for the intact bedrock and a surface area equivalent to the entire length of Tail Lake, the maximum seepage rate would be about 0.002 litre/second. If we increase the seepage path length, to compensate for the depth of the "*cut-off wall*", this value drops even lower. To place this value in perspective – this is equivalent to approximately 0.0003% of the mean annual outflow from Doris Lake. These facts supported by the physical data, is sufficient evidence to conclude that groundwater flow between the two lakes is unlikely.

Figure 3 presents the results of the thermal model as applied to the mineralized zone extending beneath Doris Lake. It is clear that even using the conservative thermal model that the talik does not intercept the Doris Hinge zone that will be mined as part of the Doris North Project. According to the model, the closest that the talik comes to the mine, would be towards the south-east (Section C-C'), to the tune of about 15 m. However, as explained previously, actual data from SRK-50, which is located exactly in this part of the proposed mine, confirm that ground temperature is at least -4^oC at this point, and therefore the talik is most certainly a significant distance further away in reality.

7 Flow through Structures

The fault zone that traverses east-west across the northern tip of Tail and Doris Lake (Figure 2), could act as a conduit for groundwater flow, under the assumption that the taliks beneath the lakes intercept the fault zone. Extensive thermal monitoring, to a depth of 20 m at the North Dam location, which lies in the vicinity of this fault zone, confirms the presence of permafrost, i.e. at this point there is no evidence of the Tail Lake talik. Therefore groundwater flow through this pathway is unlikely.

The fact that SRK-50 and TDD-261 has been drilled directly into the mineralized zone, and confirm the presence of permafrost, suggest that groundwater flow through this pathway originating in Doris Lake talik is highly unlikely.

8 Further Comments

Groundwater sampling has not been done, since groundwater has not been intercepted in any of the approximately 60 geotechnical drill holes installed in the Doris North Project Area (SRK 2003b, 2005a, b). There is therefore no background water quality data available.

Groundwater inflow into the Doris North Mine is expected to be negligible due to the presence of permafrost throughout the mined section of the deposit. The hydraulic conductivity of the frozen mass will remain low enough to have essentially zero flux to the mine. Other examples of mines that have been excavated in permafrost include the Polaris Mine (NT) and the Nanisivik Mine (NU). The Polaris Mine was located in an area of continuous permafrost extending to a depth of greater than 400 m. As the underground workings were completely within the frozen ground, the mine was completely dry and did not require any dewatering. Similar conditions occurred at the Nanisivik Mine. It should be noted that both mines are located immediately next to the marine breakwater, and extend out under the sea floor.

9 Proposed Monitoring

As the groundwater inflow to the Doris North Mine will be controlled by the frozen ground conditions, it is recommended that MHBL continue to monitor the temperatures in existing drill holes. Similarly, any groundwater flow between Doris and Tail Lakes will be controlled by permafrost conditions. The existing thermistors should be sufficient to evaluate whether the conclusions of this study remain valid as mining progresses.

10 Conclusions

Based on detailed permafrost characterization, evaluation of the site structural geology and general observations during drilling, it can be concluded that groundwater flow that could interact with the Doris North Project is highly unlikely. This data was used to develop a thermal model to predict the talik zones beneath Doris and Tail Lakes, and even using extremely conservative assumptions, the likelihood of any groundwater interaction is low. Specific conclusions regarding this groundwater assessment include:

- The entire proposed underground mine will be in an area of frozen ground;
- Ground temperatures are expected to be at least -4°C or colder in all parts of the mine;
- Between Doris and Tail Lakes there is a zone of continuous permafrost at least 425 m wide and 130 m deep;
- Known structural features on site are completely frozen.

SRK recommends that MHBL continue to monitor the thermal data from existing instrumented drill holes, throughout the mine development, operational and closure phases. This data will be sufficient to confirm that groundwater flow is not an issue of concern for the Doris North Project.

This report, "**Groundwater Assessment, Doris North Project**", has been prepared by SRK Consulting (Canada) Inc.

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11 References

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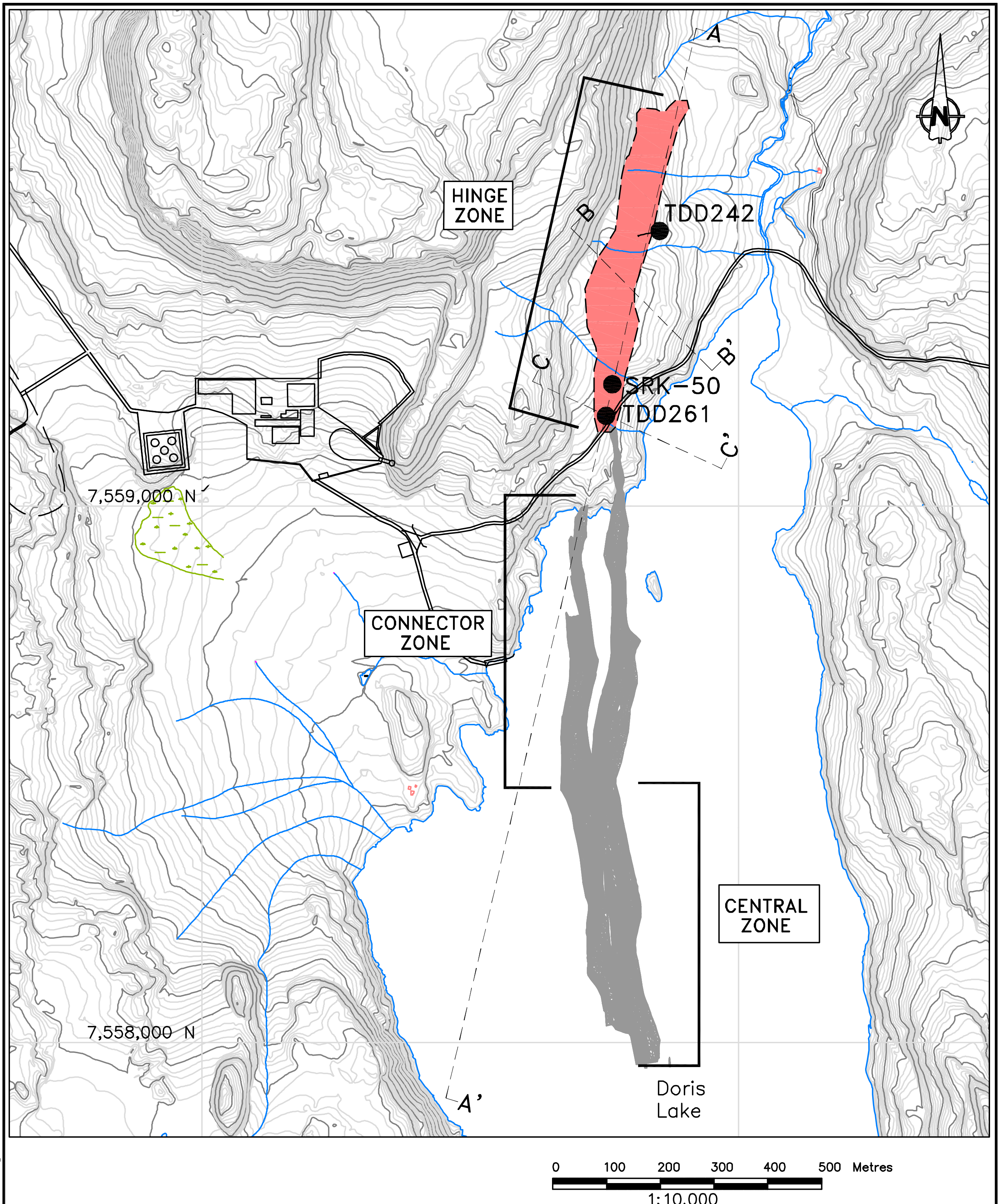
Figures



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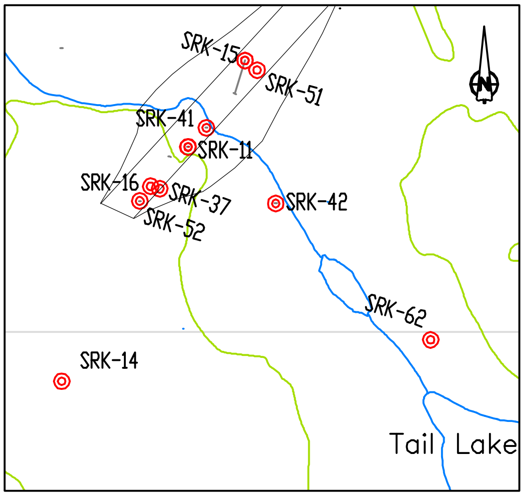
DORIS NORTH PROJECT
Groundwater Assessment

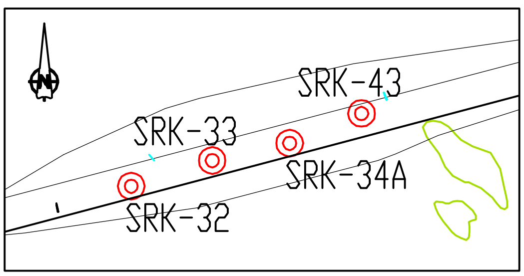
Doris Ore Body

PROJECT NO.	DATE	APPROVED	FIGURE
1CM014.006	Sept. 2005	EMR	1

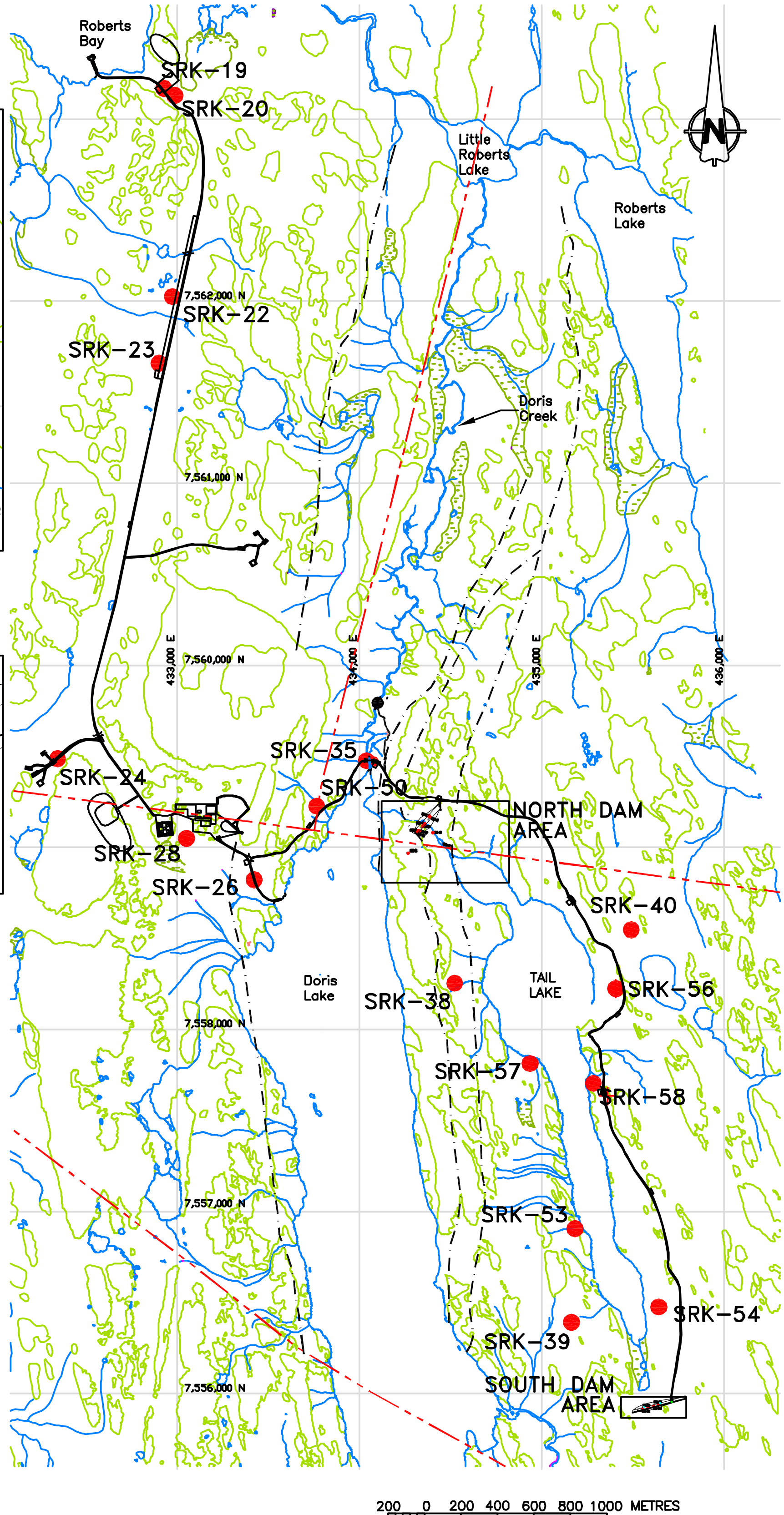
Dwg Ref: Thermistor-Orebody_Plan.dwg



NORTH DAM AREA



SOUTH DAM AREA



LEGEND

- Drillhole with thermistor
- Lithologic contacts, observed, interpreted
- Brittle Faults, major, minor, dipping, verticle

Dwg Ref: Thermistor Locations 2005.dwg

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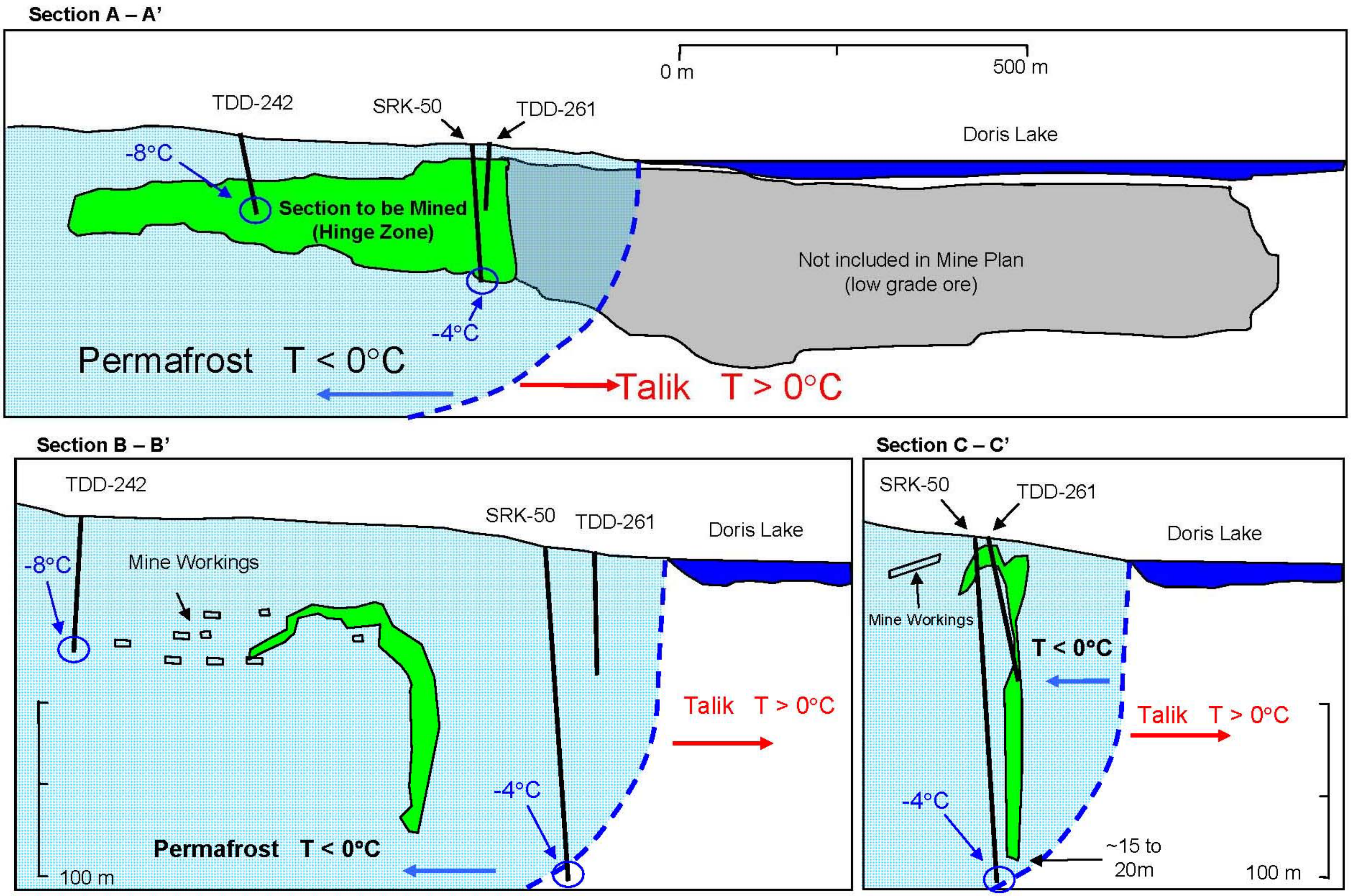
DORIS NORTH PROJECT
Groundwater Assessment

Site Layout

PROJECT NO.	DATE	APPROVED	FIGURE
1CM014.006	Sept. 2005	EMR	2



Note: Drillholes are projected onto sections.

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DORIS NORTH PROJECT
Groundwater Assessment

Predicted Doris Lake Talik in Relation to Doris Hinge Mine Development Area

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM014.006	October 2005	MDR	3

File Ref: Fig 2.ppt

Appendix A

SRK Technical Report – Preliminary Groundwater Inflow Study, Doris Crown Pillar

Preliminary Groundwater Inflow Study – Doris Crown Pillar

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Executive Summary

Preliminary calculations were carried out to assess potential inflow to the underground workings at the proposed Doris Lake deposit. Infiltration estimates were carried out using a simple analytical method designed for estimating inflow to a tunnel under a body of water. Results of the analytical calculations were used to bound the subsequent numerical modelling study results. The analytical method was also used to determine the sensitivity of the inflow estimates to the representative diameter of the workings. This information was utilized in the construction of the numerical modelling grid spacing used to represent the underground workings and stopes.

Initial numerical modelling was carried out using a 2D model due to the linear nature of the deposit. However, it was determined that scaling the estimated volumes to the mine scale was not reasonable; therefore, a simple 3D MODFLOW model was constructed. The 3D model was based on the general site layout (mine workings, planned open area of stopping when starting cut under crown pillar, crown pillar thickness, etc.) Although it was required to simplify the model to some degree, it is still a reasonable representation of the planned layout.

Hydrogeological information available for the modelling is limited to the general rock type and geometry of the rock thickness above the mine (crown pillar), lake bathymetry, and regional topography. Because of this, the estimated inflow volumes are useful for magnitude level inflows and assessing sensitivity of the groundwater system to the various data inputs.

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1 Introduction and Scope of Report

Mining of the Doris deposit could extend under the body of Doris Lake in the future. An assessment of groundwater inflow into the underground excavation is required in order to predict the pumping requirements, and the subsequent impact of mine water disposal to the receiving environment. This report outlines the methodology used to produce a preliminary inflow prediction based on available data. It should be noted that detailed structural and lithological data are not available at this time, nor were any insitu hydraulic tests carried out to measure hydraulic parameters. Therefore, this report presents the results of a simple desktop study on the subject only.

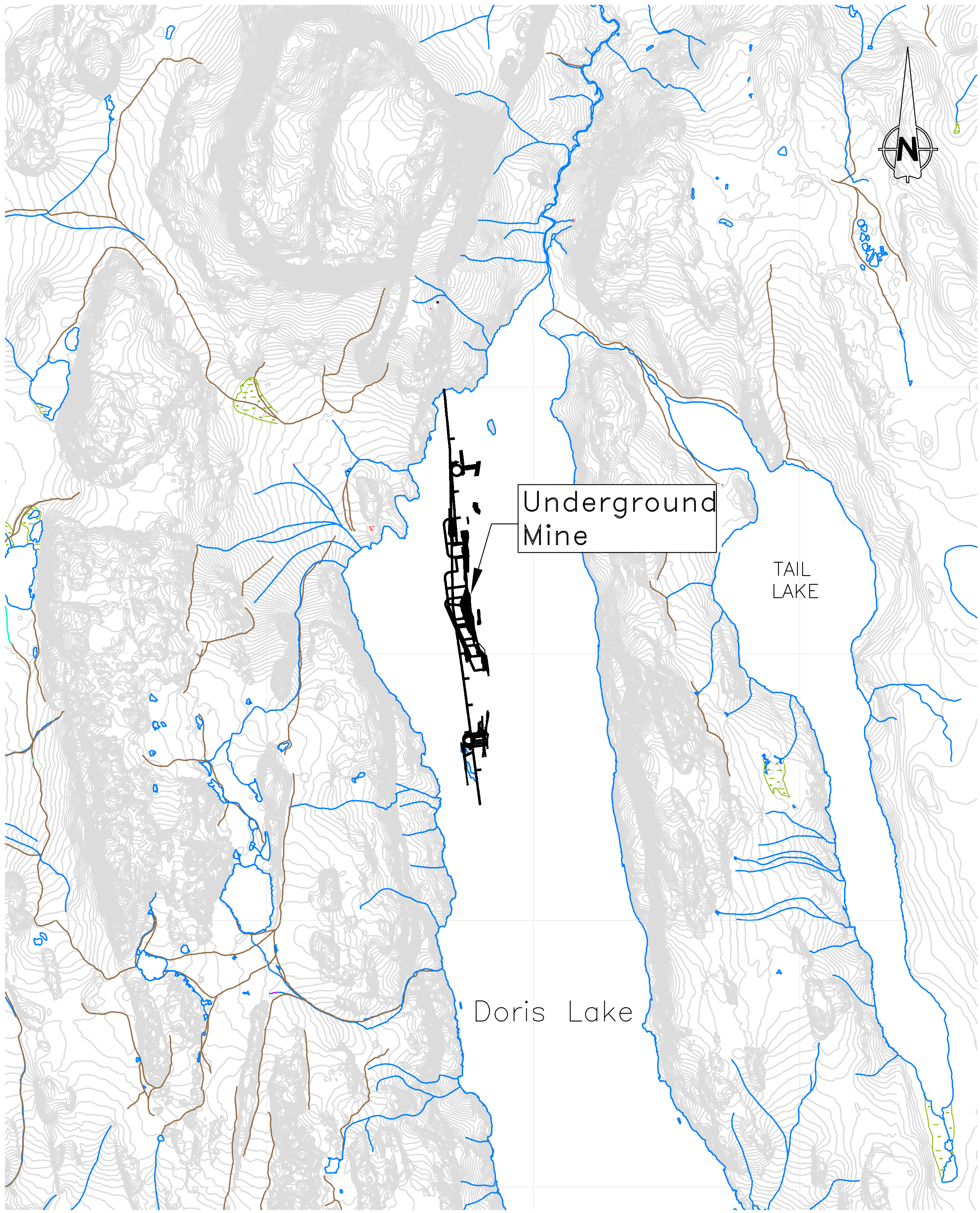
To carry out the inflow analysis, both analytical and numerical methods were used to assess steady-state mine water inflows to the tunnels and open stopes. The methods and assumptions utilized for the calculations are discussed below.

2 Site Description and Proposed Mine Layout

The proposed mine design and site details are illustrated in Figure 1. From this drawing, it is apparent that the mine workings will be completely beneath Doris Lake, except for a small section of the main decline. Because of this, inflow to the underground workings is considered to be dominated by vertical inflow, and so regional groundwater flow (lateral inflow) was ignored for this inflow estimate.

3 Calculation Methods

As discussed above, both an analytical and a numerical method were used to calculate the estimated range of inflows to the mine. The analytical methods chosen have been used to estimate inflow to a simple cylindrical opening, such as a tunnel, beneath a body of water. While this is useful in this case to provide a check on the numerical modeling, the analytical solution does not account for the complex geometry of the planned workings, nor inflow to multiple openings at different depths.



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HOPE BAY DORIS NORTH PROJECT

SITE PLAN AND PROPOSED MINE LAYOUT SCHEMATIC

PROJECT NO.	DATE	APPROVED	FIGURE
2CM008.03	Aug. 2003	MDR	1

4 Analytical Solution

The analytical solution for steady-state inflow to a tunnel is (Lei, 1998):

$$q = \frac{2\pi K\left(d + P_a - \phi_0\right)}{\ln[D/R + \sqrt{\left(D/R\right)^2 - 1}]}$$

where:

q – flow per unit length of tunnel (m^2 s^{-1})
K – hydraulic conductivity (m s^{-1})
D – distance from ground surface to axis of the tunnel (m)
R – tunnel radius (m)
ϕ - hydraulic head at the tunnel's perimeter (m)
d – height of free standing water above ground (m)
P_a – atmospheric pressure head (generally assumed to be 0 m)

The layout of the problem is shown in Figure 2. Multiplying the result by the length of mine workings gives the total mine inflow volume (m^3 s^{-1}).

Figure 2 – Schematic for Analytical Solution

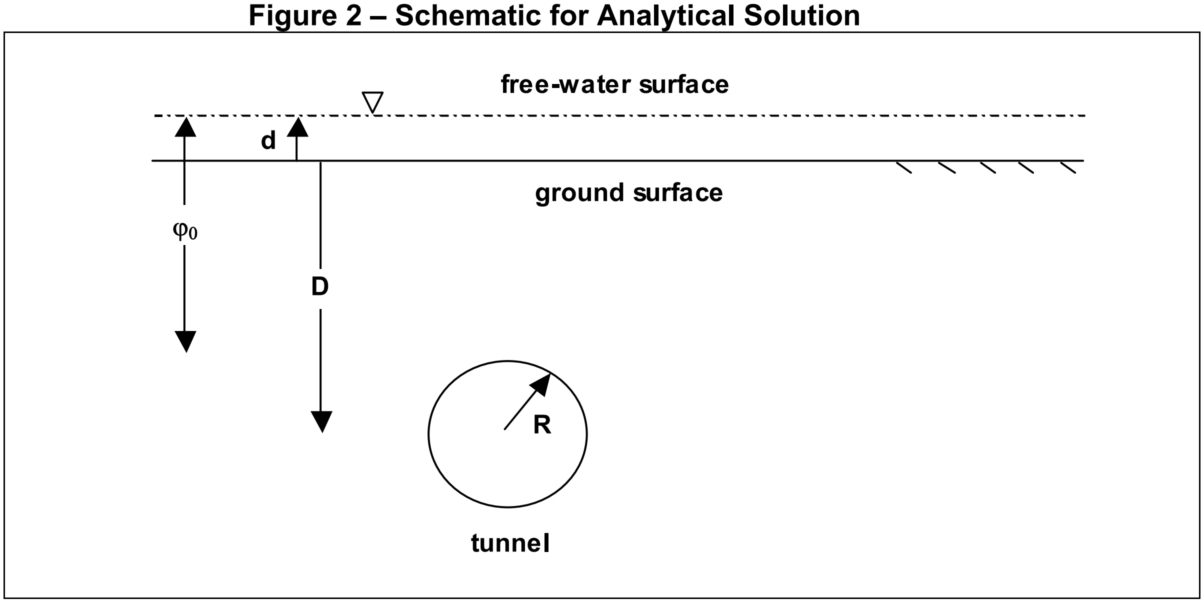


Table 1 shows the expected inflows for different values of K assuming: a lake depth (d) of 20 m, an average tunnel depth (D) of 145 m, a tunnel radius (R) of 3 m, a hydraulic head (f) of 162 m, and length of tunnel workings of 800 m.

Table 1
Results of Analytical Solution for Variable K

K (m/s)	q (m^2/s)	Q (m^3/s)	Q (m^3/d)	Q (l/hr)
1E-08	1.95E-06	0.00156	135	5,621
1E-07	1.95E-05	0.0156	1349	56,210
1E-06	1.95E-04	0.156	13490	562,097

A sensitivity analysis of the analytical solution to the tunnel radius was also carried out to determine how sensitive the numerical model might be to grid sizing, and how this would relate to the modelled size of the open areas. Assuming a standard K of 1E-8 m/s, the results are illustrated in Table 2.

Table 2
Results of Analytical Solution for Variable R, Tunnel Radius

Radius (m)	q (m^2/s)	Q (m^3/s)	Q (m^3/d)	Q (l/hr)
2.5	1.9E-06	0.0015	130	5424
5	2.2E-06	0.0017	150	6239
10	2.5E-06	0.0020	174	7255
15	2.8E-06	0.0022	191	7942
20	2.9E-06	0.0023	203	8458

As shown in the results, an 8 times increase in tunnel diameter from 2.5m to 20m only results in a 50% increase in inflow. This illustrates that the inflow calculations are not overly sensitive to tunnel radius relative to other parameters (e.g. depth below water table and hydraulic conductivity), and therefore, grid spacing in the numerical model will only need to provide a good approximation of the open void geometry.

5 Groundwater Numerical Flow Model

5.1 Conceptual Model Description

To model the potential inflow to the mine, a representative mine model was obtained from the current mine plan. The model is a depiction of the maximum open volume expected at any one time during mining in the upper part of the deposit. Therefore, it is expected to represent the maximum inflow condition from the lake floor to the workings.

Data used to produce the cross section were:

- 3D mine geology model
- 3D mine plan
- regional topography and lake elevation
- seismic interpretation of lake bathymetry

All data and models were supplied by MGML.

5.2 Mine Model – Open Area

The model was designed to depict the "worst case" inflow conditions. This is expected to occur when the majority of the tunnels (declines, ramps, cross cuts, etc.) are open, and the top section of the stopes (ie: least distance between open stope and base of lake) are being mined.

In discussions with Miramar staff, it was determined that approximately 50% of the stopes will be mined at any point in time, therefore, only 50% of the top layer of ore body is represented in the model. General tunnel and stope dimensions are used to mimic the mine design. Tunnels and open stopes are modeled as drains within larger cells (10 m x 20 m in the mine area) based on the model grid size. This method was shown to be valid based on the results of the analytical solution, where the influence of tunnel radius is not significant compared to the head above the tunnel and the hydraulic conductivity.

Figures 3 and 4 illustrate the conceptual model in cross section and the numerical model grid design in plan view. It should be noted that both figures only present a single slice through the model, and so do not illustrate the 3-dimensional shape of the available open area.

Figure 3 – Conceptual Groundwater Model

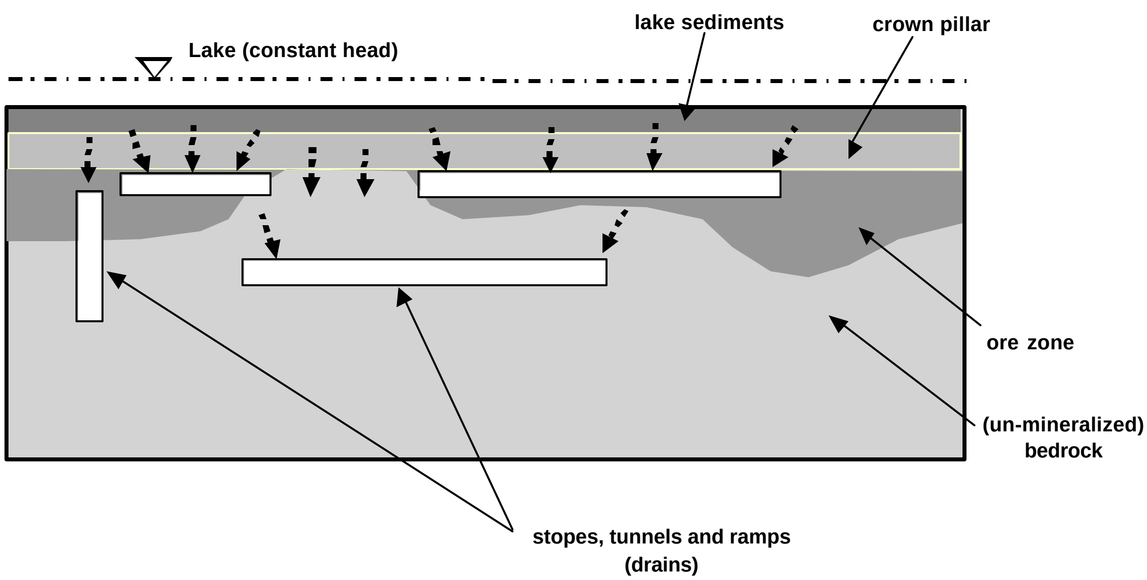
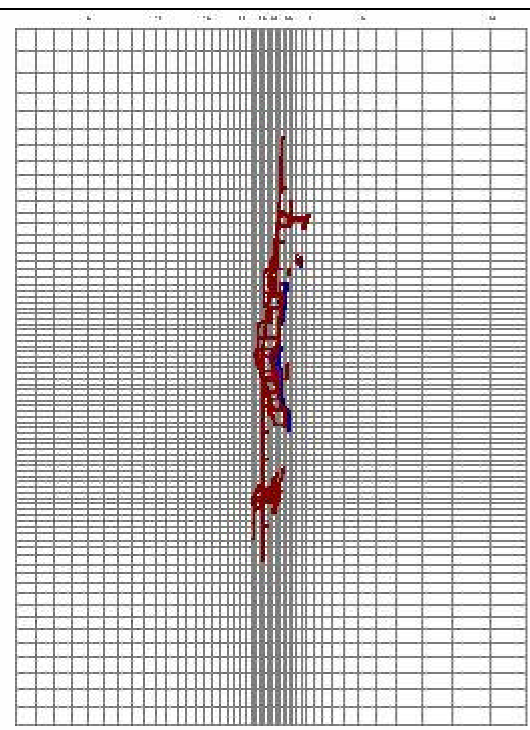


Figure 4 – Model Grid



Of note is the comparison between the entire mine excavation design, and the expected open void at any one time. The modelled open area is based planning for the initial mine development using the following limits:

- 50% of stopes actively mined at any one time
- maximum steady-state inflow expected when back of stope open to flow
- open working height in back 3.5m
- production drifts added to stope model based on:
  - production drift 3x5m, 60m from ore body
  - cross cut 3x5m
  - ramp from bottom of deposit at 15% (100m vertical, 1500m of ramp)

5.3 Geological Model

5.3.1 Lithology and Related Hydraulic Parameters

The geological model is based on a compilation of drilling results. Detailed lithological data was not used in the model. The model geology was assumed to consist of either mineralized (ore zone) or unmineralized mafic volcanics.

Because there are no available insitu hydraulic test data for the site, it was necessary to assign representative material properties and hydraulic characteristics for the model. These values have been taken from standard literature reviews of similar sites, and should be representative of the range of materials expected.

To test the sensitivity of the model calculations to the material properties, a series of sensitivity runs were conducted. In these runs, the hydraulic conductivity of the modelled materials was varied to see what effects it would have on inflow. The relationship of vertical to horizontal conductivity was also varied in order to test the influence of anisotropy.

5.3.2 Topography and Bathymetry – Crown Pillar Thickness

It should be noted that available “bathymetry” data was used to represent the sediment/bedrock contact, and not the actual lake bottom. Data from drilling results at the site were used to estimate the sediment material types and thickness covering the bedrock, but it was not considered to be spatially accurate in areas. Therefore, it was decided that the lake “bottom” would be modelled at the bedrock sediment interface.

This should not have a significant effect on the inflow prediction as it is assumed that the sediments are of higher hydraulic conductivity than the underlying rock, therefore, will not significantly impede flow to the rock. Model sensitivity runs indicate that this assumption appears to be valid, therefore, no further data is required for the sediment material parameters.

5.4 Numerical Model Design

A 3-dimensional groundwater flow model was constructed in MODFLOW to estimate steady-state inflows from the lake to the tunnels and open stopes. The model code was run in a steady state condition, with inflow to the mine workings being simulated by use of “drain” nodes along the open sections walls, back, and floor.

The model space represents a volume approximately 2000 m wide by 2500 m long around the mine, and extends to 270 m below ground surface. The lake was represented by constant head cells

(CH=3015 m) and open workings (stopes, tunnels and ramps) were represented by drain nodes. A 10 m wide by 20 m long cell spacing was used in the vicinity of the mine workings.

The base case parameters for the model are summarized in Table 2.

Table 2
Numerical Model Base Case Parameters

Parameter	Value	Units
Lake Constant Head Boundary	3015	m
Bedrock Hydraulic Conductivity	1×10^{-8}	m/s
Crown Pillar Hydraulic Conductivity	1×10^{-9}	m/s
Ore Zone Hydraulic Conductivity	1×10^{-8}	m/s
Lake Sediment Hydraulic Conductivity	1×10^{-8}	m/s
Drain Conductance (open workings)	1×10^{-3}	m^2/s
Bedrock Vertical Anisotropy (Kh:Kv)	1	none

6 Modeling Results

6.1 Simulation of Base Case

The simulated steady-state flow to mine workings for the base case parameters is estimated to be 2.72×10^{-3} m^3/s (i.e. 9798 l/hr or 235 m^3/d).

6.2 Sensitivity Analysis to Range of Possible Hydraulic Parameters

To test the sensitivity of the model calculations to the material properties, a series of sensitivity runs were conducted. In these runs, the hydraulic conductivity of the modelled materials was varied to see what effects it would have on inflow. The relationship of vertical to horizontal conductivity was also varied in order to test the influence of anisotropy.

6.2.1 Sensitivity to Drain Conductance

Use of the drain package to simulate open workings requires assignment of a value for drain conductance. The conductance relates to the ease with which water can drain from the aquifer formation into the open workings. Drain conductance is an empirical parameter and is typically calibrated to field data when available. In lieu of field data, a sensitivity analysis was carried out to determine the sensitivity of drain conductance to inflows. Table 3 summarizes the results of the sensitivity analysis. Note that inflows are relatively insensitive to conductance values below 1×10^{-3} m^2/s, while the model did not converge for conductance values above 1×10^{-2} m^2/s. Therefore, a conductance of 1×10^{-3} m^2/s was deemed to be suitable as the base case parameter.

Table 3
Sensitivity to Drain Conductance

Drain Conductance m^2/s	Q (m^3/s)	Q (l/hr)	Q (m^3/d)	Comments
1.0E-06	2.90E-03	10,440	251	Sensitivity to Drain Conductance
1.0E-05	2.92E-03	10,516	252	Sensitivity to Drain Conductance
1.0E-04	2.75E-03	9,886	237	Sensitivity to Drain Conductance
1.0E-03	2.72E-03	9,799	235	Base Case
1.0E-02	did not converge			Sensitivity to Drain Conductance

6.2.2 Sensitivity to K_h:K_v

To test the sensitivity of the model calculations to the material properties, a series of sensitivity runs were conducted. In these runs, the hydraulic conductivity of the modelled materials was varied to see what effects it would have on inflow. The relationship of vertical to horizontal conductivity was also varied in order to test the influence of anisotropy. Of special interest are the sensitivity runs where the angle the conductivity factor is applied was changed. These runs were used to mimic preferential flow through dipping fractures in the bedrock.

Fracture orientation at the site is unknown. The most conservative assumption is to assume dominant fractures are vertically dipping thus increasing vertical anisotropy and decreasing the K_h:K_v of the hard rock formations. Table 4 summarizes the results of these sensitivity runs.

Table 4
Sensitivity To Kh:Kv[1]

K_h : K_v	Q (m^3/s)	Q (l/hr)	Q (m^3/d)
0.1	6.89E-03	24,796	595
0.01	1.23E-02	44,161	1,060

[1] Note: Kh:Kv decreased for crown pillar, bedrock and ore zone

6.2.3 Overall Sensitivity to K

As no measures of hydraulic conductivity exist for the site, a general sensitivity analysis was carried out for all geologic formations. Table 5 summarizes the results of this analysis.

Multiplier	Q (m^3/s)	Q (l/hr)	Q (m^3/d)	Remark
All K's x 10	2.75E-02	98,863	2,372	sensitivity to K – High
All K's x 100	2.92E-01	105,1416	2,5234	sensitivity to K – Very High
All K's X 0.1	3.80E-04	1,368	32.8	sensitivity to K – Low

7 Conclusions

Preliminary modelling, using a simplified conceptual model of the Doris deposit and proposed mine layout indicates that:

1. Modelling is considered to be preliminary. Parameters were estimated from the literature. True site parameters depend on degree and orientation of fracturing and could vary significantly from those estimated for this study.

2. General agreement exists between the analytical and numerical solution, therefore general conceptual model is reasonable.

3. Base case model predicts inflows on the order of 235 m^3/d.

4. Direct connection between the mine workings and the lake could dramatically increase mine inflows. Sensitivity analyses suggest mine inflows could be upwards of 25,250 m^3/d, assuming hydraulic conductivity values up to 2 orders of magnitude higher than the base case.

Appendix B

SRK Technical Memorandum – Thermal Modelling, Permafrost between Doris and Tail Lakes

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Technical Memorandum

To:	Brian Labadie	**Date:**	October 4, 2005
cc:	Project Files	**From:**	Michel Noël
Subject:	Hope Bay Doris North Project Thermal modelling – Permafrost between Doris and Tail Lakes	**Project #:**	1CM014.006

1 Introduction

This technical memorandum presents the results of thermal modelling that was carried out to assess the extent of the talik between Doris and Tail Lakes. This thermal model was used to predict the ground temperature in the vicinity of Doris and Tail Lakes. The predicted temperature distribution was then compared with actual deep ground temperature measurements taken at the site.

It is generally understood that in the continuous permafrost environment, that a talik exist beneath large bodies of permanent water, such as is present in Doris and Tail Lakes. Geotechnical studies to confirm the extent of the talik beneath Doris and Tail Lakes was not carried out, primarily as a result of this thermal modeling, supported by actual deep thermistor data.

Essentially, the model confirms that even under the most conservative assumptions that a very large body of permafrost exist between Doris and Tail Lakes. This fact, together with the fact that this body of permafrost is present in competent in-tact bedrock, confirms that the likelihood of groundwater flow between these two Lake is negligible.

2 Model Setup

The thermal modelling presented herein consists of reproducing the region covering both Doris and Tail Lake talik, as a two dimensional cross-section. The section is oriented approximately west – east as shown in Figure 1. The modelled geometry has the following dimensions:

- Distance between Tail and Doris Lakes = 425 m
- Width of Doris Lake = 950 m
- Width of Tail Lake = 780 m
- Total width of geometry = 5,680 m
- Total depth of geometry = 3,350 m

These dimensions was selected specifically to be conservative, i.e. it represents the widest sections of Doris and Tail lakes (at the FSL of 33.5 m, as opposed to the standard water level of 28.3 m), and the narrowest section of land between these two lakes.

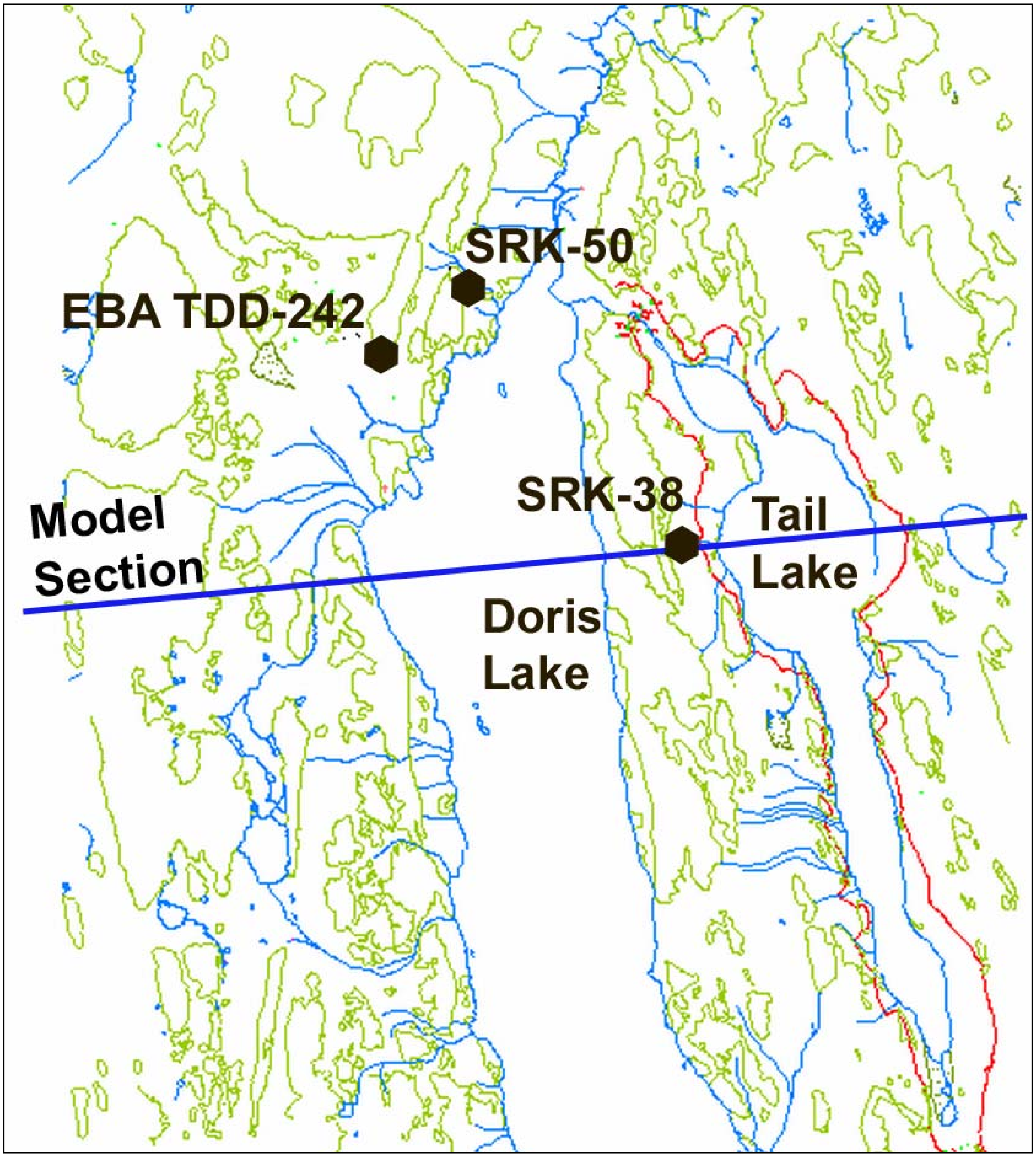


Figure 1: Site plan showing components relevant to the thermal model.

Seasonal climatic oscillation was neglected since the simulations were performed as steady state. The top boundary was assigned a constant temperature of +5 ^{o}C over the lake surfaces and -6^{o}C elsewhere. Both of these temperatures simulate the mean annual surface temperatures. It should however be noted that the measured ground temperature at the site outside water bodies average about -8°C over a range of -10 to -6°C (SRK 2005). The temperature representing the lakes assumes a water column of at least 1.5 m, which is generally referenced as being sufficient to prevent complete freezing of the water column over the winter.

The ground profile was simulated using typical properties of the in-tact competent basalt bedrock. The thermal properties were assumed as follows:

- Bulk dry density = 2,850 $kg.m^{-3}$
- Porosity = 0.05
- Degree of saturation = 100%
- Thermal conductivity (unfrozen and frozen) = 260 $kJ.m^{-1}.day^{-1}.°C^{-1}$
- Volumetric heat capacity (unfrozen) = 2,238 $kJ.m^{-3}.°C^{-1}$
- Volumetric heat capacity (frozen) = 2,133 $kJ.m^{-3}.°C^{-1}$

The bottom boundary was assigned a geothermal heat flux calculated from the local geothermal gradient and the thermal conductivity of the bedrock. The ground temperature measured inside drill hole SRK-50 indicates a geothermal gradient of about 11.4 $°C.km^{-1}$ between 75 to 200 m (bottom of drill hole) below ground surface (SRK 2005). Such geothermal gradient suggests a permafrost depth in the order of 550 m. Deep ground temperatures reported by EBA (1996) for Boston Camp indicate a geothermal gradient of 18 $°C.km^{-1}$ and an estimated permafrost depth of 563 m (Golder 2001). A geothermal gradient of 12 $°C.km^{-1}$ was adopted for the simulation, and consequently, the bottom boundary was assigned a geothermal heat flux of 3,120 $J.day^{-1}$.

The thermal modelling was carried out using the finite element code SVHEAT version 4.51 developed by SoilVision Systems Ltd. SVHEAT models heat transport for both steady-state or time-dependent analyses. It incorporates the latent heat associated with phase changes of water. The geometry is treated as a 2D vertical cross-section. SVHEAT supports multiple boundary conditions as well as transient boundary conditions. Further details are available in the User's Manual of SVHEAT (SoilVision Systems 2005).

3 Modeling Results

The predicted permafrost distribution is illustrated in Figure 2. It shows that the ground is frozen down to elevation -130 m between the two lakes, or approximately 130 and 140 m below Doris and Tail Lakes respectively. The predicted permafrost depth is in the order of 400 m outside the influence of the lakes. Such depth is smaller than the permafrost depth suggested by the deep ground temperature measurements, which places the permafrost depth at about 550 m. The difference is indicative of the conservative assumptions that were adopted with the modelling.

Temperature profiles were extracted from the thermal modelling and were compared to field measurements (Figure 3). Three temperature profiles were compared: drill holes SRK-38, SRK-50 and EBA TDD-242 (Golder 2001). Their approximate locations are shown in Figure 1. Their distances from shoreline were used as the position to extract the temperature profile from the thermal model. The shoreline distances are 145 m from Tail Lake for SRK-38, 95 m from Doris Lake for SRK-50 and 200 m from Doris Lake for EBA TDD-242. Figure 3 compares the predicted ground temperature profiles (red lines) with the corresponding field measurements (blue lines). The measured ground temperatures are all colder than the predictions. It indicates that the thermal model underestimates the size of the permafrost. The predicted permafrost distribution shown in Figure 2 is therefore in all likelihood significantly smaller than would actually exist.

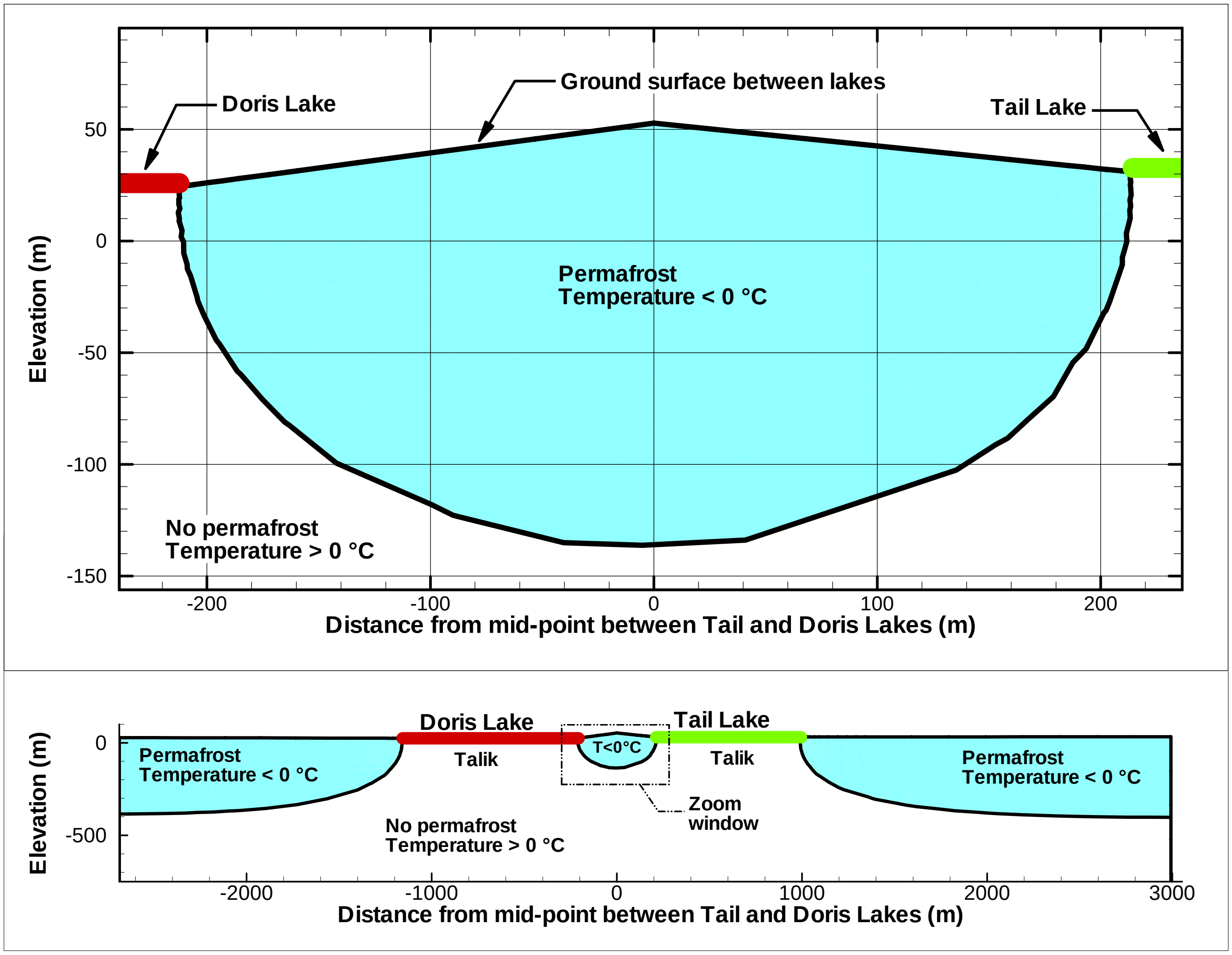


Figure 2: Permafrost location between Doris and Tail Lakes.

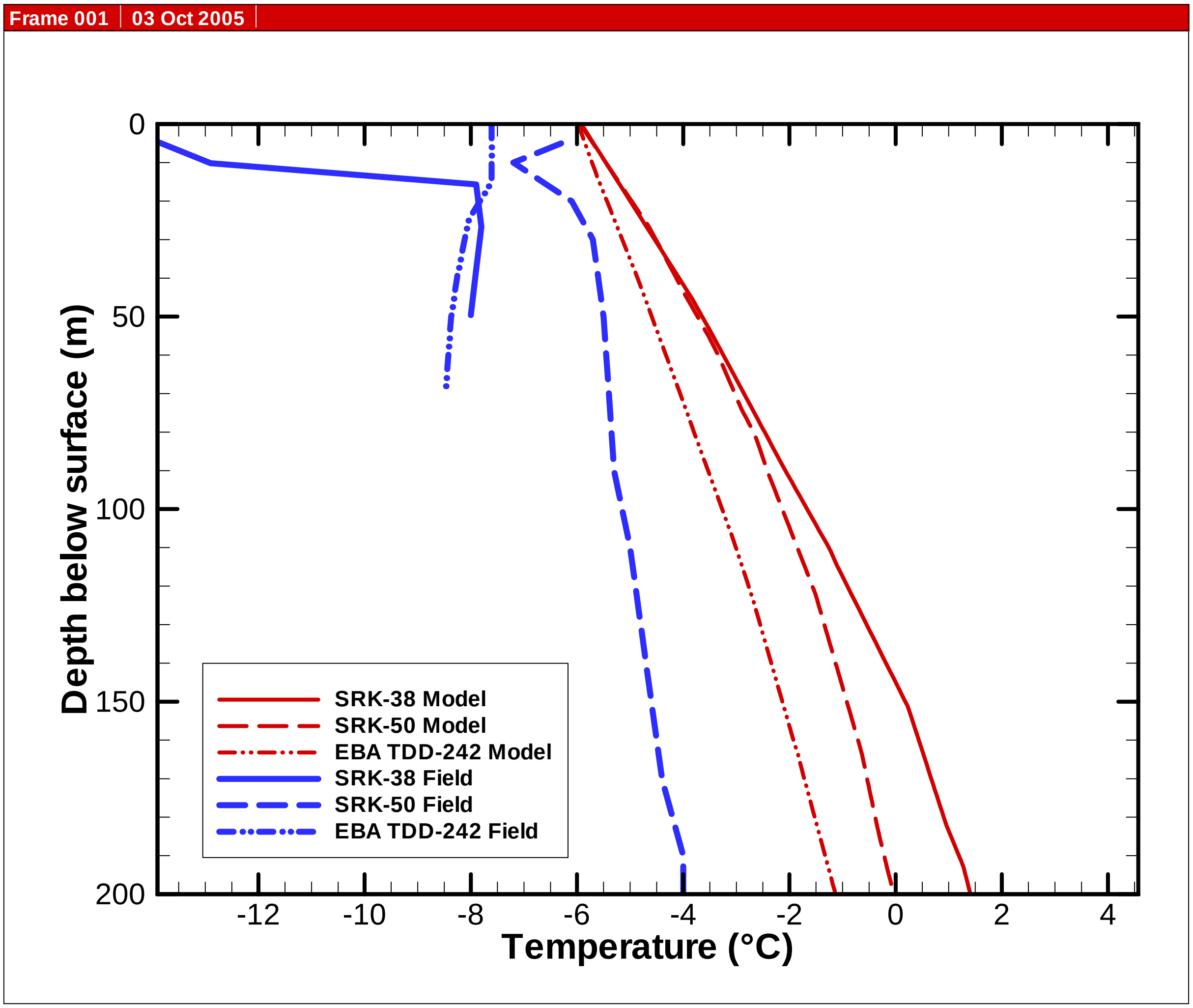


Figure 3: Comparison of predicted and ground temperature near Doris and Tail Lakes.

4 Conclusions

The thermal analysis presented herein confirms that there is a substantial section of permafrost between Doris and Tail Lakes (measuring 130 m deep and 425 m wide). Furthermore, a comparison between the thermal modeling results and data from three on-site thermistors confirm that the thermal model is in all likelihood underestimating the extent of permafrost between the two lakes in question.

Based on these results, combined with the fact that the materials between the two lakes is competent in-tact bedrock, supports the conclusion that groundwater flow between these two lakes are unlikely to occur.

5 REFERENCES

EBA. 1996. *Boston Gold Project, Surficial Geology and Permafrost Features*. Report submitted to Rescan Environmental Services Ltd.

Golder. 2001. *Report on Thermistor Data Review – Hope Bay Project.* Letter-report submitted to Miramar Mining Corporation, November 27.

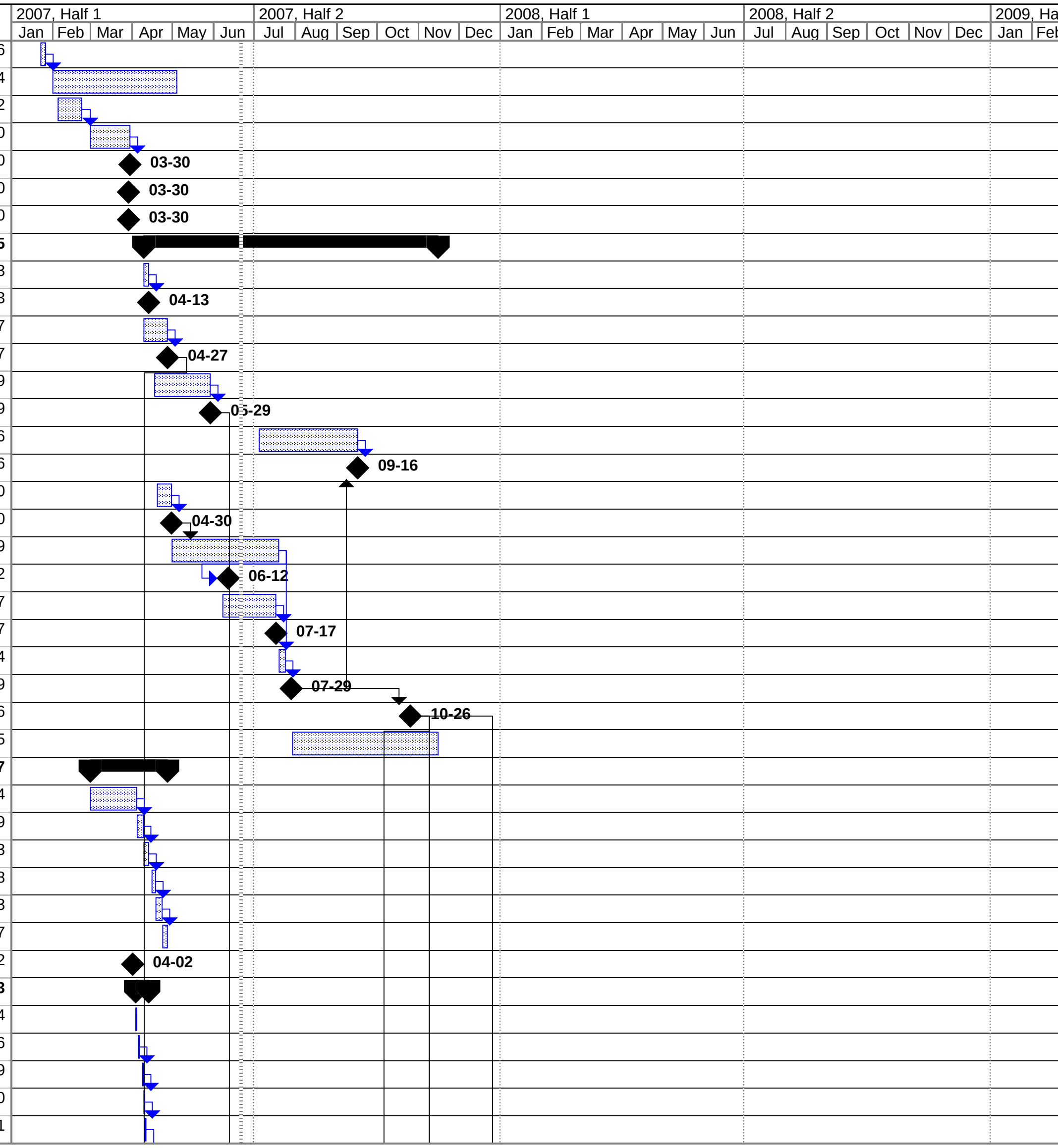
SoilVision Systems Ltd. 2005. *SVHeat User's Manual v.4*. Saskatoon, SK, Canada.

SRK Consulting (Canada) Inc. 2005. *Preliminary Tailings Dam Design, Doris North project, Hope Bay, Doris North Project*. Report submitted to Miramar Hope Bay Limited, October 2005.

APPENDIX D:
Project Construction Schedule

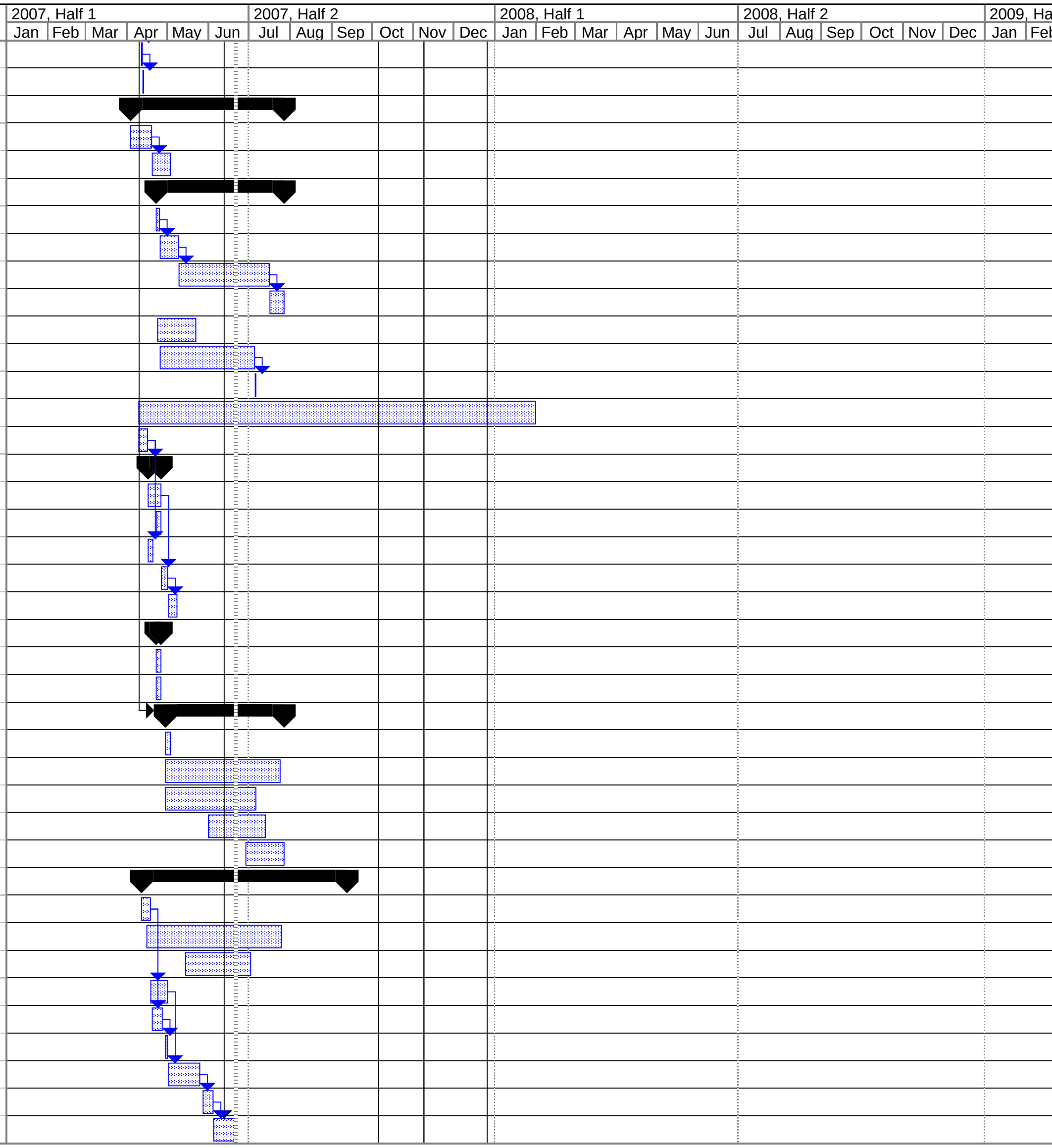
Doris North Gold Mine Project

ID		Task Name	Duration	Start	Finish
1		Kitnuna Equip Insp	4 days	Tue 07-01-23	Fri 07-01-26
2		Owner Windy Lake Airstrip	68 days	Thu 07-02-01	Fri 07-05-04
3		Kitnuna Negotiations	14 days	Mon 07-02-05	Thu 07-02-22
4		Interim Kitnuna Agreement	22 days	Thu 07-03-01	Fri 07-03-30
5		Finalized Kitnuna Agreement	0 days	Fri 07-03-30	Fri 07-03-30
6		Purch order mill bldg	0 days	Fri 07-03-30	Fri 07-03-30
7		NUNA Agreement	0 days	Fri 07-03-30	Fri 07-03-30
8		**Permitting Schedule**	**173 days**	**Tue 07-04-10**	**Thu 07-11-15**
9		MHBL application to KIA for HB Land Use An	4 days	Tue 07-04-10	Fri 07-04-13
10		KIA issues license amendment	0 days	Fri 07-04-13	Fri 07-04-13
11		MHBL Application to NRCan for Explosives S	14 days	Tue 07-04-10	Fri 07-04-27
12		NRCan issues permit for explosives storage	0 days	Fri 07-04-27	Fri 07-04-27
13		MHBL submits supplement for INAC Jetty Le	30 days	Wed 07-04-18	Tue 07-05-29
14		INAC issues foreshore lease for the jetty	0 days	Tue 07-05-29	Tue 07-05-29
15		MHBL negotiates surface leases with the KI/	60 days	Thu 07-07-05	Sun 07-09-16
16		KIA issues surface leases	0 days	Sun 07-09-16	Sun 07-09-16
17		Resubmission of DNorth Water License Appli	7 days	Fri 07-04-20	Mon 07-04-30
18		NWB accepts Application, starts 60 day Tech	0 days	Mon 07-04-30	Mon 07-04-30
19		Technical Review of Water License Applicatio	60 days	Tue 07-05-01	Thu 07-07-19
20		NWB Technical Meeting	0 days	Tue 07-06-12	Tue 07-06-12
21		MHBL submits revised application to Transpc	30 days	Fri 07-06-08	Tue 07-07-17
22		TC issues authorization for culvert constructic	0 days	Tue 07-07-17	Tue 07-07-17
23		NWB Water License Hearing	4 days	Fri 07-07-20	Tue 07-07-24
24		NWB issues Water License	0 days	Sun 07-07-29	Sun 07-07-29
25		Minister of INAC signs Water License	0 days	Fri 07-10-26	Fri 07-10-26
26		MMER Approval	90 days	Mon 07-07-30	Thu 07-11-15
27		**2007 Cat Train (CT)- Cam Bay to Site**	**43 days**	**Thu 07-03-01**	**Fri 07-04-27**
28		NUN-Kit marshall Cat Train	26 days	Thu 07-03-01	Wed 07-04-04
29		CT-1 Cam Bay-Wndy WHVN Equip	3 days	Thu 07-04-05	Mon 07-04-09
30		CT-2 Cam Bay-R Bay Equip Fuel	4 days	Tue 07-04-10	Fri 07-04-13
31		CT-3 Cam Bay R Bay fuel	3 days	Mon 07-04-16	Wed 07-04-18
32		CT-4 Cam Bay R Bay fuel	3 days	Thu 07-04-19	Mon 07-04-23
33		CT-5 Cam Bay R Bay fuel	4 days	Tue 07-04-24	Fri 07-04-27
34		Set up Airfreight contract	0 days	Mon 07-04-02	Mon 07-04-02
35		**Heavy Air Freight Program**	**8 days**	**Wed 07-04-04**	**Fri 07-04-13**
36		Hercules Flight - 1(Patch Lk drill & Cont't)	1 day	Wed 07-04-04	Wed 07-04-04
37		Hercules Flight - 2 (2nd drill and comp'r)	1 day	Fri 07-04-06	Fri 07-04-06
38		Hercules Flight - 3 (Cat 980 Cam Bay)	1 day	Mon 07-04-09	Mon 07-04-09
39		Hercules Flight - 4 (Cat 980 Cam Bay, htrs,m	1 day	Tue 07-04-10	Tue 07-04-10
40		Hercules Flight - 5 (p/u, Mech trk, Lt towers)	1 day	Wed 07-04-11	Wed 07-04-11



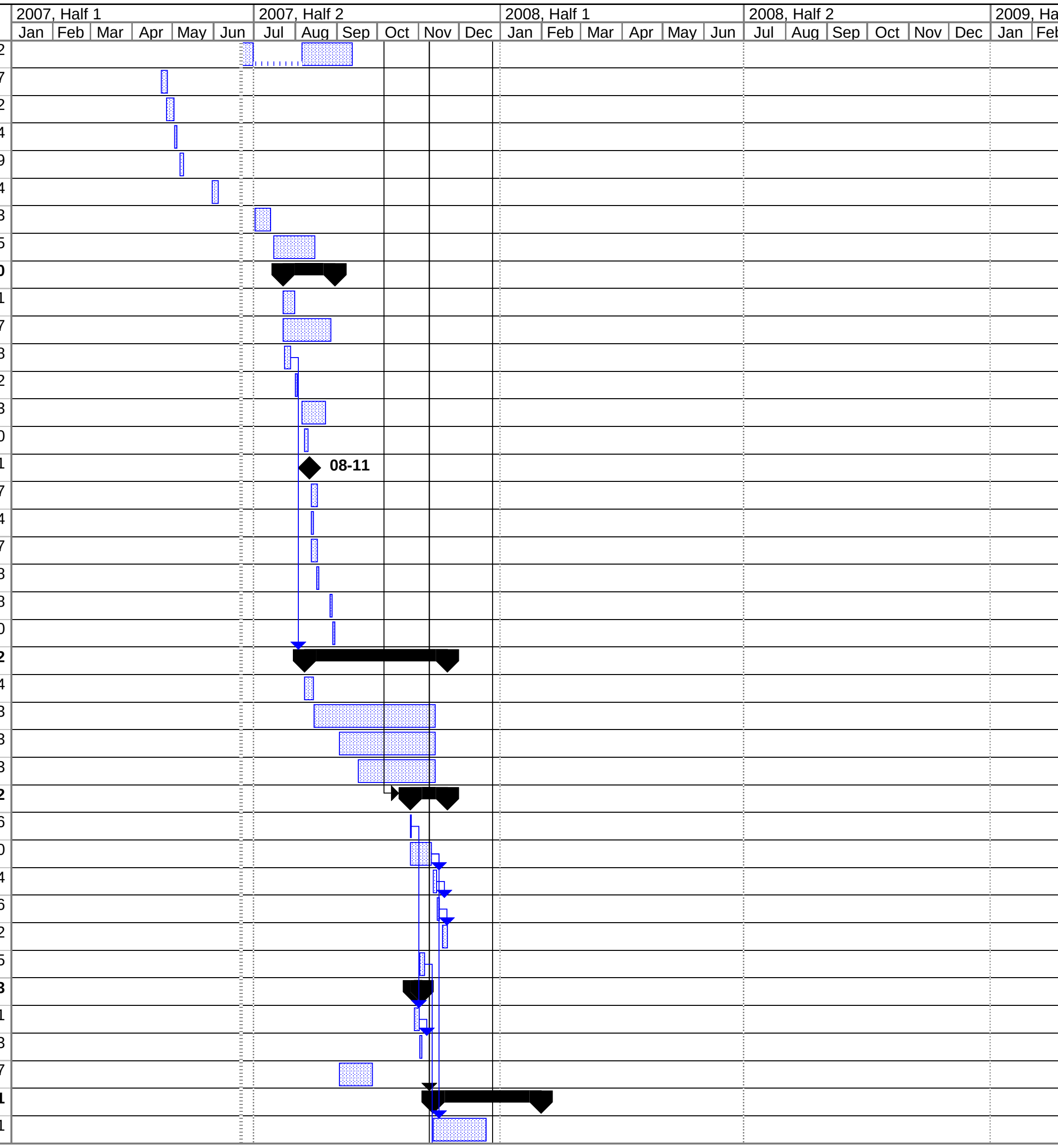
Doris North Gold Mine Project

ID	Task Name	Duration	Start	Finish
41	Hercules Flight - 6 (CS563 Grid pckr, sprs lut	1 day	Thu 07-04-12	Thu 07-04-12
42	Hercules Flight - 7 (Misc Equip, Spares,Lube:	1 day	Fri 07-04-13	Fri 07-04-13
43	**Ball Mills refurbishment program**	**86 days**	**Wed 07-04-04**	**Fri 07-07-27**
44	Hay River / Ball Mill Clean Up	12 days	Wed 07-04-04	Thu 07-04-19
45	Hay R / Ball Mill Inspection	10 days	Fri 07-04-20	Thu 07-05-03
46	**1250 HP Synchr Motor**	**73 days**	**Mon 07-04-23**	**Fri 07-07-27**
47	Motor Insp TWMI	3 days	Mon 07-04-23	Wed 07-04-25
48	Ship Motor to TWMI	10 days	Thu 07-04-26	Wed 07-05-09
49	Motor refurb at TWMI	50 days	Thu 07-05-10	Mon 07-07-16
50	Return Motor to NTCL	10 days	Tue 07-07-17	Fri 07-07-27
51	Order/deliver mill parts* (excludes motor)	21 days	Tue 07-04-24	Tue 07-05-22
52	Refurbish mills	53 days	Thu 07-04-26	Thu 07-07-05
53	Load mill NTCL	1 day	Fri 07-07-06	Fri 07-07-06
54	Operate Const Helicopter Service	228 days	Tue 07-04-10	Thu 08-01-31
55	Mob const crew Windy Camp	5 days	Tue 07-04-10	Mon 07-04-16
56	**Weatherhaven Emergency Shelter-Kitnuna**	**8 days**	**Tue 07-04-17**	**Thu 07-04-26**
57	Set Up WHVN Dorm and Kitchen@ Robert's	8 days	Tue 07-04-17	Thu 07-04-26
58	Install shelter Services	4 days	Mon 07-04-23	Thu 07-04-26
59	Set Up WHVN Dorms @ Windy	4 days	Tue 07-04-17	Fri 07-04-20
60	Set up NUNA equip mtnc struc	3 days	Fri 07-04-27	Tue 07-05-01
61	Build winter road network	5 days	Wed 07-05-02	Tue 07-05-08
62	**Communications**	**4 days**	**Mon 07-04-23**	**Thu 07-04-26**
63	Install Two-way Radio System - DanMax	4 days	Mon 07-04-23	Thu 07-04-26
64	Commission Ind Sat Phones	4 days	Mon 07-04-23	Thu 07-04-26
65	**Quarry No 1 Initial Program**	**68 days**	**Mon 07-04-30**	**Fri 07-07-27**
66	Open Quarry No 1	4 days	Mon 07-04-30	Thu 07-05-03
67	Drill / Blast Program	65 days	Mon 07-04-30	Tue 07-07-24
68	RoQ Mass Fills	52 days	Mon 07-04-30	Fri 07-07-06
69	Sorting <150mm Sub Base Material	33 days	Fri 07-06-01	Fri 07-07-13
70	Stockpiling RoQ Material	23 days	Fri 07-06-29	Fri 07-07-27
71	**Rock Excavation / ROQ Fill Program**	**118 days**	**Thu 07-04-12**	**Wed 07-09-12**
72	Prep Rock exc equip	5 days	Thu 07-04-12	Wed 07-04-18
73	Drill / Blast program Quarry No 1	76 days	Mon 07-04-16	Wed 07-07-25
74	Prepare Sub Base Capping 150mm (-)	37 days	Tue 07-05-15	Mon 07-07-02
75	Construct Temporary Magazine Area	9 days	Thu 07-04-19	Tue 07-05-01
76	Construct Temporary Fuel Area	6 days	Fri 07-04-20	Fri 07-04-27
77	Install Temp Fuel area Cont't	2 days	Mon 07-04-30	Tue 07-05-01
78	Place Beach Laydown Area	18 days	Wed 07-05-02	Fri 07-05-25
79	Place Beach Approach Road	6 days	Mon 07-05-28	Mon 07-06-04
80	Place Jetty	12 days	Tue 07-06-05	Wed 07-06-20



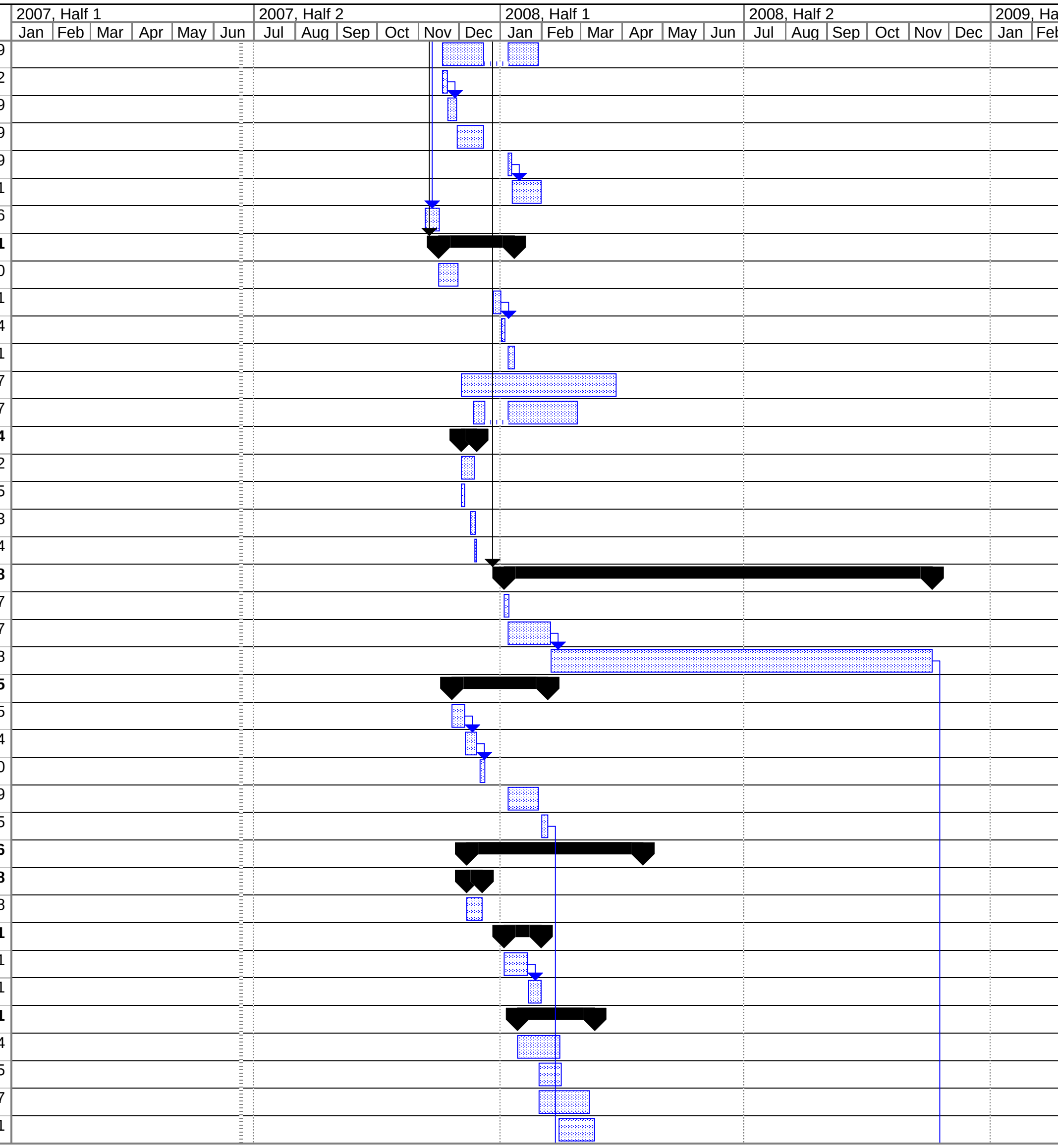
Doris North Gold Mine Project

ID		Task Name	Duration	Start	Finish
81		Place Sub-base Cap'g Beach Area	41 days	Thu 07-06-21	Wed 07-09-12
82		Set up Temp Fuel Containment	5 days	Mon 07-04-23	Fri 07-04-27
83		Reloc/Set Pat Lk Tanks Temp Fuel Storage	4 days	Fri 07-04-27	Wed 07-05-02
84		Move U/G Mining Equip to Portal	2 days	Thu 07-05-03	Fri 07-05-04
85		Reloc Existing Expl Mags Temp Loc	3 days	Mon 07-05-07	Wed 07-05-09
86		Temp Float Plane Dock Rob Bay	3 days	Thu 07-05-31	Mon 07-06-04
87		Install temp barge mooring	10 days	Mon 07-07-02	Fri 07-07-13
88		Dept of Fisheries Foreshore Closure	25 days	Mon 07-07-16	Wed 07-08-15
89		**2007 Sealift**	**33 days**	**Mon 07-07-23**	**Thu 07-08-30**
90		Top up fuel tanks	8 days	Mon 07-07-23	Tue 07-07-31
91		Offload barges establish laydown	30 days	Mon 07-07-23	Mon 07-08-27
92		Unload / Move Crshg Plnt to No 1 Quarry	5 days	Tue 07-07-24	Sat 07-07-28
93		Unload + store ball mills	2 days	Wed 07-08-01	Thu 07-08-02
94		Set-up NUNA Fabric bldg at beach	16 days	Mon 07-08-06	Thu 07-08-23
95		Set Perm Mags in Temp Area	3 days	Wed 07-08-08	Fri 07-08-10
96		Reg Inspection Temp Mags Inst	0 days	Sat 07-08-11	Sat 07-08-11
97		Load Perm Mags from Transcans	5 days	Mon 07-08-13	Fri 07-08-17
98		Set 3-Envirotanks & Fill	2 days	Mon 07-08-13	Tue 07-08-14
99		Return trip to Cam Bay	5 days	Mon 07-08-13	Fri 07-08-17
100		Unload & Stack Sand	2 days	Fri 07-08-17	Sat 07-08-18
101		Load wastes, etc. for return to HR	2 days	Mon 07-08-27	Tue 07-08-28
102		Moor Fuel Storage Barges - Freeze-in	2 days	Wed 07-08-29	Thu 07-08-30
103		**Crush/Screen Plant Beach**	**88 days**	**Wed 07-08-08**	**Thu 07-11-22**
104		Set up plant	5 days	Wed 07-08-08	Tue 07-08-14
105		Operate Plant / Stockpile / Place toppings	76 days	Wed 07-08-15	Tue 07-11-13
106		Place 150 mm product where possible	59 days	Mon 07-09-03	Tue 07-11-13
107		Place 38 mm product where possible	47 days	Mon 07-09-17	Tue 07-11-13
108		**Tote roads**	**22 days**	**Fri 07-10-26**	**Thu 07-11-22**
109		Road to new Temp Mag Area	1 day	Fri 07-10-26	Fri 07-10-26
110		Push Tote Road to Millsite	13 days	Fri 07-10-26	Sat 07-11-10
111		Push Tote Road to Magazines	3 days	Mon 07-11-12	Wed 07-11-14
112		Push Tote Road to Landfill	2 days	Thu 07-11-15	Fri 07-11-16
113		Push Tote Road to Fuel Storage	4 days	Mon 07-11-19	Thu 07-11-22
114		Push Tote Road to Doris Lake	3 days	Fri 07-11-02	Mon 07-11-05
115		**Temporary Magazines**	**6 days**	**Mon 07-10-29**	**Sat 07-11-03**
116		Place new Temp Mag Area	4 days	Mon 07-10-29	Thu 07-11-01
117		Relocate Temp Mags	2 days	Fri 07-11-02	Sat 07-11-03
118		Complete Jetty and Barge Moorings	22 days	Mon 07-09-03	Thu 07-09-27
119		**Mill Area Excavation Cut/Fill**	**59 days**	**Mon 07-11-12**	**Thu 08-01-31**
120		Mill Area D/B/Doze Exc'n	30 days	Mon 07-11-12	Fri 07-12-21



Doris North Gold Mine Project

ID		Task Name	Duration	Start	Finish
121		Sort & Place<150mm Sub Base Mtl	40 days	Mon 07-11-19	Tue 08-01-29
122		Portal Area Platform	4 days	Mon 07-11-19	Thu 07-11-22
123		Place Ancillary Building Area	5 days	Fri 07-11-23	Thu 07-11-29
124		Place Camp Area	14 days	Fri 07-11-30	Wed 07-12-19
125		Place Landfill Area Access Road	3 days	Mon 08-01-07	Wed 08-01-09
126		Perm Mag Area Access /Pad	16 days	Thu 08-01-10	Thu 08-01-31
127		Install Doris Lk water system	10 days	Tue 07-11-06	Fri 07-11-16
128		**Millsite Temporary Power Plant**	**41 days**	**Fri 07-11-16**	**Fri 08-01-11**
129		Pour Concrete Gensets Fndtns	11 days	Fri 07-11-16	Fri 07-11-30
130		Set Temp Gensets / Sychr Equip	4 days	Thu 07-12-27	Tue 08-01-01
131		Commission Mill Generators	3 days	Wed 08-01-02	Fri 08-01-04
132		Install initial Temp Elec Distribution	5 days	Mon 08-01-07	Fri 08-01-11
133		Winter Mntnc & Sec'ty crew	86 days	Mon 07-12-03	Thu 08-03-27
134		Set up Shanco Camp	45 days	Wed 07-12-12	Wed 08-02-27
135		**Weatherhaven Camp**	**10 days**	**Mon 07-12-03**	**Fri 07-12-14**
136		Set up WTRHVN Campsite at Beach	8 days	Mon 07-12-03	Wed 07-12-12
137		Move Dorm Units From Windy	3 days	Mon 07-12-03	Wed 07-12-05
138		Connect WTRHVN services	4 days	Mon 07-12-10	Thu 07-12-13
139		Provision & Commission Camp	2 days	Thu 07-12-13	Fri 07-12-14
140		**Mine Development**	**232 days**	**Fri 08-01-04**	**Tue 08-11-18**
141		Install Temp Power (125 kW)	2 days	Fri 08-01-04	Mon 08-01-07
142		Collar portal	24 days	Mon 08-01-07	Thu 08-02-07
143		UG Workings	207 days	Fri 08-02-08	Tue 08-11-18
144		**Place 38mm (-) topping**	**52 days**	**Mon 07-11-26**	**Tue 08-02-05**
145		Road to Millsite	8 days	Mon 07-11-26	Wed 07-12-05
146		Camp & Ancil Blgs Area	7 days	Thu 07-12-06	Fri 07-12-14
147		Portal Area	4 days	Mon 07-12-17	Thu 07-12-20
148		Millsite area (Partial)	17 days	Mon 08-01-07	Tue 08-01-29
149		Magazine Area	3 days	Fri 08-02-01	Tue 08-02-05
150		**Crushing Plant Prod'n Millsite**	**96 days**	**Fri 07-12-07**	**Wed 08-04-16**
151		**Crushing Plant**	**8 days**	**Fri 07-12-07**	**Tue 07-12-18**
152		Move plant and re-erect at Millsite	8 days	Fri 07-12-07	Tue 07-12-18
153		**Road & Pad Topping**	**20 days**	**Fri 08-01-04**	**Thu 08-01-31**
154		Produce 38mm (-) topping	12 days	Fri 08-01-04	Mon 08-01-21
155		Produce 150mm sub-base	8 days	Tue 08-01-22	Thu 08-01-31
156		**Tailings Dam(s) Components**	**43 days**	**Mon 08-01-14**	**Tue 08-03-11**
157		Sort Rip-Rap matls	24 days	Mon 08-01-14	Thu 08-02-14
158		Produce Frozen Core Mtl	13 days	Wed 08-01-30	Fri 08-02-15
159		Produce Core "Cover' Mtl	29 days	Wed 08-01-30	Fri 08-03-07
160		Produce Transition Mtl	20 days	Thu 08-02-14	Tue 08-03-11



Doris North Gold Mine Project

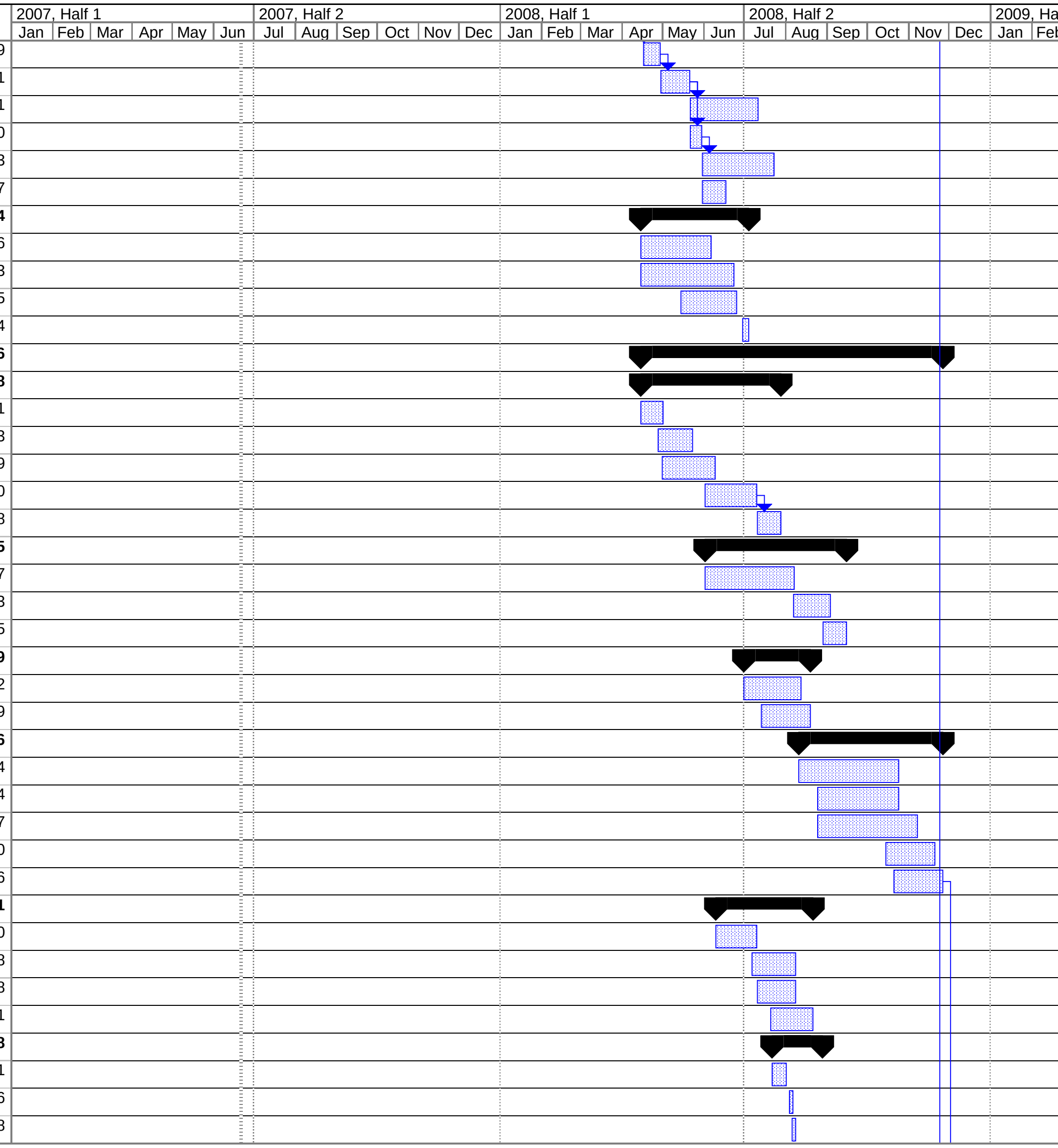
ID		Task Name	Duration	Start	Finish
161		**Topping & Concrete Aggregates**	**27 days**	**Wed 08-03-12**	**Wed 08-04-16**
162		Produce 38mm Nominal	15 days	Wed 08-03-12	Mon 08-03-31
163		Produce 20mm Nominal	15 days	Wed 08-03-12	Mon 08-03-31
164		Produce 13mm Nominal	15 days	Wed 08-03-12	Mon 08-03-31
165		Produce 8mm (-) sand	15 days	Wed 08-03-12	Mon 08-03-31
166		Produce 38mm (-) Topping Mtl	12 days	Tue 08-04-01	Wed 08-04-16
167		D/B/Doze/Stockpile Fuel Stor Area	6 days	Thu 07-12-27	Thu 08-01-03
168		Set up NUNA Bldg at Millsite	14 days	Fri 08-01-04	Wed 08-01-23
169		D/B/Doze/Stockpile Landfill Area	38 days	Fri 08-01-04	Tue 08-02-26
170		Re-Mob for dam work	3 days	Thu 08-01-10	Mon 08-01-14
171		Move Frozen Core equip into NUNA Bldg	10 days	Thu 08-01-24	Wed 08-02-06
172		Set Perm Mags & Complete Earthwks	9 days	Thu 08-02-07	Tue 08-02-19
173		Wint rd to dam sites	7 days	Tue 08-01-22	Wed 08-01-30
174		**South Road Bridge**	**13 days**	**Thu 08-01-24**	**Mon 08-02-11**
175		Prep brdge abutments	7 days	Thu 08-01-24	Fri 08-02-01
176		Place bridge Accesses	7 days	Thu 08-01-24	Fri 08-02-01
177		Set Bridge Beams & Deck	6 days	Mon 08-02-04	Mon 08-02-11
178		**North Tailings Dam**	**45 days**	**Wed 08-01-23**	**Fri 08-03-21**
179		Prep N Dam site + matls	7 days	Wed 08-01-23	Thu 08-01-31
180		Prep froz core kiln	4 days	Fri 08-02-08	Wed 08-02-13
181		Exc Key trench	2 days	Thu 08-02-14	Fri 08-02-15
182		Place geosyn clay liner	4 days	Mon 08-02-18	Thu 08-02-21
183		Set thermosyphons N Dam	3 days	Fri 08-02-22	Tue 08-02-26
184		Place N Dam incl froz core	20 days	Wed 08-02-27	Fri 08-03-21
185		Tote Road to South Tlgs Dam	5 days	Mon 08-02-18	Fri 08-02-22
186		**South Tailings Dam**	**32 days**	**Mon 08-02-25**	**Fri 08-04-04**
187		Prep S Dam site + mls	5 days	Mon 08-02-25	Fri 08-02-29
188		Exc Key trench	2 days	Sat 08-03-01	Mon 08-03-03
189		Place geosyn clay liner	4 days	Tue 08-03-04	Fri 08-03-07
190		Set S Dam thermosyphons	3 days	Mon 08-03-10	Wed 08-03-12
191		Place S Dam incl froz core	18 days	Thu 08-03-13	Fri 08-04-04
192		Move to Quarry No 3 if necessary	0 days	Wed 08-02-27	Wed 08-02-27
193		Build airstrip	20 days	Mon 08-03-17	Fri 08-04-11
194		Perm comms + NavAids	20 days	Wed 08-04-09	Tue 08-05-06
195		**Concrete Program**	**80 days**	**Tue 08-04-15**	**Thu 08-07-31**
196		Conc batching Fcility/Aggs	9 days	Tue 08-04-15	Fri 08-04-25
197		Process Plant	41 days	Wed 08-04-16	Mon 08-06-09
198		Mine Shop	23 days	Tue 08-06-10	Thu 08-07-10
199		Power Plant	12 days	Fri 08-07-11	Mon 08-07-28
200		Miscellaneous	11 days	Thu 08-07-17	Thu 08-07-31

2007, Half 1: Jan Feb Mar Apr May Jun | 2007, Half 2: Jul Aug Sep Oct Nov Dec | 2008, Half 1: Jan Feb Mar Apr May Jun | 2008, Half 2: Jul Aug Sep Oct Nov Dec | 2009, Half: Jan Feb

02-27

Doris North Gold Mine Project

ID	Task Name	Duration	Start	Finish
201	Construct fuel trans	9 days	Thu 08-04-17	Tue 08-04-29
202	Construct Fuel Storage Containment	16 days	Wed 08-04-30	Wed 08-05-21
203	Const fuel tnks+ppg+equip	39 days	Thu 08-05-22	Fri 08-07-11
204	Perm road to beach laydown	7 days	Thu 08-05-22	Fri 08-05-30
205	Perm road to S Dam	40 days	Sat 08-05-31	Wed 08-07-23
206	Construct Doris Lake Dock	14 days	Sat 08-05-31	Tue 08-06-17
207	**Con Mine Dismantling Program**	**61 days**	**Tue 08-04-15**	**Fri 08-07-04**
208	Pre-Eng Structure + Clean-up	40 days	Tue 08-04-15	Fri 08-06-06
209	Process Tanks/Equip + Clean-up	52 days	Tue 08-04-15	Mon 08-06-23
210	Miscellaneous Eqip/ Mtls + Clean-up	32 days	Thu 08-05-15	Wed 08-06-25
211	Barge Pick-up at Ykf	5 days	Mon 08-06-30	Fri 08-07-04
212	**Process Plant**	**164 days**	**Tue 08-04-15**	**Wed 08-11-26**
213	**Process Area Concrete**	**77 days**	**Tue 08-04-15**	**Mon 08-07-28**
214	Detailed Excavation Mill Bldg	13 days	Tue 08-04-15	Thu 08-05-01
215	Drill/set rock ancs mill bldg	20 days	Mon 08-04-28	Fri 08-05-23
216	Concrete Ext Strc Stl Ftgs	30 days	Thu 08-05-01	Mon 08-06-09
217	Process & Ancillary Equip Ftngs	30 days	Mon 08-06-02	Thu 08-07-10
218	Power Plant Foundations	12 days	Fri 08-07-11	Mon 08-07-28
219	**Structural Steel**	**77 days**	**Mon 08-06-02**	**Mon 08-09-15**
220	Mill Building Shell & Envelope	50 days	Mon 08-06-02	Thu 08-08-07
221	Interior Steel	20 days	Thu 08-08-07	Wed 08-09-03
222	Ancillary Steel	12 days	Fri 08-08-29	Mon 08-09-15
223	**Non-Process Mech/Ppg/Elec/Inst**	**36 days**	**Tue 08-07-01**	**Tue 08-08-19**
224	Mill non-process services	31 days	Tue 08-07-01	Tue 08-08-12
225	Mill HVAC & lighting	27 days	Mon 08-07-14	Tue 08-08-19
226	**Process Mech/Ppg/Elec Inst**	**78 days**	**Mon 08-08-11**	**Wed 08-11-26**
227	Mechanical	55 days	Mon 08-08-11	Fri 08-10-24
228	Piping	45 days	Mon 08-08-25	Fri 08-10-24
229	Electricasl	55 days	Mon 08-08-25	Fri 08-11-07
230	Instrumentation	27 days	Wed 08-10-15	Thu 08-11-20
231	Precommissioning	27 days	Tue 08-10-21	Wed 08-11-26
232	**Mine Shop**	**53 days**	**Tue 08-06-10**	**Thu 08-08-21**
233	Fdn Exc Conc	23 days	Tue 08-06-10	Thu 08-07-10
234	Steel Erection = Roofing / Siding	25 days	Mon 08-07-07	Fri 08-08-08
235	Floor Slabs	21 days	Fri 08-07-11	Fri 08-08-08
236	Elec / Mech / Misc Equip Inst	24 days	Mon 08-07-21	Thu 08-08-21
237	**2008 Sealift (at Roberts Bay)**	**28 days**	**Tue 08-07-22**	**Thu 08-08-28**
238	Fill Permanent Fuel Tanks	9 days	Tue 08-07-22	Fri 08-08-01
239	Fill Permanent Magazines	3 days	Mon 08-08-04	Wed 08-08-06
240	Unload + Move Tails Piping Materials	3 days	Wed 08-08-06	Fri 08-08-08



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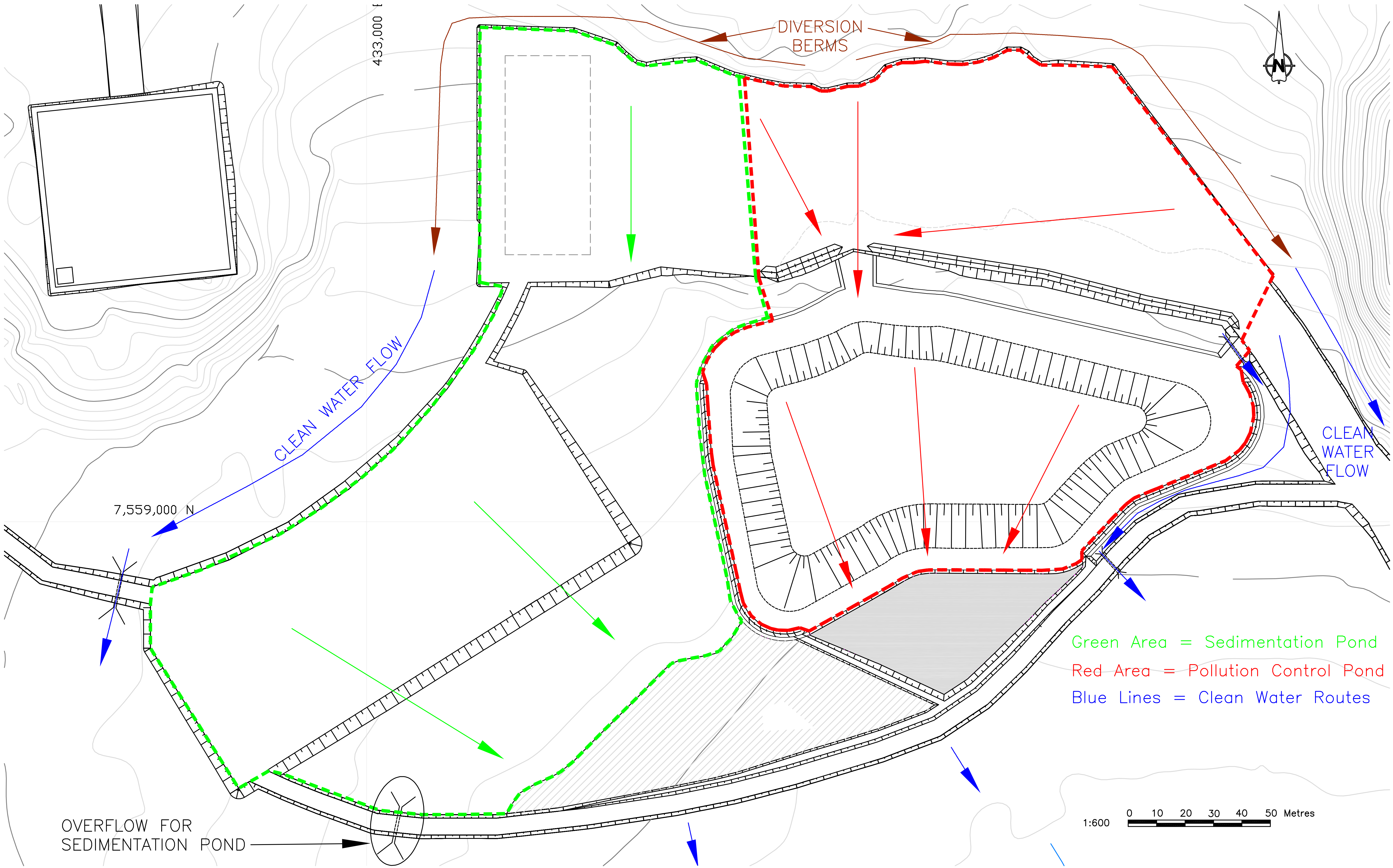
Engineers & Constructors

Doris North Gold Mine Project

ID		Task Name	Duration	Start	Finish
241		Unload Con Barge + move to Millsite	4 days	Fri 08-08-08	Wed 08-08-13
242		Unload Process / Ancil Equip Mtls	3 days	Thu 08-08-14	Mon 08-08-18
243		Unload Perm Gensets + Appurt's	3 days	Tue 08-08-19	Thu 08-08-21
244		Demob Const Equipment	3 days	Fri 08-08-22	Tue 08-08-26
245		Load wastes,etc for return trip	2 days	Wed 08-08-27	Thu 08-08-28
246		Set perm pow plant+start	22 days	Thu 08-08-21	Fri 08-09-19
247		**Permanent Power**	0 days	Fri 08-09-19	Fri 08-09-19
248		Taiis, Reclaim & Decant lines	32 days	Mon 08-08-04	Tue 08-09-16
249		Set Crushing Plant Perm Config	14 days	Mon 08-08-11	Thu 08-08-28
250		Crush mine wastes	45 days	Fri 08-08-29	Thu 08-10-30
251		Crush Ore	46 days	Fri 08-10-31	Fri 09-01-02
252		**Mine into prod'n phase**	21 days	Wed 08-11-19	Wed 08-12-17
253		**Commission + Start-up Mill**	17 days	Thu 08-11-27	Fri 08-12-19
254		**Full mine & mill production**	0 days	Fri 08-12-19	Fri 08-12-19

SNC·LAVALIN
Engineers & Constructors

APPENDIX E:
Figure 3.6 Revision


DIVERSION
BERMS
433,000 E
CLEAN WATER FLOW
7,559,000 N
CLEAN
WATER
FLOW
Green Area = Sedimentation Pond
Red Area = Pollution Control Pond
Blue Lines = Clean Water Routes
OVERFLOW FOR
SEDIMENTATION POND
1:600
0 10 20 30 40 50 Metres

APPENDIX F:
Contractor Procedures

CLIENT: Miramar Hope Bay Ltd..

PROJECT NAME: Doris North Project

PROJECT NUMBER:

INSTRUCTION TO DOCUMENT CONTROL

- [ ] Entire specification revised. Reissue all pages.
- [ ] Reissue revised pages only.

STAMP THE SPECIFICATION AS FOLLOWS:

- [x] Issued for comments.
- [ ] Issued for approval.
- [ ] Issued for quotation.
- [ ] Issued for purchase.
- [ ] Issued for construction.

SPECIFICATION REVISION INDEX

No.	Prepared By Date	Checked By Date	Area Manager Date	Client Approved Date	Pages Revised	Remarks
0	Larry Connell, May 04, 2007					1st Draft
1	Larry Connell, May 07, 2007					2nd Draft

TABLE OF CONTENTS

1. GENERAL

1.1 Scope of Specification

The Work refers to the construction site work at the Doris North Project site in Nunavut. This specification relates to environmental protection measures associated with the Work. It includes, but is not limited to:

- Protection of surface features (i.e. soils, vegetation, and permafrost);
- Protection of aquatic resources (i.e. lakes, streams, and other water courses/water bodies);
- Protection of air quality (i.e. with respect to noise, dust, and pollution);
- Protection of wildlife and wildlife habitat;
- Protection of heritage/archaeological resources.

The environmental protection measures include provision of suitable waste disposal means, including, but not limited to disposal of:

- Construction wastes;
- Sanitary wastes;
- Process wastes;
- Any other waste materials generated during the conduct of the Work.

Environmental protection, as it relates to the Work, requires adherence to all applicable Municipal, Territorial, and Federal Legislation, including Regulations, Orders, Standards, and Guidelines. It requires adherence to all conditions provided in the Miramar Hope Bay Ltd. documents referred to in Section 1.2 below. Environmental protection also includes obtaining and complying with provisions of all Permits, Permissions, Allowances and Licenses required by governing bodies for the conduct of the Work.

1.2 Reference Standards

The following publications shall be referred to for additional information with respect to commitments, legislation and regulations applicable to this Work:

- The Doris North Project Certificate issued by the Nunavut Impact Review Board (NIRB) in September of 2006;
- Land Use License KTL307C009 issued by the Kitikmeot Inuit Association
- The Nunavut Environmental Protection Act;
- The Nunavut Environmental Rights Act;
- The Nunavut Waters Act and the associated regulations under the Northwest Territories Waters Act
- Nunavut Environmental Guideline for General Management of Hazardous Waste;

- Nunavut Environmental Guideline for Dust Suppression;
- Nunavut Environmental Guideline for Waste Solvents
- Nunavut Environmental Guideline for Waste Paint;
- Nunavut Environmental Guideline for Waste Batteries;
- Nunavut Environmental Guideline for Waste Asbestos:
- Nunavut Environmental Guideline for Waste Antifreeze;
- Nunavut Environmental Guideline for Ozone Depleting Substances;
- Nunavut Environmental Guideline for Industrial Waste Discharges;
- Nunavut Environmental Guideline for Site Remediation;
- Nunavut Environmental Guideline for Air Quality – Sulphur Dioxide and Suspended Particulates;
- Nunavut Spill Contingency Planning and Reporting Regulations under the Nunavut EPA;
- Nunavut Transportation of Dangerous Goods Regulation;
- Nunavut Asbestos Safety Regulations;
- Nunavut Camp Sanitation Regulations:
- Nunavut Pesticide Act;
- Nunavut Pesticide Regulations;
- Nunavut Explosives Regulations under the Explosives Act;
- Environmental Guidelines for Management of Petroleum Storage Tanks;
- CCME Environmental Code of Good Practice for Aboveground Storage Tank Systems Containing Petroleum Products;
- The Canadian Environmental Protection Act;
- The Fisheries Act;
- NWT Mine, Health and Safety Act and Regulations;
- Fire Prevention Act of the NWT;
- Material Safety Data Sheets for Diesel Fuel and Ammonium Nitrate

Doris North Environmental Policy & Plans:

- Hope Bay Safety Policy;
- Miramar Hope Bay Ltd.’s Environmental Policy;
- Spill Contingency and Emergency Response Plan;
- Air Quality Management Plan;
- Noise Abatement Plan;
- Waste Rock Management Plan;
- Hazardous Materials Management Plan;
- Explosives Management Plan;
- Landfill Management Plan;
- Landfarm Management Plan;
- Tailings Management Plan;
- Water Management Plan;

- Quality Assurance Quality Control Plan;
- Mine Closure and Reclamation Plan;
- Monitoring and Follow-up Plan:
- Heritage Resource Protection Plan;
- Wildlife Monitoring and Management Plan;
- Wildlife Mitigation Plan;
- Fuel Dispensing Procedure;
- Environmental Protection Plan – Introduction. Appendix A contains the following procedures currently in place for Miramar Hope Bay Ltd.'s activities on the Hope Bay Belt:
  - Grubbing and Disposal of Related Debris;
  - Solid Waste Management;
  - Equipment Movement and Supply;
  - Maintenance of Buffer Zones from water bodies and archaeological sites;
  - Erosion Prevention;
  - Exploration Drilling;
  - Dust Control;
  - Working in or near water mitigation measures;
  - Dewatering of work areas;
  - Marine vessels;
  - Use of gasoline/diesel powered pumps and generators;
  - Noise Control;
  - Blasting on surface;
  - Use of Winter Trails;
  - Wildlife encounters; and
  - Discovery of Heritage Resources.

These documents have been placed on a CD ROM and are included with this document. The CD ROM is also accessible from the Miramar Mining Corporation office in North Vancouver (contact Larry Connell at lconnell@miramarmining.com or (604) 904-5579) and at Miramar Hope Bay Ltd.'s Windy Camp through the Environmental Coordinator (Matthew Kawei – mkawei@miramarmining.com or (604) 759-2286). Hard copies are also available for viewing at the Miramar Hope Bay Windy Camp.

1.3 Submittals

Unless otherwise noted, reference to the term "Manager" means the Construction Manager appointed by Miramar Hope Bay Ltd. To oversee all construction activity being carried out on the Doris North Project by the various construction contractors.

1.3.1 Initial Submissions

The Contractor shall submit the following to the Manager for review and acceptance prior to starting the Work or engaging in new aspects of the Work:

- Design

  Design of all environmental protection measures which are included in the Work or incidental thereto.

- Methodology

  Methodology for all environmental protection measures which are included in the Work or incidental thereto.

- Emergency Response Plan

  Emergency Response Plan for protection of the environment.

- Responsible Parties

  The names of all responsible parties to the Work and how these persons may be contacted at any time.

1.3.2 Intermittent Submissions

The Contractor shall submit evidence of valid Licenses, Permits, Permissions, and Approvals if requested by the Manager, and/or any governing body.

1.4 Definitions

ENVIRONMENT means all natural physical, chemical and biological components as well as all social, cultural and historic components the Doris North project area and any other geographic areas directly associated with the Work.

WATER BODY shall mean any body of water, whether moving or still, including, but not limited to, rivers, streams, creeks, lakes, ponds, marshes, sloughs, swamps, bogs, natural swales and/or ditches with water in them, and shall include the area bounded by these bodies up to and including the high water mark. A water body in this context is not defined by whether it contains aquatic life. Seasonal natural runoff pathways are considered to be water bodies under thus definition.

2. EXECUTION

3.1 General

The Contractor shall protect the environment to the satisfaction of the Manager, and to all agencies having regulatory jurisdiction, and assure the lowest degree of environmental degradation at the Site during and as a result of the Work.

Special care shall be taken to prevent petroleum products such as diesel fuel, gasoline and/or other hazardous substances from entering the soil or adjacent water systems, particularly when refuelling equipment.

Special care shall be taken to prevent any unnecessary damage to the land. During non-winter months no wheeled vehicles shall be operated off the Project's constructed all weather roads, pads or laydown areas. To protect the permafrost all construction of roads (initial placement of rockfill), pads or laydown areas must only be undertaken during months when the ground is still frozen. During winter months all vehicular travel must stay on the designated roads or winter trails. There must be sufficient snow cover on the winter trails (as designated by the Manager) to protect the underlying frozen tundra from vehicle damage.

3.2 Surface Features

3.2.1 Erosion Control

Exposed, erosion prone soils shall be protected from erosion by one or more of the following methods:

- Covering with a suitable material such as rockfill, crushed rock, natural fibre matting, geotextile and or plastic sheeting (only viable under summer conditions);
- Installation of erosion bars, stone check dams, and water diversion structures.

Ditches and waterways shall be protected from erosion by one or more of the following methods:

- Lining with an erosion resistant material;
- Construction of silt fences using suitable geotextile, or utilizing prefabricated silt fencing;
- Diversion of water around the erosive area using flexible pipe, corrugated steel pipe, or other suitable conduit;
- Installation of debris restrainers where there is potential for large debris to enter the watercourse.

Ditches and culverts shall be properly sized to accommodate anticipated flows.

Erosion protection measures shall be undertaken under the direction of the Manager.

Re-vegetation, if required, shall be by conducted by Miramar Hope Bay Ltd.

3.2.2 Vegetation and Permafrost Protection

The Contractor shall avoid unnecessary damage to vegetation, and the ground surface in the areas adjacent to the Work.

Removal or disturbance of the surface vegetation in permafrost areas has the potential to cause significant permafrost degradation. The Contractor shall not remove the surface vegetation or organic soils unless prior written approval has been obtained from the Manager.

3.3 Aquatic Resources

3.3.1 Watercourse Environmental Protection

A Watercourse Environmental Protection Zone shall exist within 50 metres of the high water mark of all water bodies, with the exception of onshore and offshore construction related activities, which will require site specific approval by the Manager.

If any of the Work is undertaken within a Watercourse Environmental Protection Zone, the Contractor is advised that conduct of the Work will require particular care to protect the environment.

Activities undertaken within a Watercourse Environmental Protection Zone shall be limited to that absolutely necessary for the performance of the Work. The following activities shall be undertaken within a Watercourse Environmental Protection Zone only with the specific approval of the Manager:

- Fuelling or servicing equipment;
- Washing of equipment;
- Disposal of waste materials, including, but not limited to, waste rock and soils, construction wastes, garbage, or any other materials;
- Blasting resulting in deposition of rock or other materials within the wet perimeter of a water body.

Work undertaken within a Watercourse Environmental Protection Zone shall be conducted as expeditiously as possible.

No fuels, oils, grease, or any other substance, including, but not limited to, paints, solvents, chemicals, cement, grout, or building materials may be stored within a Watercourse Environmental Protection Zone without the specific approval of the Manager.

Work within the wet perimeter of a water body shall be conducted under the inspection and with the approval of the Manager and the regulatory authority when required. Plans and methods for such Work shall be submitted to the Manager for approval prior to undertaking such Work.

Suitable diversions, coffer dams, and other structures shall be established prior to any Work within the wet perimeter of a water body where feasible.

The Contractor shall ensure that no substances deleterious to fish or fish habitat enter a water body or are placed in such a location that they could enter a water body. All hazardous materials shall be stored greater than 30 meters from any body of water.

Work in and about watercourses shall be avoided during times of fish spawning, aggregation, migrations, and other sensitive periods as defined by the regulatory agencies. Typically for the marine environment this period is from mid July thru August. Other blackout periods may vary depending upon the aquatic life use of the stream. Miramar Hope Bay Ltd.'s onsite Environmental Coordinator (Matthew Kawei - – mkawei@miramarmining.com or (604) 759-2286) should be consulted for information on such blackout periods before planning any in water activity.

3.3.2 Water Quality Protection

The Contractor shall detain, treat, or otherwise process all waters exiting the Site of the Work to ensure that suspended solids, sediments, concrete and/or grout wash water, oil and grease, or any other material is removed, to a level which meets the requirements of the regulatory authorities.

A sump shall be excavated to contain all excess concrete, laitance, and concrete wash water. The sump shall be located greater than 30 meters from watercourses to prevent accidental contamination of the water body. Materials collected in the sump shall be disposed of in a manner consistent with MHBL procedures and Territorial and local regulations. Additional information on such procedures can be obtained by consulting Miramar Hope Bay Ltd.'s onsite Environmental Coordinator (Matthew Kawei - – mkawei@miramarmining.com or (604) 759-2286).

All concrete forms used in and around watercourses shall be tight fitting to prevent concrete and laitance from contaminating the watercourse or soils. All water displaced from concrete forms during pouring of the concrete shall be directed into the above mentioned sump.

All cast in place concrete shall be totally isolated from flowing waters for a minimum curing period of 48 hours to allow the pH to reach neutral levels.

The Contractor shall control all water flowing through the Site of the Work to ensure such water does not become contaminated as a result of the Work.

The Contractor shall be responsible to ensure that all water exiting the area of their Work meets or exceeds Federal, Territorial or Municipal water quality standards for the activities being undertaken, and is in full compliance with all site permits and water license requirements.

For construction activities at the Doris North Project all water draining from any worksite or downstream of any required silt curtain must comply with the following water quality for total suspended solids (TSS) and visible oil and grease.

Parameter Being Monitored	Discharge Standard (mg/L)
pH	5.0 to 9.0
Total Suspended solids (TSS)	15
Oil and Grease	No visible sheen

TSS Limits may be lower than those stated herein, pending issue of Final Water License regulated limits and requirements.

3.4 Air Quality

3.4.1 Dust and Air Pollution Measures

The Contractor shall control dust emissions from the Work or activities incidental to the Work to the satisfaction of the Manager (see Nunavut Environmental Guideline for Dust Suppression for additional guidance). Miramar has committed to use no chemical dust suppressants at the Doris North Project site consequently use of water is the only viable dust suppressant allowable.

All equipment shall be fitted with standard emission control devices appropriate to the equipment and in compliance with Federal and Territorial regulations and standards (see Nunavut Environmental Guideline for Air Quality – Sulphur Dioxide and Suspended Particulates for additional guidance).

3.4.2 Burning

Burning of any material, except fuels in a piece of equipment designed to burn fuels, shall not be permitted except with the express written consent of the Manager. Burning will be limited to wood/timber/cardboard and only through an approved facility such as an incinerator. Burning of tires, plastics or waste fuels will not be permitted except under special circumstance and with approval of the Nunavut Department of Environment. Miramar Hope Bay Ltd. will not allow open burning on the permafrost.

All burning, as permitted above, shall be under the supervision of a responsible party at all times.

The Contractor shall have on-site suitable fire fighting equipment as approved by the Manager.

All burning shall be as specified by Federal and Territorial authorities. Valid permits and authorisations shall be obtained from the appropriate authorities and a copy of such shall be submitted to the Manager for any and all burning.

3.5 Wildlife and Wildlife Habitat

The Contractor shall avoid disturbance of wildlife and or disruption to wildlife habitat.

The Contractor shall provide “wildlife-proof” garbage disposal containers for all food scraps, lunchroom scraps, and other wastes which might attract wildlife.

Feeding of wildlife, including, but not limited to, bears, birds, and small mammals, shall not be permitted.

Site specific wildlife interaction procedures found within the Doris North Wildlife Mitigation Plan shall be followed.

3.6 Heritage/Archaeological Resources

The Contractor shall conduct activities so that social, cultural and historical resources are protected.

Archaeological sites or other sites of historic or cultural significance shall be protected. Disturbance of such sites in any manner shall not be permitted except with the express written consent of the Manager and the responsible governing body. Upon discovery or suspicion of discovery of a potential historic site or artefact work should cease and reference made to the Miramar Discovery of Heritage Resources Plan for guidance.

The Contractor shall observe all regulations concerning public health and is responsible for providing sanitation facilities if required. Sanitary waste shall be taken to an approved disposal site (see the Nunavut Camp Sanitation Regulations for additional guidance).

The Contractor shall ensure that their workforce does not adversely impact adjacent communities or individuals.

3.7 Petroleum Products

All fuelling must be conducted within a secondary containment facility. Diesel fuel storage shall be provided by Miramar Hope Bay Ltd. unless otherwise specified under contract.

Storage of other petroleum products by the contractor, including propane storage and lubricant storage shall be designed to meet or exceed the existing safety regulations of the appropriate Provincial/Territorial Petroleum Association, the National Fire Code, and the Workers' Compensation Board.

All personnel handling fuels shall be trained in Fuel Handling Procedures, and contingency measures for spillage and leakage of fuels. Additional information can be referenced from the Miramar Fuel Dispensing Procedure, the Miramar Hazardous Materials Management Plan, the Miramar Spill Contingency and Emergency Response Plan, the Nunavut Environmental Guideline for General Management of Hazardous Waste, the Environmental Guidelines for Management of Petroleum Storage Tanks, and the CCME Environmental Code of Good Practice for Aboveground Storage Tank Systems Containing Petroleum Products.

Contingency plans to deal with spillage or leakage of fuel shall consist of Contractor supplied absorbent materials as outlined in the Doris North Spill Contingency and Emergency Response Plan. These, and other requirements, shall be approved in writing by the Manager's Representative prior to the movement and use of petroleum products onto the Site of the Work by the Contractor.

Any spill of petroleum products by the Contractor greater than 0.5 litres shall be reported immediately to the Manager. Clean-up of such spills shall commence immediately by the Contractor. Reporting of petroleum spills to authorities shall be as set out in the appropriate legislation and regulations (Nunavut Spill Contingency Planning and Reporting Regulations under the Nunavut Environmental Protection Act). Such reporting is the responsibility of the Contractor causing the spill. However copies of all spill reports made to the NWT/NU Spill Report Line must be provided to the Construction Manager and to Miramar's onsite Environmental Coordinator (Matthew Kawei - – mkawei@miramarmining.com or (604) 759-2286) within 4 hours of the event.

Waste fuel, oil, solvents, and other petroleum products must be removed from site for disposal at a location which has been approved by the regulatory authorities. Waste materials such as oil cans, grease tubes; spent filters must be collected and packaged for off-site disposal. Oily rags and adsorbent pads shall be collected and properly disposed of by burning through the incinerator. Additional guidance on such disposal can be obtained by contacting Miramar's onsite Environmental Coordinator (Matthew Kawei - – mkawei@miramarmining.com or (604) 759-2286).

Hydrocarbon contaminated soil that requires remediation must be arranged through contact with Miramar's on-site environmental coordinator. No contaminated soil should be moved to the on-site landfarm with the specific written approval of Miramar's on site Environmental Coordinator.

Service trucks shall be equipped with suitable spill containment equipment including absorbent pads, containers to hold oil contaminated soils, and oil absorbent materials which can be used to collect spilled oil for disposal.

3.8 Sandblasting

All areas to be sandblasted shall be shrouded in such as way that all materials being used in the sandblasting, with the exception of the compressed air, are collected.

Collected sand, paint chips, and corroded materials shall be disposed of in accordance with government regulations (see Nunavut Environmental Guideline for General Management of Hazardous Waste) and after consultation with Miramar's on-site Environmental Coordinator.

Shrouding for sandblasting shall control dust from coming in contact with other workers (see Workers' Compensation Board Regulations) or the surrounding area.

Removal of shrouding shall be conducted in such a manner, that dust and materials which have collected in the shrouding are not released to the environment.

Shrouding shall be constructed of such materials that the structure and shrouding can withstand normal wind and storm events encountered during the period of Work for the area. Shrouding which becomes torn and/or inoperative due to weather conditions, or construction accidents, shall be repaired prior to resuming Work.

3.9 Painting

The following shall apply to the storage and disposal of painting materials:

- Materials used in painting shall be stored in such a manner that accidental release to the environment is prevented;
- Storage facilities shall be set back a minimum of 50 metres from the high water mark of watercourses. The storage facilities shall be diked or otherwise contained so that a release of all stored materials will be contained within the dike;

- Storage facilities shall be well away from other buildings, petroleum storage facilities, and other combustibles;
- Storage facilities shall be protected with suitable locks and closures against vandalism and wildlife;
- Disposal of used brushes, rags, solvents, and other materials shall be consistent with local and territorial (see Nunavut Environmental Guideline for Waste Paint and Waste Solvents).

3.10 Restoration and Reclamation

The Contractor shall coordinate with the Manager to ensure that all debris, waste, garbage and other materials not naturally found at the Site are removed at the completion of the Work, and that the Site is left in a neat and tidy condition satisfactory to the Manager.

All temporary structures shall be removed at the completion of the Work.

Soils and/or other materials contaminated by petroleum products, chemicals or other undesirable materials shall be cleaned up to the satisfaction of the Manager. Materials so fouled shall be excavated and hauled to an approved off-site disposal site, unless otherwise agreed in writing by the Manager’s Representative. Areas so fouled shall be repaired and restored to the satisfaction of the Manager.

Sediments collected in sediment control traps shall be removed at the completion of the Work. Sediment control traps shall be similarly removed unless otherwise directed by the Manager. These materials shall be disposed of in a manner satisfactory to the Manager.

All Work areas, staging sites, storage areas and other sites disturbed during the conduct of the Work shall be restored as directed by the Manager.

3.11 Domestic Waste

The Contractor shall store domestic solid waste and sewage in suitably designed containers. The stored wastes shall be disposed of as approved by the Manager.

END OF SPECIFICATION

APPENDIX G:
Doris Lake Level

REPORT ON

DORIS NORTH PROJECT

DORIS LAKE WATER LEVEL EFFECTS ANALYSIS

UPDATED SEPTEMBER 2005

Submitted to:

Miramar Mining Corporation
300 – 889 Harbourside Drive
North Vancouver, BC V7P 3S1

DISTRIBUTION:

1 Copy - Miramar Mining Corporation
1 Copy - Golder Associates Ltd.

September 2005 05-1373-008

Suggested Citation: Golder Associates Ltd. 2005. Doris North Project Doris Lake Water Level Effects Analysis – Revised September 2005. Prepared for Miramar Hope Bay Ltd. Golder Report No. 05-1373-008.2000: 16 p. + 2 app.

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1.0 INTRODUCTION

Meteorological and hydrological data from the Doris North Project baseline report (AMEC 2003) and subsequent monitoring (RL&L/Golder 2003) were used to assess the potential effects of water withdrawal, closed-circuiting and effluent discharges on Doris Lake water levels and Doris Lake Outflow discharges. This report describes the methods used to model the effects and the results of the analysis.

2.0 DATA AND METHOD

2.1 Data

Meteorology and hydrology data required for the analysis included:

- The derived weekly runoff series for Doris and Tail Lakes. These were based on gauging data from the Environment Canada station on the Ellice River (10QD001) and were provided by AMEC. The Ellice River station has a period of record from 1971 to present. However, data prior to 1984 were not used, on the advice of Environment Canada, and data from 1997 to 2000 were also discarded due to discontinuous data in those years;
- The monthly precipitation series for the Doris North area. The undercatch-corrected record presented in the baseline report (AMEC 2003) was used; and
- The Doris Lake Outflow stage-discharge rating curve. The open-water rating curve from the station installed at Doris Lake Outflow (RL&L/Golder 2003) was used.

Project water management activities that will affect Doris Lake water levels and Doris Lake Outflow discharges are described below.

Exploration Phase: There will be no withdrawals from Doris Lake and no discharges of effluent from Tail Lake.

Construction Phase: Water will be withdrawn from Doris Lake to supply potable water to the construction camp. Based on a 175-person camp and water use of 400 litres per person per day, this is estimated to be 70 m^3/d. Closed-circuiting of Tail Lake will reduce the Doris Lake watershed by approximately 5%. There will be no discharges of effluent from Tail Lake.

Operations Phase: Water will be withdrawn from Doris Lake to supply potable water to the mine camp. Based on a 175-person camp and water use of 400 litres per person per day, this is estimated to be 70 m^3/d. Process make-up water will be withdrawn from Doris Lake from October to May at a rate of 1182.4 m^3/d. Closed-circuiting of Tail Lake will reduce the Doris Lake watershed by approximately 5% of its 93.1 km^2 drainage area.

Water will be decanted from the Tail Lake tailings facility, from the first year of operations (assuming it meets MMER regulations prior to release), by pipeline to a discharge point on the Doris Lake Outflow. The quantity to be discharged each year has yet to be determined, but three scenarios have been suggested. These are described in Table 1.

Table 1 Project Raw Water Withdrawals and Effluent Discharges

Month	Hydrograph Ratio[a]	Total Annual and Monthly Discharges (m^3)		
		1,000,000	750,000	500,000
June	0.4284	428,358	321,269	214,179
July	0.2657	265,672	199,254	132,836
August	0.1119	111,940	83,955	55,970
September	0.1433	143,284	107,463	71,642
October	0.0500	50,000	37,500	25,000

(a) Proportion of annual runoff during mean conditions.

Closure Phase: Water will be withdrawn from Doris Lake to supply potable water to the mine camp. Based on a 175-person camp and water use of 400 litres per person per day, this is estimated to be 70 m^3/d. Closed-circuiting of Tail Lake will reduce the Doris Lake watershed by approximately 5% of its 93.1 km^2 drainage area. No process make-up water will be withdrawn from Doris Lake.

Water meeting MMER standards will be decanted from the Tail Lake tailings facility by pipeline to a discharge point on the Doris Lake Outflow, as described in Table 1.

Post-Closure Phase: There will be no withdrawals from Doris Lake and no discharges of effluent from Tail Lake. Tail Lake will discharge naturally to Doris Lake.

2.2 Method

A time series of daily discharges for the period June 1984 to May 1997 was prepared. The time series considered a mean annual water yield from Doris Lake of 134 mm. This is the sensitivity analysis case, as described by the Project hydrological design basis, and thus represents a conservative analysis.

Water levels, or stages, were calculated for open-water conditions (June to October) using the stage-discharge rating curve for the Doris Lake Outflow. From November to May, the lake outlet was assumed to be frozen, and increases in stage due to direct precipitation were calculated based on the derived monthly precipitation values, corrected for undercatch, as presented by AMEC (2003). The results of the analysis for natural mean conditions are shown in Table 2.

Table 2 Derived Doris Lake Monthly Stages for Natural Mean Conditions

Month	Water Yield[a] (mm)	Mean Discharge (m^3/s)	Calculated Stage[b] (m)
Jan	0.0	0.000	0.447
Feb	0.0	0.000	0.457
Mar	0.0	0.000	0.468
Apr	0.0	0.000	0.480
May	0.0	0.000	0.494
Jun	55.6	1.999	0.951
Jul	36.6	1.271	0.849
Aug	16.0	0.557	0.660
Sep	18.2	0.655	0.685
Oct	7.6	0.265	0.516
Nove	0.0	0.000	0.420
Dec	0.0	0.000	0.434

(a) For period June 1984 to May 1997

(b) Based on open water rating curve $Q = 4.1972\ Stage^{2.1253}$ (Arbitrary Datum)

The open-water rating curve was derived for a location approximately 50 m downstream of the lake outlet; however, the velocity head of the flow, which would be equal to the drawdown of the water surface elevation at the lake outlet, was found to be small and relatively insensitive to variations in discharge. Therefore, stage at the hydrometric station was taken as representative of the lake stage in this analysis.

Changes to flows due to the Project were applied to this water balance model to assess effects on Doris Lake water levels and Doris Lake Outflow discharges during the Construction, Operations and Closure phases of the Project. These are described in the following sections. No effects are anticipated during the Exploration and Post-Closure phases of the Project.

3.0 PROJECT MEAN CONDITIONS

3.1 Construction Phase

To estimate the effects of the Project during the Construction phase under mean conditions, the closed-circuiting of Tail Lake was considered first. Tail Lake discharges were subtracted from Doris Lake discharges, to produce a revised time series of Doris Lake discharges. Doris Lake stages were then calculated, again adjusting for direct precipitation during non-discharging months. The results of this calculation are shown in columns 4 and 5 of Table 3.

Withdrawals of water from Doris Lake to the Project were then applied to derive a time series of Doris Lake stages and discharges for Project conditions. The results of the analysis for mean conditions are shown in columns 6 and 7 of Table 3.

Because water will not be decanted from Tail Lake during the Construction phase of the Project, there will be no difference in Doris Lake Outflow discharge rate at points upstream and downstream of the proposed decant discharge point.

Table 3 Derived Doris Lake Monthly Stages and Discharges for Construction Phase (Mean Conditions)

	Natural Conditions		Tail Lake Closed-Circuited (No Withdrawal from Doris Lake)		Tail Lake Closed-Circuited and Withdrawal from Doris Lake	
Month	Doris Lake Mean Discharge (m^3/s)[a]	Tail Lake Mean Discharge (m^3/s)[a]	Doris Lake Net Mean Discharge (m^3/s)[a]	Doris Lake Mean Stage (m)[b]	Doris Lake Mean Stage (m)[b]	Doris Lake Net Mean Discharge (m^3/s)[a]
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Jan	0.000	0.000	0.000	0.447	0.446	0.000
Feb	0.000	0.000	0.000	0.457	0.455	0.000
Mar	0.000	0.000	0.000	0.468	0.465	0.000
Apr	0.000	0.000	0.000	0.480	0.476	0.000
May	0.000	0.000	0.000	0.494	0.490	0.000
Jun	1.999	0.100	1.899	0.939	0.936	1.892
Jul	1.271	0.048	1.222	0.841	0.841	1.221
Aug	0.557	0.014	0.542	0.656	0.656	0.541
Sep	0.655	0.019	0.636	0.680	0.679	0.635
Oct	0.265	0.005	0.260	0.514	0.517	0.259
Nov	0.000	0.000	0.000	0.420	0.420	0.000
Dec	0.000	0.000	0.000	0.434	0.433	0.000

(a) Derived based on Table 18 of Baseline Report (AMEC 2003)

(b) Based on open-water rating curve $Q = 4.1972\ Stage^{2.1253}$ (Arbitrary Datum)

3.2 Operations Phase

To estimate the effects of the Project during the Operations phase under mean conditions, the method described in Section 3.1 was used, considering the additional water withdrawal for process make-up water. The results of the analysis for mean conditions are shown Table 4.

Water will be decanted from Tail Lake (assuming it meets MMER regulations) to an outfall on the Doris Lake Outflow, starting in the first year of the Operations phase of the Project. Table 5 provides estimates of discharges in Doris Lake Outflow at points upstream and downstream of the outfall. Because the concern related to decant discharges is related to the potential for erosion or geomorphic change due to increased flows, the highest estimate of decant discharge rate (1,000,000 m^3/year in Table 1) was used in this analysis.

Table 4 Derived Doris Lake Monthly Stages and Discharges for Operations Phase (Mean Conditions)

	Natural Conditions		Tail Lake Closed-Circuited (No Withdrawal from Doris Lake)		Tail Lake Closed-Circuited and Withdrawal from Doris Lake	
Month	Doris Lake Mean Discharge (m^3/s)[a]	Tail Lake Mean Discharge (m^3/s)[a]	Doris Lake Net Mean Discharge (m^3/s)[a]	Doris Lake Mean Stage (m)[b]	Doris Lake Mean Stage (m)[b]	Doris Lake Net Mean Discharge (m^3/s)[a]
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Jan	0.000	0.000	0.000	0.447	0.420	0.000
Feb	0.000	0.000	0.000	0.457	0.419	0.000
Mar	0.000	0.000	0.000	0.468	0.419	0.000
Apr	0.000	0.000	0.000	0.480	0.420	0.000
May	0.000	0.000	0.000	0.494	0.423	0.000
Jun	1.999	0.100	1.899	0.939	0.894	1.796
Jul	1.271	0.048	1.222	0.841	0.841	1.221
Aug	0.557	0.014	0.542	0.656	0.656	0.541
Sep	0.655	0.019	0.636	0.680	0.679	0.635
Oct	0.265	0.005	0.260	0.514	0.505	0.246
Nov	0.000	0.000	0.000	0.420	0.415	0.000
Dec	0.000	0.000	0.000	0.434	0.417	0.000

(a) Derived based on Table 18 of Baseline Report (AMEC 2003)

(b) Based on open-water rating curve $Q = 4.1972\ Stage^{2.1253}$ (Arbitrary Datum)

Table 5 Derived Monthly Discharges for Operations Phase Downstream of Doris Lake Outflow Effluent Outfall (Mean Conditions)

	Natural Conditions		Tail Lake Effluent Decant Outfall Discharge (m^3/s)	Tail Lake Closed-Circuited (No Withdrawal from Doris Lake)		Tail Lake Closed-Circuited and Withdrawal from Doris Lake	
Month	Doris Lake Mean Discharge (m^3/s)	Tail Lake Mean Discharge (m^3/s)		Doris Lake Outlet Mean Discharge (m^3/s)	Mean Discharge Below Outfall (m^3/s)	Doris Lake Outlet Mean Discharge (m^3/s)	Mean Discharge Below Outfall (m^3/s)
Jan	0.000	0.000	-	0.000	0.000	0.000	0.000
Feb	0.000	0.000	-	0.000	0.000	0.000	0.000
Mar	0.000	0.000	-	0.000	0.000	0.000	0.000
Apr	0.000	0.000	-	0.000	0.000	0.000	0.000
May	0.000	0.000	-	0.000	0.000	0.000	0.000
Jun	1.999	0.100	0.165	1.899	2.064	1.796	1.961
Jul	1.271	0.048	0.099	1.222	1.321	1.221	1.321
Aug	0.557	0.014	0.042	0.542	0.584	0.541	0.583
Sep	0.655	0.019	0.055	0.636	0.691	0.635	0.690
Oct	0.265	0.005	0.019	0.260	0.279	0.246	0.265
Nov	0.000	0.000	-	0.000	0.000	0.000	0.000
Dec	0.000	0.000	-	0.000	0.000	0.000	0.000

3.3 Closure Phase

The effects of the Project during the Closure phase under mean conditions are identical with respect to Doris Lake water levels and Doris Lake Outflow discharges, and are presented in Table 3. However, during the Closure phase of the Project, water will be decanted from Tail Lake (assuming it meets MMER Regulations prior to discharge) to an outfall on the Doris Lake Outflow. Table 6 provides estimates of discharges in Doris Lake Outflow at points upstream and downstream of the outfall. Because the concern related to decant discharges is related to the potential for erosion or geomorphic change due to increased flows, the highest estimate of decant discharge rate (1,000,000 m^3/year in Table 1) was used in this analysis.

Table 6 Derived Monthly Discharges for Closure Phase Downstream of Doris Lake Outflow Effluent Outfall (Mean Conditions)

	Natural Conditions		Tail Lake Effluent Decant Outfall Discharge (m^3/s)	Tail Lake Closed-Circuited (No Withdrawal from Doris Lake)		Tail Lake Closed-Circuited and Withdrawal from Doris Lake	
Month	Doris Lake Mean Discharge (m^3/s)	Tail Lake Mean Discharge (m^3/s)		Doris Lake Outlet Mean Discharge (m^3/s)	Mean Discharge Below Outfall (m^3/s)	Doris Lake Outlet Mean Discharge (m^3/s)	Mean Discharge Below Outfall (m^3/s)
Jan	0.000	0.000	-	0.000	0.000	0.000	0.000
Feb	0.000	0.000	-	0.000	0.000	0.000	0.000
Mar	0.000	0.000	-	0.000	0.000	0.000	0.000
Apr	0.000	0.000	-	0.000	0.000	0.000	0.000
May	0.000	0.000	-	0.000	0.000	0.000	0.000
Jun	1.999	0.100	0.165	1.899	2.064	1.892	2.058
Jul	1.271	0.048	0.099	1.222	1.321	1.221	1.321
Aug	0.557	0.014	0.042	0.542	0.584	0.541	0.583
Sep	0.655	0.019	0.055	0.636	0.691	0.635	0.691
Oct	0.265	0.005	0.019	0.260	0.279	0.259	0.278
Nov	0.000	0.000	-	0.000	0.039	0.000	0.000
Dec	0.000	0.000	-	0.000	0.049	0.000	0.000

4.0 NATURAL VARIATION (WET AND DRY CONDITIONS)

To characterize the expected variation of stage and discharge, the mean, minimum and maximum monthly stages from the Doris Lake time series are presented in Tables 7 and the corresponding discharges are presented in Table 8. Table 9 describes discharges below the Doris Lake Outlet Effluent Outfall.

Table 7 Derived Mean and Extreme Monthly Stages for Doris Lake (Period of Record June 1984 to May 1997)

	Natural Conditions (Including Exploration Phase and Post-Closure Phase)			Construction Phase			Operations Phase			Closure Phase		
Month	Minimum Monthly Stage (m)	Mean Monthly Stage (m)	Maximum Monthly Stage (m)	Minimum Monthly Stage (m)	Mean Monthly Stage (m)	Maximum Monthly Stage (m)	Minimum Monthly Stage (m)	Mean Monthly Stage (m)	Maximum Monthly Stage (m)	Minimum Monthly Stage (m)	Mean Monthly Stage (m)	Maximum Monthly Stage (m)
Jan	0.259	0.447	0.647	0.257	0.446	0.645	0.232	0.420	0.619	0.257	0.446	0.645
Feb	0.270	0.457	0.651	0.268	0.455	0.649	0.232	0.419	0.613	0.268	0.455	0.649
Mar	0.280	0.468	0.656	0.277	0.465	0.653	0.232	0.419	0.607	0.277	0.465	0.653
Apr	0.295	0.480	0.661	0.292	0.476	0.658	0.236	0.420	0.602	0.292	0.476	0.658
May	0.313	0.494	0.669	0.309	0.490	0.665	0.243	0.423	0.599	0.309	0.490	0.665
Jun	0.825	0.951	1.105	0.807	0.936	1.087	0.784	0.894	1.050	0.807	0.936	1.087
Jul	0.649	0.849	1.026	0.645	0.841	1.012	0.645	0.841	1.012	0.645	0.841	1.012
Aug	0.488	0.660	0.872	0.485	0.656	0.863	0.485	0.656	0.863	0.485	0.656	0.863
Sep	0.521	0.685	0.963	0.518	0.679	0.951	0.517	0.679	0.951	0.518	0.679	0.951
Oct	0.372	0.516	0.673	0.376	0.517	0.674	0.353	0.505	0.669	0.376	0.517	0.674
Nov	0.225	0.420	0.608	0.225	0.420	0.608	0.220	0.415	0.602	0.225	0.420	0.608
Dec	0.242	0.434	0.634	0.241	0.433	0.633	0.226	0.417	0.618	0.241	0.433	0.633

Table 8 Derived Mean and Extreme Monthly Discharges from Doris Lake (Period of Record June 1984 to May 1997)

	Natural Conditions (Including Exploration Phase and Post-Closure Phase)			Construction Phase			Operations Phase			Closure Phase		
Month	Minimum Monthly Discharge (m^3/s)	Mean Monthly Discharge (m^3/s)	Maximum Monthly Discharge (m^3/s)	Minimum Monthly Discharge (m^3/s)	Mean Monthly Discharge (m^3/s)	Maximum Monthly Discharge (m^3/s)	Minimum Monthly Discharge (m^3/s)	Mean Monthly Discharge (m^3/s)	Maximum Monthly Discharge (m^3/s)	Minimum Monthly Discharge (m^3/s)	Mean Monthly Discharge (m^3/s)	Maximum Monthly Discharge (m^3/s)
Jan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Feb	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mar	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Apr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
May	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jun	1.294	1.999	2.809	1.229	1.892	2.655	1.132	1.796	2.559	1.229	1.892	2.655
Jul	0.488	1.271	2.246	0.477	1.221	2.137	0.477	1.221	2.137	0.477	1.221	2.137
Aug	0.169	0.557	1.277	0.166	0.541	1.232	0.166	0.541	1.232	0.166	0.541	1.232
Sep	0.211	0.655	1.785	0.208	0.635	1.710	0.207	0.635	1.709	0.208	0.635	1.710
Oct	0.075	0.265	0.542	0.073	0.259	0.529	0.061	0.246	0.516	0.073	0.259	0.529
Nov	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Dec	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 9 Derived Mean and Extreme Monthly Discharges Downstream of Doris Lake Outflow Effluent Outfall (Period of Record June 1984 to May 1997)

	Natural Conditions (Including Exploration Phase and Post-Closure Phase)			Construction Phase			Operations Phase			Closure Phase		
Month	Minimum Monthly Discharge (m^3/s)	Mean Monthly Discharge (m^3/s)	Maximum Monthly Discharge (m^3/s)	Minimum Monthly Discharge (m^3/s)	Mean Monthly Discharge (m^3/s)	Maximum Monthly Discharge (m^3/s)	Minimum Monthly Discharge (m^3/s)	Mean Monthly Discharge (m^3/s)	Maximum Monthly Discharge (m^3/s)	Minimum Monthly Discharge (m^3/s)	Mean Monthly Discharge (m^3/s)	Maximum Monthly Discharge (m^3/s)
Jan	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Feb	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mar	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Apr	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
May	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Jun	1.294	1.999	2.809	1.229	1.892	2.655	1.298	1.961	2.724	1.394	2.058	2.821
Jul	0.488	1.271	2.246	0.477	1.221	2.137	0.576	1.321	2.237	0.576	1.321	2.237
Aug	0.169	0.557	1.277	0.166	0.541	1.232	0.208	0.583	1.274	0.208	0.583	1.274
Sep	0.211	0.655	1.785	0.208	0.635	1.710	0.262	0.690	1.764	0.263	0.691	1.765
Oct	0.075	0.265	0.542	0.073	0.259	0.529	0.080	0.265	0.534	0.092	0.278	0.548
Nov	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Dec	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

5.0 DISCUSSION

Changes to Doris Lake water levels and discharges will be largest during the Operations phase of the Project and smaller during the Construction and Closure phases of the Project. No effects are anticipated during the Exploration and Post-Closure phases of the Project.

Figure 1 shows the derived mean monthly water levels for Doris Lake, and Figure 2 shows the derived mean monthly discharges from Doris Lake, for each phase of the Project. The data presented on Figure 1 show that effects on lake water levels will be small. The largest effects will occur due to the winter drawdown of Doris Lake for water supply to the project, and the largest effects on lake discharge will occur during spring runoff, also due to drawdown over the preceding winter. From June to September, changes in water levels and discharges are primarily due to the closed-circuiting of Tail Lake; from October to May, changes in water levels and discharges are primarily due to direct withdrawals of water from Doris Lake. This is because Tail Lake does not naturally contribute water to Doris Lake under frozen conditions.

Figure 3 shows the derived mean monthly discharges in the Doris Lake Outflow, downstream of the effluent outfall. It shows that water decanted from Tail Lake will generally cause discharges in the outflow to be equal to, or slightly larger than, those occurring under natural conditions.

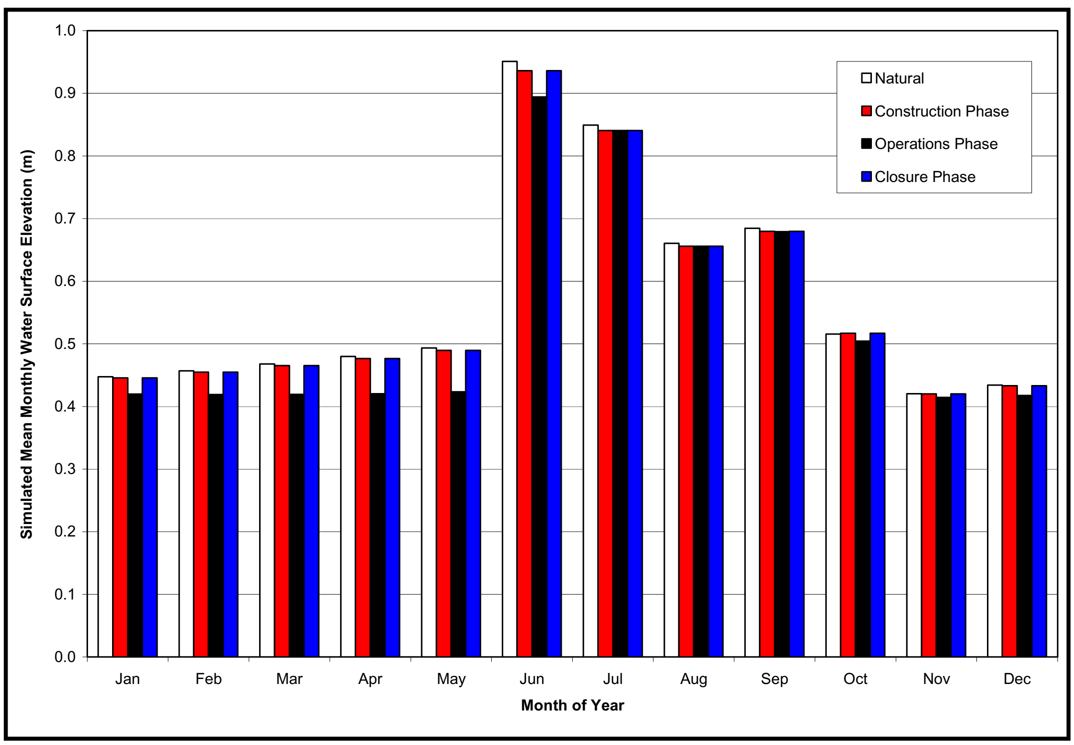

Figure 1 Derived Mean Monthly Doris Lake Water Levels by Project Phase (Mean Conditions, Arbitrary Datum)

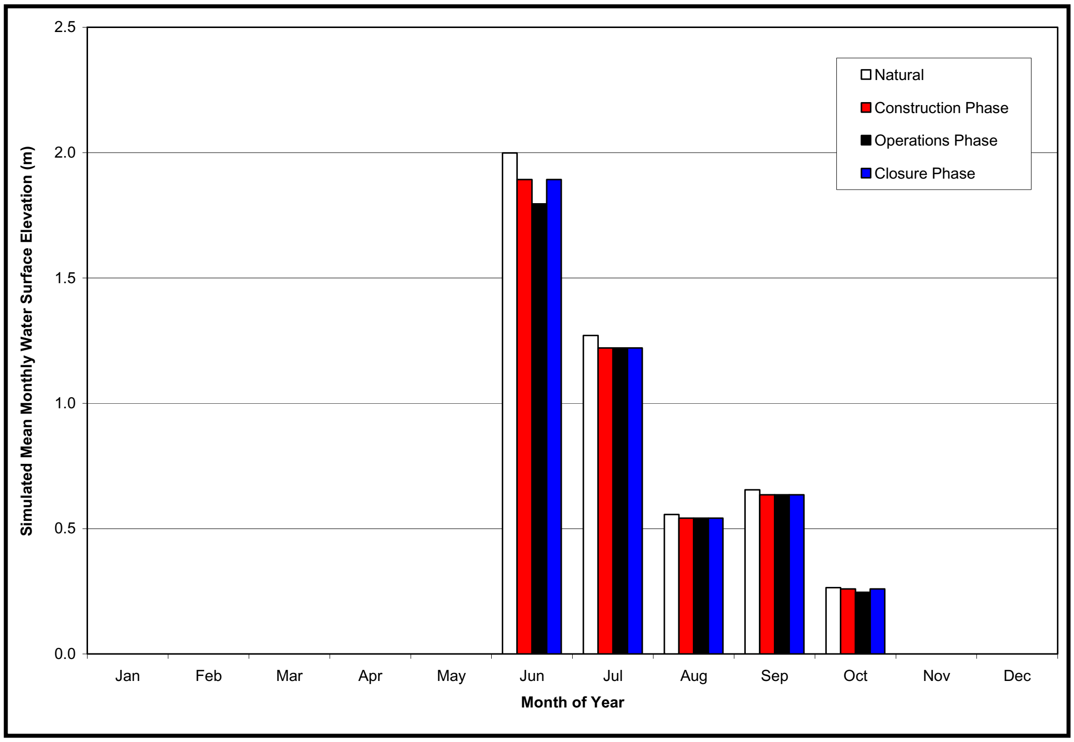

Figure 2 Derived Mean Monthly Doris Lake Outlet Discharges by Project Phase (Mean Conditions)

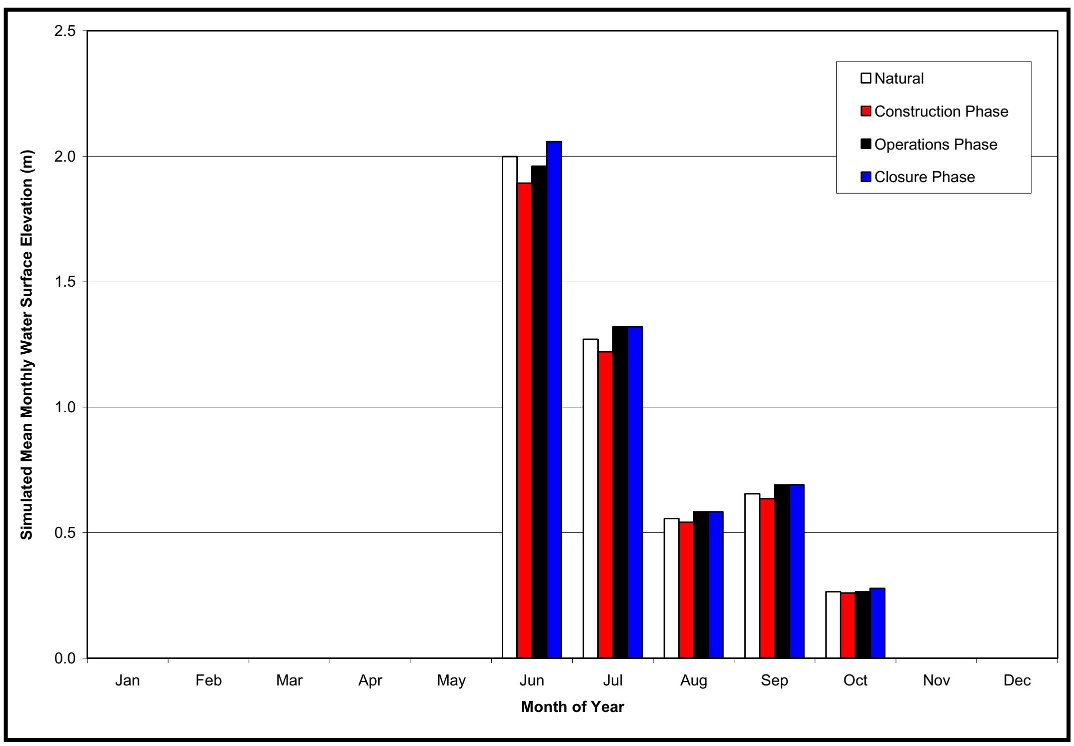

Figure 3 Derived Mean Monthly Discharges Below Doris Lake Outflow Effluent Outfall by Project Phase (Mean Conditions)

Mean monthly and extreme monthly water level data for Doris Lake, as well as calculated changes due to the Project, are presented in Table 10, and mean monthly and extreme monthly discharge data for Doris Lake Outflow, as well as calculated changes due to the Project, are presented in Table 11. Both of these tables are based on the Operations phase of the project, where changes will be the greatest. Table 12 presents mean monthly and extreme monthly discharge data for Doris Lake Outflow below the effluent outfall, as well as calculated changes due to the Project. This table is based on the Closure phase of the project, where increases in discharge will be the greatest.

Table 10 - Derived Changes to Doris Lake Water Levels due to the Project (Operations Phase)

Month	Mean Conditions			Conditions of Maximum Change		
	Natural	EIS Case (Operations)		Natural	EIS Case (Operations)	
	WL (m) [a]	WL (m) [a]	Δ WL (m)	WL (m) [a]	WL (m) [a]	Δ WL (m)
Jan	0.447	0.420	-0.028	0.259	0.232	-0.027
Feb	0.457	0.419	-0.038	0.270	0.232	-0.038
Mar	0.468	0.419	-0.049	0.280	0.232	-0.048
Apr	0.480	0.420	-0.059	0.295	0.236	-0.059
May	0.494	0.423	-0.070	0.313	0.243	-0.070
Jun	0.951	0.894	-0.057	0.876	0.784	-0.093
Jul	0.849	0.841	-0.009	1.026	1.012	-0.014
Aug	0.660	0.656	-0.005	0.872	0.863	-0.009
Sep	0.685	0.679	-0.005	0.963	0.951	-0.012
Oct	0.516	0.505	-0.011	0.623	0.615	-0.008
Nov	0.420	0.415	-0.006	0.225	0.220	-0.005
Dec	0.434	0.417	-0.017	0.242	0.226	-0.016

(a) Water levels are referenced to an arbitrary datum and do not reflect lake depth

Table 11 - Derived Changes to Doris Lake Outlet Discharges due to the Project (Operations Phase)

Month	Mean Conditions				Conditions of Maximum Change[a]			
	Natural	EIS Case (Operations)			Natural	EIS Case (Operations)		
	Q (m^3/s)	Q (m^3/s)	ΔQ (m^3/s)	% Change	Q (m^3/s)	Q (m^3/s)	ΔQ (m^3/s)	% Change
Jan	0.000	0.000	0.000	-	0.000	0.000	0.000	-
Feb	0.000	0.000	0.000	-	0.000	0.000	0.000	-
Mar	0.000	0.000	0.000	-	0.000	0.000	0.000	-
Apr	0.000	0.000	0.000	-	0.000	0.000	0.000	-
May	0.000	0.000	0.000	-	0.000	0.000	0.000	-
Jun	1.999	1.796	0.203	-10.2%	2.809	2.559	0.250	-8.9%
Jul	1.271	1.221	0.049	-3.9%	2.246	2.137	0.108	-4.8%
Aug	0.557	0.541	0.015	-2.7%	1.277	1.232	0.046	-3.6%
Sep	0.655	0.635	0.020	-3.1%	1.785	1.709	0.077	-4.3%
Oct	0.265	0.246	0.019	-7.1%	0.542	0.516	0.026	-4.9%
Nov	0.000	0.000	0.000	-	0.000	0.000	0.000	-
Dec	0.000	0.000	0.000	-	0.000	0.000	0.000	-

(a) The largest absolute change observed for each calendar month for the period of the simulation is presented here. Typically, the largest change occurs in years with large natural flows, so the change may be lower than that for mean conditions, when expressed as a percentage.

Table 12 - Projected Changes to Discharges Below the Doris Lake Outflow Effluent Outfall due to the Project (Closure Phase)

Month	Mean Conditions				Conditions of Maximum Change[a]			
	Natural	EIS Case (Closure)			Natural	EIS Case (Closure)		
	Q (m^3/s)	Q (m^3/s)	ΔQ (m^3/s)	% Change	Q (m^3/s)	Q (m^3/s)	ΔQ (m^3/s)	% Change
Jan	0.000	0.000	0.000	-	0.000	0.000	0.000	-
Feb	0.000	0.000	0.000	-	0.000	0.000	0.000	-
Mar	0.000	0.000	0.000	-	0.000	0.000	0.000	-
Apr	0.000	0.000	0.000	-	0.000	0.000	0.000	-
May	0.000	0.000	0.000	-	0.000	0.000	0.000	-
Jun	1.999	2.058	0.059	2.9%	1.294	1.394	0.101	7.8%
Jul	1.271	1.321	0.050	3.9%	0.488	0.576	0.088	18.0%
Aug	0.557	0.583	0.027	4.8%	0.169	0.208	0.039	23.1%
Sep	0.655	0.691	0.035	5.4%	0.211	0.263	0.052	24.5%
Oct	0.265	0.278	0.013	4.8%	0.075	0.092	0.017	23.2%
Nov	0.000	0.000	0.000	-	0.000	0.000	0.000	-
Dec	0.000	0.000	0.000	-	0.000	0.000	0.000	-

(a) The largest absolute change observed for each calendar month for the period of the simulation is presented here. Typically, the largest change occurs in years with small natural flows, so the change may appear substantially larger than that for mean conditions, when expressed as a percentage.

6.0 CONCLUSION

The results presented in the preceding figures and tables show that the effects of the closed-circuiting of Tail Lake and the planned raw water withdrawal from Doris Lake will reduce the water level of, and the discharge from, Doris Lake. The discharge of water from Tail Lake into the Doris Lake Outflow will increase discharges in the outflow below the point of discharge (immediately above the falls). Key results are:

1. During the winter months (October through May), the effect of raw water withdrawal is expected to be larger than that due to closed-circuiting of Tail Lake. Tail Lake and Doris Lake are not expected to discharge from November through May, so the daily reduction in water level due to the withdrawal is equal to the daily withdrawal (1252.4 m^3) divided by the lake surface area (3.54 km^2), or 0.35 mm/day.

2. From July to September, the effect of the closed-circuiting of Tail Lake is expected to be larger than that of raw water withdrawal. The Tail Lake watershed has a drainage area of 4.4 km^2, which is approximately 5% of the 93.1 km^2 drainage area of the Doris-Ogama-Tail Lake system.

3. In June, effects from the closed circuiting of Tail Lake and of direct withdrawals from Doris Lake are similar. The effects of direct withdrawal are primarily due to prior drawdown, during the winter months, that reduces the spring snowmelt flood peak by reducing antecedent water levels in Doris Lake.

4. The water balance simulation for the EIS case predicts that during the Operations phase of the Project and under mean conditions, mean monthly lake drawdown will vary from 5 mm to

70 mm. The most extreme calculated monthly lake drawdowns varied from 7 mm to 93 mm over the course of the year. These values may be compared to the derived natural mean annual variation in lake water level of approximately 500 mm, as shown in Table 2.

5. The effects of the Project on discharge in the Doris Lake Outflow are partially mitigated by the release of water from Tail Lake, once it meets water quality criteria for discharge.

The effects of changes to flow depths and velocities, with regards to fish habitat in the Doris Lake Outflow, are discussed in Appendix I.

A discussion of the ice conditions in the Doris Lake Outflow channel, and potential implications for the ability to discharge water from Tail Lake during freshet, is provided in Appendix II.

7.0 CLOSURE

This report was prepared by Golder Associates Ltd. (Golder) for the account of Miramar Mining Corporation, including submission to and review by the Nunavut Impact Review Board (NIRB). The material in it reflects Golder's best judgment in light of information available to it at the time of preparation. Any use which a third party, other than NIRB for the purpose of Project regulatory review, makes of this report or any reliance on or decisions to be made based on it, are the responsibility of such third party. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decision made or action based on this report.

We trust the information contained in this report is sufficient for your present needs. Should you have any questions regarding the project, please do not hesitate to contact the undersigned.

Yours truly,

GOLDER ASSOCIATES LTD.

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NS/GRA/arw

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APPENDIX I
EFFECTS ON FISH HABITAT
IN THE DORIS LAKE OUTFLOW CHANNEL

This appendix was prepared in September 2005, in response to questions from Fisheries and Oceans Canada (DFO). DFO specifically requested that the proponent:

1. Show monthly flow rates and water depth changes in Doris Lake Outflow, to indicate whether the channel could go dry due to water management regime; and
2. Show effects of Tail Lake discharges on flow velocities in the Doris Lake Outflow channel.

The question of whether the Doris Lake Outflow channel could go dry due to the water management regime is best answered by examining the monthly time series of flows from the simulated water balance. The largest decrease in flows in the Doris Lake Outflow channel will occur during the operations phase of the proposed project.

The Doris Lake water level and discharge impact analysis was based on the derived weekly runoff series for Doris and Tail Lakes, as discussed in Section 2.1. Changes for mean and extreme conditions, for the construction, operations and closure were presented in Sections 3 and 4 of this report. In this appendix, Table I-1 presents a monthly summary the time series of simulated monthly discharges and channel depths for the open water period of the water balance, during the operations phase of the proposed project. Figure I-1 shows the time series of simulated monthly discharges and Figure I-2 shows the time series of simulated monthly outflow channel depths.

The table and figures show that the effects on the Doris Lake Outflow throughout the simulation are consistent with the effects described in Section 6 of the report. The largest effects of the project will be felt during relatively high flows and will be relatively small. During lower flow periods, which generally occur after spring runoff, reductions in flow depth in the Doris Lake Outflow channel due to the project will be small. Mean monthly channel depths during the simulation period of 1984 to 1997 show decreases of between one and 10 mm for the August to October low flow period. The water balance simulation does not show any conditions under which the Doris Lake Outflow channel would go dry. It is anticipated that the channel would go dry only if unusual extreme drought conditions affected the entire watershed.

Table I-1 Time Series of Simulated Doris Lake Outflow Discharges and Depths

	Mean Discharge (m^3/s)			Mean Channel Depth (m)		
	Baseline (Natural)	EIS Case (Operational)	Difference	Baseline (Natural)	EIS Case (Operational)	Difference
May-84						
Jun-84	2.428	2.206	0.222	0.603	0.579	0.024
Jul-84	0.791	0.769	0.022	0.371	0.367	0.004
Aug-84	0.632	0.617	0.015	0.339	0.336	0.003
Sep-84	0.564	0.551	0.013	0.325	0.322	0.003
Oct-84	0.220	0.203	0.017	0.247	0.242	0.004
Nov-84						
May-85						
Jun-85	2.809	2.559	0.250	0.640	0.616	0.024
Jul-85	1.469	1.415	0.054	0.485	0.477	0.008
Aug-85	1.006	0.974	0.032	0.411	0.405	0.006
Sep-85	1.371	1.322	0.049	0.470	0.463	0.008
Oct-85	0.404	0.382	0.022	0.290	0.285	0.005
Nov-85						
May-86						
Jun-86	1.294	1.132	0.161	0.458	0.432	0.026
Jul-86	1.740	1.662	0.078	0.523	0.512	0.010
Aug-86	0.583	0.569	0.014	0.329	0.326	0.003
Sep-86	0.647	0.630	0.017	0.342	0.339	0.003
Oct-86	0.325	0.306	0.019	0.272	0.267	0.004
Nov-86						
May-87						
Jun-87	1.414	1.239	0.175	0.477	0.450	0.027
Jul-87	2.246	2.137	0.108	0.584	0.572	0.012
Aug-87	1.277	1.232	0.046	0.456	0.449	0.007
Sep-87	1.062	1.029	0.033	0.420	0.415	0.006
Oct-87	0.542	0.516	0.026	0.320	0.315	0.006
Nov-87						
May-88						
Jun-88	2.109	1.902	0.207	0.568	0.544	0.025
Jul-88	1.341	1.292	0.050	0.466	0.458	0.008
Aug-88	0.836	0.812	0.024	0.379	0.375	0.005
Sep-88	0.750	0.729	0.022	0.363	0.359	0.004
Oct-88	0.474	0.449	0.025	0.305	0.300	0.006
Nov-88						
May-89						
Jun-89	2.096	1.886	0.210	0.567	0.542	0.025
Jul-89	1.081	1.045	0.036	0.424	0.417	0.006
Aug-89	0.334	0.327	0.006	0.274	0.272	0.001
Sep-89	0.269	0.264	0.005	0.258	0.257	0.001
Oct-89	0.156	0.140	0.016	0.231	0.227	0.004
Nov-89						

Table I-1 Time Series of Simulated Doris Lake Outflow Discharges and Depths (continued)

	Mean Discharge (m^3/s)			Mean Channel Depth (m)		
	Baseline (Natural)	EIS Case (Operational)	Difference	Baseline (Natural)	EIS Case (Operational)	Difference
May-90						
Jun-90	1.887	1.685	0.202	0.542	0.515	0.026
Jul-90	1.692	1.620	0.072	0.516	0.507	0.010
Aug-90	0.538	0.525	0.012	0.319	0.317	0.003
Sep-90	0.405	0.396	0.008	0.290	0.288	0.002
Oct-90	0.167	0.151	0.016	0.233	0.229	0.004
Nov-90						
May-91						
Jun-91	1.902	1.712	0.190	0.544	0.519	0.024
Jul-91	0.818	0.795	0.023	0.376	0.372	0.004
Aug-91	0.332	0.326	0.006	0.273	0.272	0.001
Sep-91	0.284	0.279	0.005	0.262	0.261	0.001
Oct-91	0.099	0.085	0.015	0.216	0.213	0.004
Nov-91						
May-92						
Jun-92	1.900	1.699	0.201	0.543	0.517	0.026
Jul-92	1.249	1.203	0.046	0.451	0.444	0.007
Aug-92	0.372	0.364	0.007	0.282	0.281	0.002
Sep-92	0.211	0.207	0.004	0.244	0.243	0.001
Oct-92	0.093	0.078	0.015	0.215	0.211	0.004
Nov-92						
May-93						
Jun-93	2.334	2.106	0.228	0.593	0.568	0.025
Jul-93	1.538	1.475	0.063	0.495	0.486	0.009
Aug-93	0.384	0.376	0.008	0.285	0.284	0.002
Sep-93	0.262	0.257	0.005	0.257	0.256	0.001
Oct-93	0.075	0.061	0.014	0.210	0.206	0.004
Nov-93						
May-94						
Jun-94	2.090	1.889	0.202	0.566	0.542	0.024
Jul-94	0.488	0.477	0.012	0.309	0.306	0.003
Aug-94	0.169	0.166	0.003	0.234	0.233	0.001
Sep-94	0.581	0.566	0.015	0.328	0.325	0.003
Oct-94	0.280	0.261	0.019	0.261	0.256	0.004
Nov-94						
May-95						
Jun-95	1.716	1.527	0.189	0.520	0.494	0.026
Jul-95	0.975	0.943	0.032	0.405	0.399	0.006
Aug-95	0.303	0.298	0.006	0.267	0.265	0.001
Sep-95	0.234	0.230	0.005	0.250	0.249	0.001
Oct-95	0.101	0.087	0.014	0.217	0.213	0.004
Nov-95						

Table I-1 Time Series of Simulated Doris Lake Outflow Discharges and Depths (continued)

	Mean Discharge (m^3/s)			Mean Channel Depth (m)		
	Baseline (Natural)	EIS Case (Operational)	Difference	Baseline (Natural)	EIS Case (Operational)	Difference
May-96						
Jun-96	2.434	2.211	0.223	0.604	0.580	0.024
Jul-96	0.609	0.593	0.016	0.334	0.331	0.003
Aug-96	0.545	0.528	0.017	0.321	0.317	0.004
Sep-96	1.785	1.709	0.077	0.529	0.519	0.010
Oct-96	0.467	0.443	0.024	0.304	0.298	0.005
Nov-96						

Figure I-1 Time Series of Simulated Doris Lake Outflow Discharges

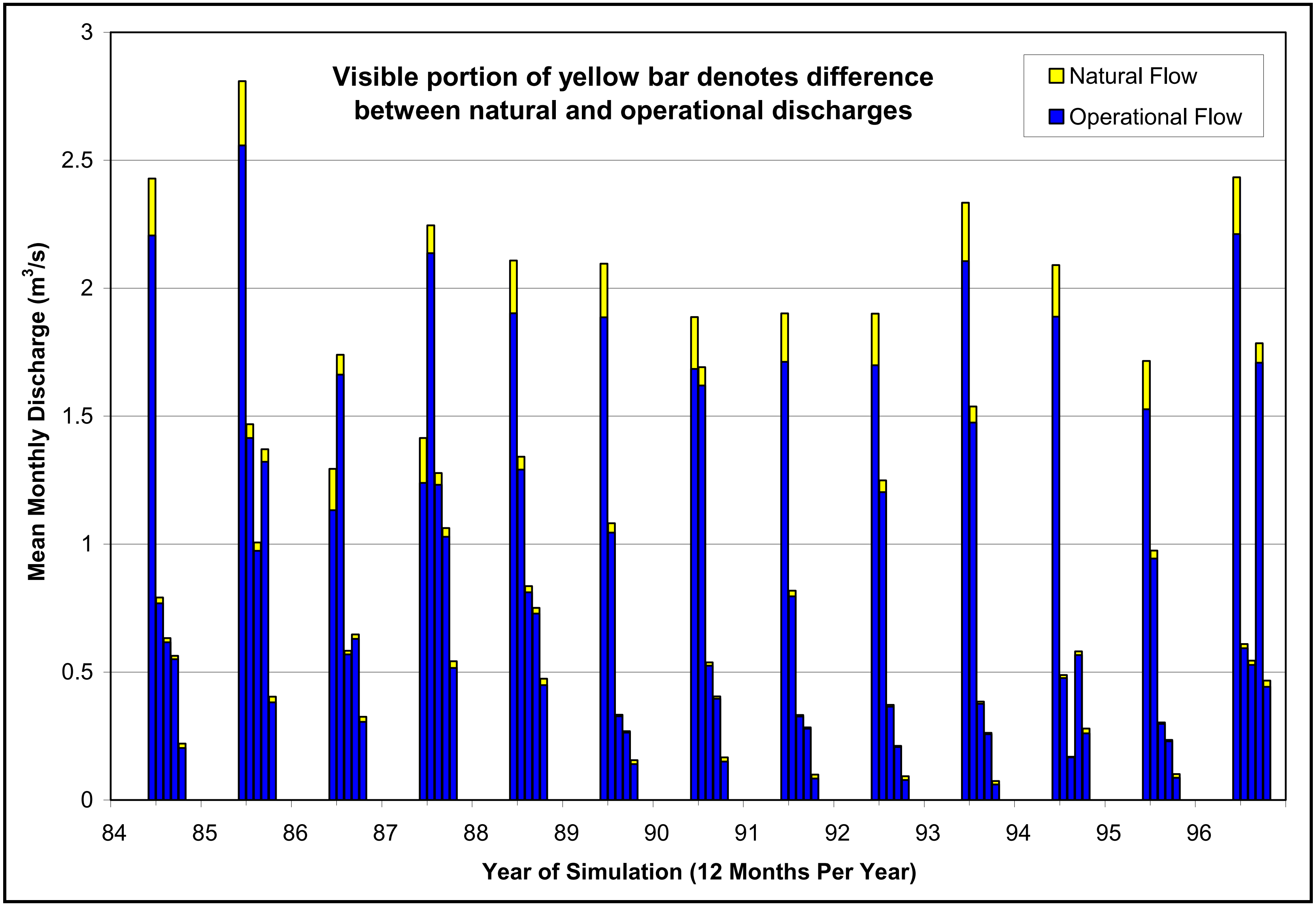
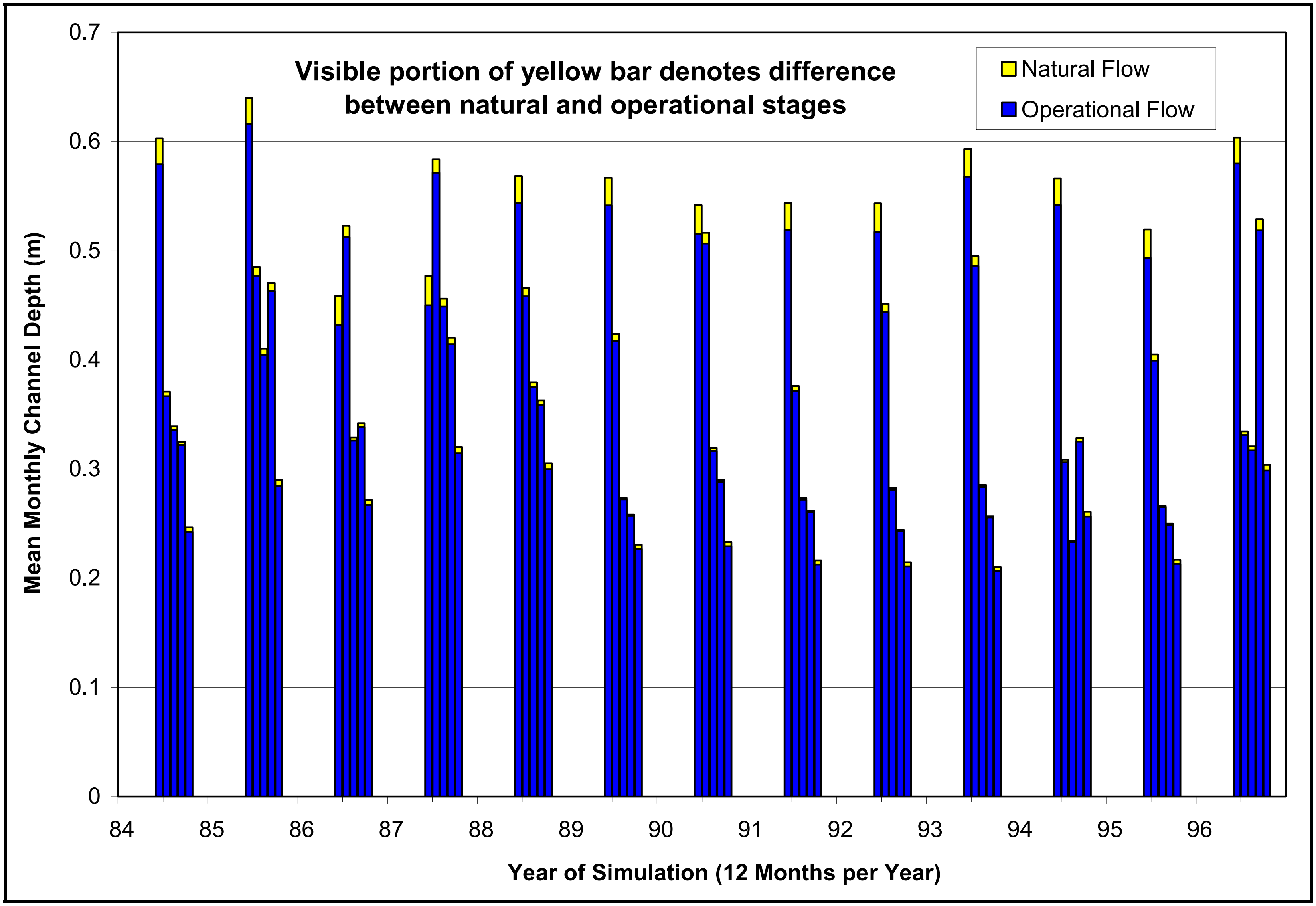


Figure I-2 Time Series of Simulated Doris Lake Outflow Channel Depths



Note: Channel Depth denotes depth at deepest part of channel, based on outlet channel rating curve

The question of whether discharges from Tail Lake will affect flow velocities in the Doris Lake Outflow channel is best answered using the following method:

- develop stage-discharge rating curves for the Doris Lake Outflow channel; and
- use these to examine the effects of changes to discharge on changes to flow depth and velocity.

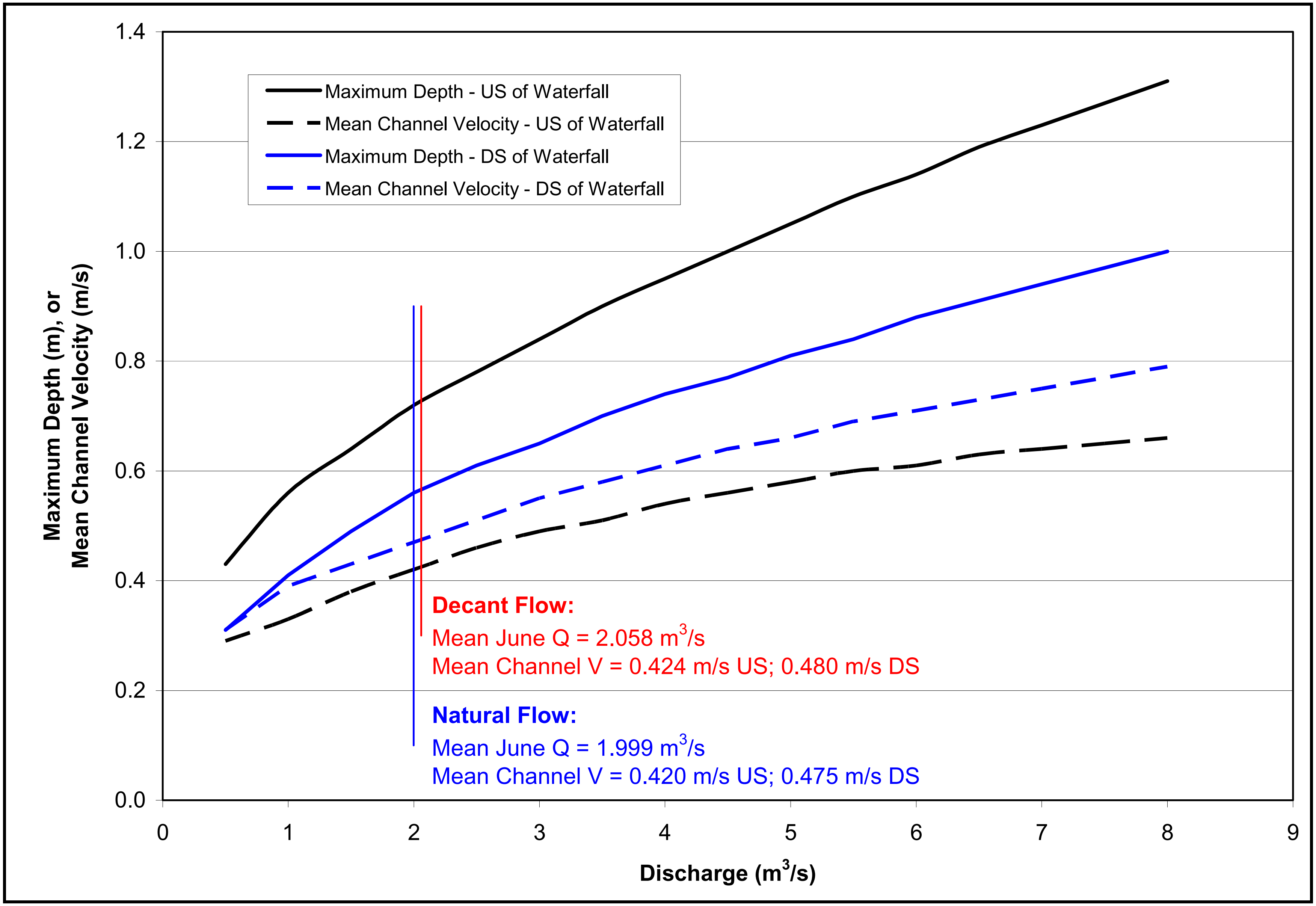
Channel cross-sections measured above the Doris Lake Outflow waterfall during the 2003 field studies (RL&L/Golder 2003) and below the waterfall during the 2000 field studies (Rescan 2002) were used as a basis for the analysis. Discharges collected concurrently with the cross-sections were used to calibrate a Manning equation-based flow model to develop rating curves relating channel maximum depth to discharge, and mean channel velocity to discharge, for each cross-section. The resulting rating curves are shown in Figure I-3.

Figure I-3 can be used to show that increases in channel velocity due to the increased discharges during discharges from Tail Lake are not of concern. In open channel flow, as the discharge increases, so do the flow depth and cross-sectional area. This means that the flow velocity does not increase proportionally with discharge rate, but rather increases at a lesser rate.

The increases in flow rate in the channel are also relatively small, and are partially mitigated due to the fact that, as water is discharged from Tail Lake, the natural flow from Tail Lake is still closed-circuited. Thus, the increase in flow in Doris Outflow is not equal to the decant flow, but rather the decant flow less what the natural flow from Tail Lake would have been.

Figure I-3 uses values from Table 6 (for the month of June, when natural flow velocities are highest) to illustrate the magnitude of the anticipated change in channel velocity due to the discharges from Tail Lake. Increasing the discharge rate from the natural value of 1.999 m^3/s to a rate of 2.058 m^3/s results in an increase in flow velocity in the Doris Lake Outflow channel below the waterfall from 0.475 m/s to 0.480 m/s. This represents an increase in mean channel flow velocity of approximately one percent.

Figure I-3 Rating Curves of Channel Depth and Mean Velocity vs. Discharge for Doris Lake Outflow Channel



APPENDIX II
DISCUSSION OF ICE CONDITIONS
IN THE DORIS LAKE OUTFLOW CHANNEL

This appendix was prepared in September 2005, in response to questions from Indian and Northern Affairs Canada (INAC) . INAC specifically requested that the proponent:

1. Provide characterization of the ice in Doris Creek including the timing and mechanism for ice clearing;
2. Provide a qualitative description on the manual method of measuring Doris Lake outflows to determine spring discharge rates; and
3. Provide information on the continuance of snowcourse surveys undertaken by MHBL as part of on-going water management strategy. Include this information as part of decant discussion.

These questions are addressed in the following text.

1. Characterization of Doris Lake Outflow Spring Flows

1.1 Background

The meteorology and hydrology data compilation report for the project (Rescan 2002) noted that:

Peak flows in arctic streams occur soon after the open water season begins. The open water season typically begins in June. Snow and ice begin to melt mobilizing the stored water volume.

The magnitude of the peak daily flows generally reflect the size of the drainage basin. On a unit yield basis this trend is often scattered as local conditions influence peak flows. For streams that are small enough to be fully or partially blocked by snow and ice, large peaks can occur once these blockages are cleared.

The meteorology and hydrology baseline report (AMEC 2003) noted that:

It is anticipated that the streams in the study area will be frozen, with zero discharge from the beginning of November until the end of May. Spring runoff is estimated to typically start in the first half of June, with the second week likely being most common.

1.2 Site Specific Observations

Neither the data compilation report (Rescan 2002) or baseline report (AMEC 2003) provided site-specific measurements or observations of early season flows. These were first measured in the spring of 2004 (Golder 2005). The 2004 measurements were consistent with the observations presented by Rescan (2002) and AMEC (2003). The following pages contain a summary of observations by field crews at the Doris Lake (Table II-1) and Tail Lake (Table II-2) outflows, the derived hydrographs for Doris Lake (Figure II-1) and Tail Lake (Figure II-2) outflows, and a time series of photographs covering the snowmelt period. A record of mean hourly and mean daily temperatures recorded during the period May 20 to June 29 is also provided in Figure II-3.

The data for 2004 include the raw pressure transducer readings provided in Figure II-4. The transducers were installed in "dry holes" augered into solid ice, and it can be seen that water first entered the Doris Lake hole on June 6 and the Doris Lake outflow hole on June 8. Field observations show that zero flow and bedfast ice were observed in the Doris Lake outflow channel on June 9. The channel cleared and within five days (June 14) the channel flow was at approximately 40% of the eventual peak discharge (0.56 m^3/s vs. 1.36 m^3/s). This demonstrates the rapid onset of flow as the bedfast ice in the channel melts, and the clearing of ice from the channel well before the peak flow. This transition occurred during a period where the mean air temperature was less than 5°C. During this period, ice melt was likely driven by solar radiation and exposure to warmer water, heated by absorption of solar radiation at lake and channel edges.

The data for 2004 show a peak flow on June 28, two weeks after ice-free conditions, followed by a flow recession curve that is less steep than the rising limb. The sustained outflow from Doris Lake is enhanced by the fact that it is the lowest in a chain of four lakes: upstream lakes include Ogama, Patch and Wolverine lakes. Thus, the timing and magnitude of the spring flood peak is influenced by melt conditions in the upstream lakes. This is supported by a comparison with 2004 monitoring data from Roberts Lake. The two lakes have similar drainage areas (97.8 km^2 for Roberts Lake vs. 93.1 km^2 for Doris Lake) and 2004 water yields (61 mm for Roberts Lake vs. 62 mm for Doris Lake). However, the spring flood peak discharge from Roberts Lake was 2.30 m^3/s, compared to 1.36 m^3/s for Doris Lake. The lower peak and longer receding limb on the Doris Lake outflow hydrograph means that more of the outflow occurs later in the year, and increases the potential for discharge of water from the Tail Lake tailings impoundment under open-water conditions.

Based on the 2004 monitoring data and the assumption that there were ice effects until June 14, inclusive, no more than 2% of the outflow from Doris Lake occurred under ice-affected conditions. It should also be noted that 2004 was a year in which there were no late-season secondary flow peaks due to rainfall, which would otherwise have reduced the proportion of outflow under ice-affected conditions.

1.3 Summary

- The Doris Lake outflow channel typically freezes solid and fills to bankfull with frozen ice and snow over the winter;
- In late spring, the ice in the channel rots in place as snow melts in adjacent overbank areas. The low albedo of the exposed overbank areas (relative to a snow cover) increases soil temperatures. Ice melt in the channel and upstream lake begins from the shoreline and proceeds offshore;
- Water flowing from the lake, warmed in nearshore areas, flows on top of bedfast ice in the channel. The transition from frozen bedfast to fully open-water conditions in the Doris Lake outflow channel is rapid and was observed in 2004 to occur over a period of less than five days; and
- Doris Lake has several lakes upstream, which undergo similar melt processes at the same time and attenuate the spring flood peak. Ice-free conditions prevail in the Doris Lake outflow channel well before the spring flood peak, and the vast majority of annual flow occurs under ice-free conditions.

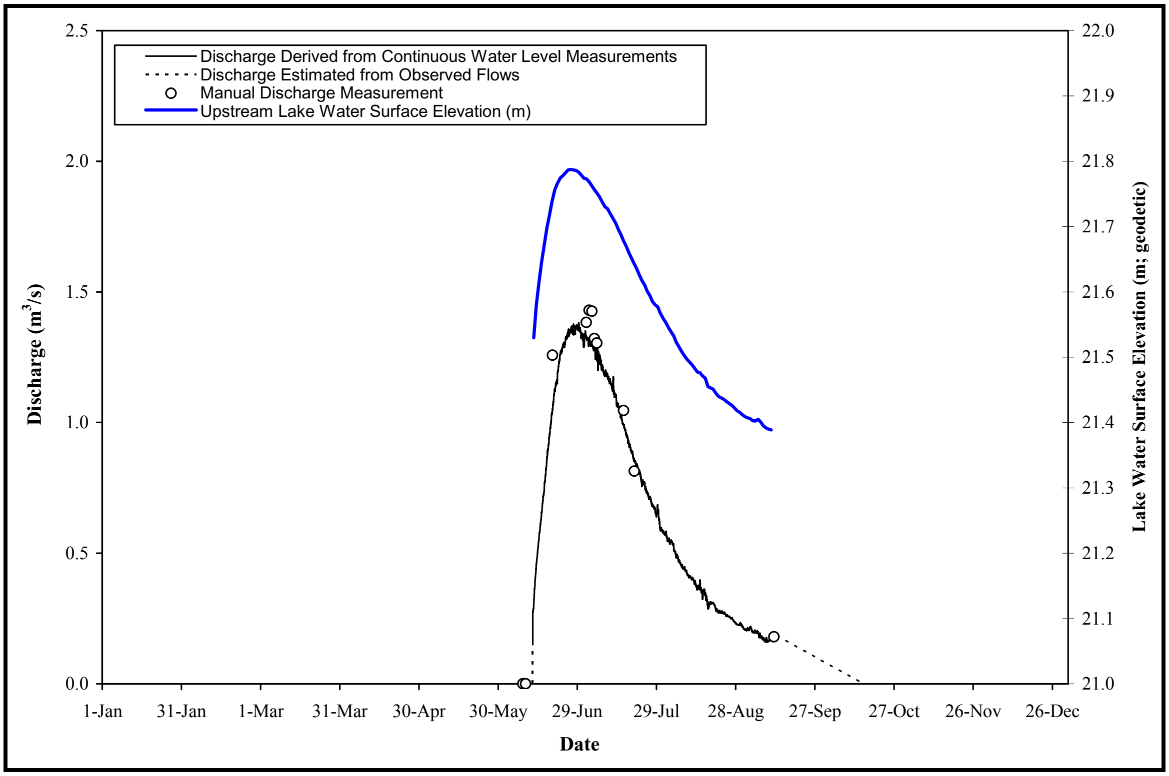
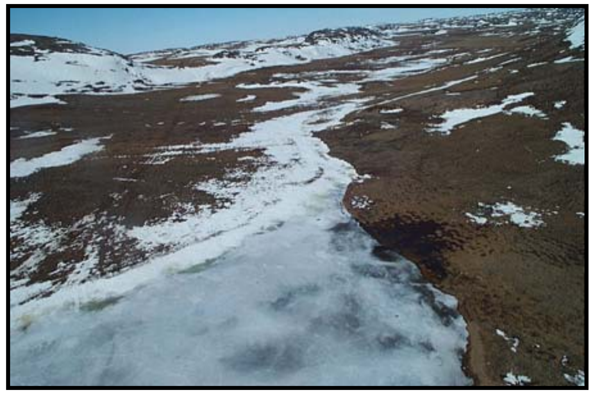


Figure II-1 Hydrographs of Doris Lake and Doris Creek Hydrometric Stations, 2004

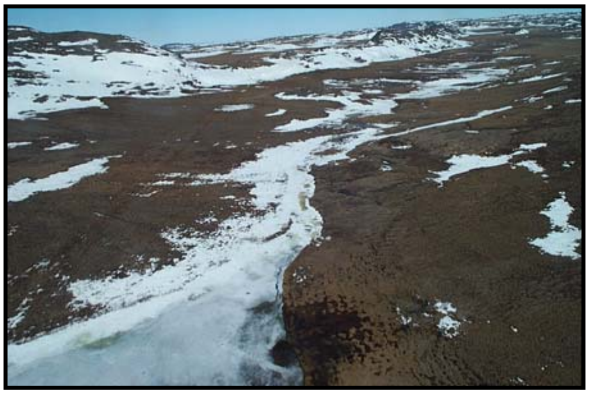
Table II-1 Site visits to Doris Lake and Doris Creek Hydrometric Stations, Spring 2004

Date	Activities	Discharge
7 May 2004	Installed transducer at frozen hole at Doris Lake.	n/a
5 June 2004	Checked transducer at Doris Lake; ice affected.	n/a
6 June 2004	Checked transducer at Doris Lake; ice affected.	n/a
7 June 2004	Checked transducer at Doris Lake; ice affected.	n/a
8 June 2004	Checked transducer at Doris Lake; ice affected. Installed transducer in frozen hole on Doris Creek; observed ice conditions and zero flow.	0.000 m^3/s
9 June 2004	Checked transducer at Doris Lake; ice affected. Observed zero flow at Doris Creek.	0.000 m^3/s
14 June 2004	No Golder personnel on site; visit by helicopter pilot. Appears to be no bedfast ice. Discharge based on derived, continuous record.	0.560 m^3/s
19 June 2004	Surveyed water level and measured discharge at Doris Creek.	1.258 m^3/s
23 June 2004	Checked transducer at Doris Lake; ice on lake but free water conditions. Discharge based on derived, continuous record.	1.290 m^3/s
2 July 2004	Surveyed water level and measured discharge at Doris Creek.	1.383 m^3/s
3 July 2004	Surveyed water level and measured discharge at Doris Creek.	1.430 m^3/s
4 July 2004	Surveyed water level and measured discharge at Doris Creek.	1.426 m^3/s
5 July 2004	Surveyed water level and measured discharge at Doris Creek.	1.321 m^3/s
6 July 2004	Surveyed water level and measured discharge at Doris Creek.	1.304 m^3/s

5 Jun 04 – Doris Lake Outflow view to N (view downstream)



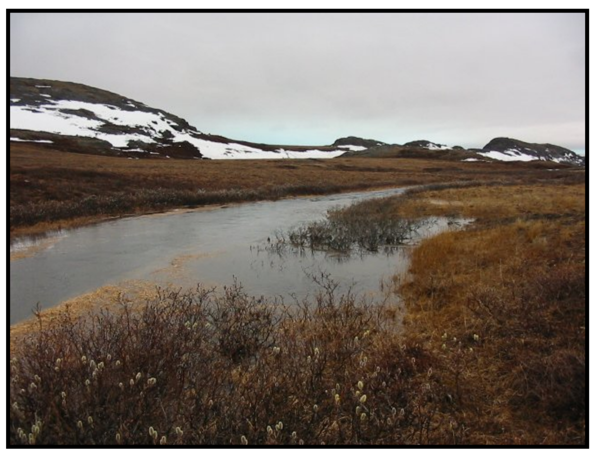
6 Jun 04 – Doris Lake Outflow view to N (view downstream)



7 Jun 04 – Doris Lake Outflow view to N (view downstream)

8 Jun 04 – Doris Lake Outflow view to N (view downstream)

14 Jun 04 – Doris Lake Outflow view to NW (flow from left to right)



19 Jun 04 – Doris Lake Outflow view to NW (flow from left to right)

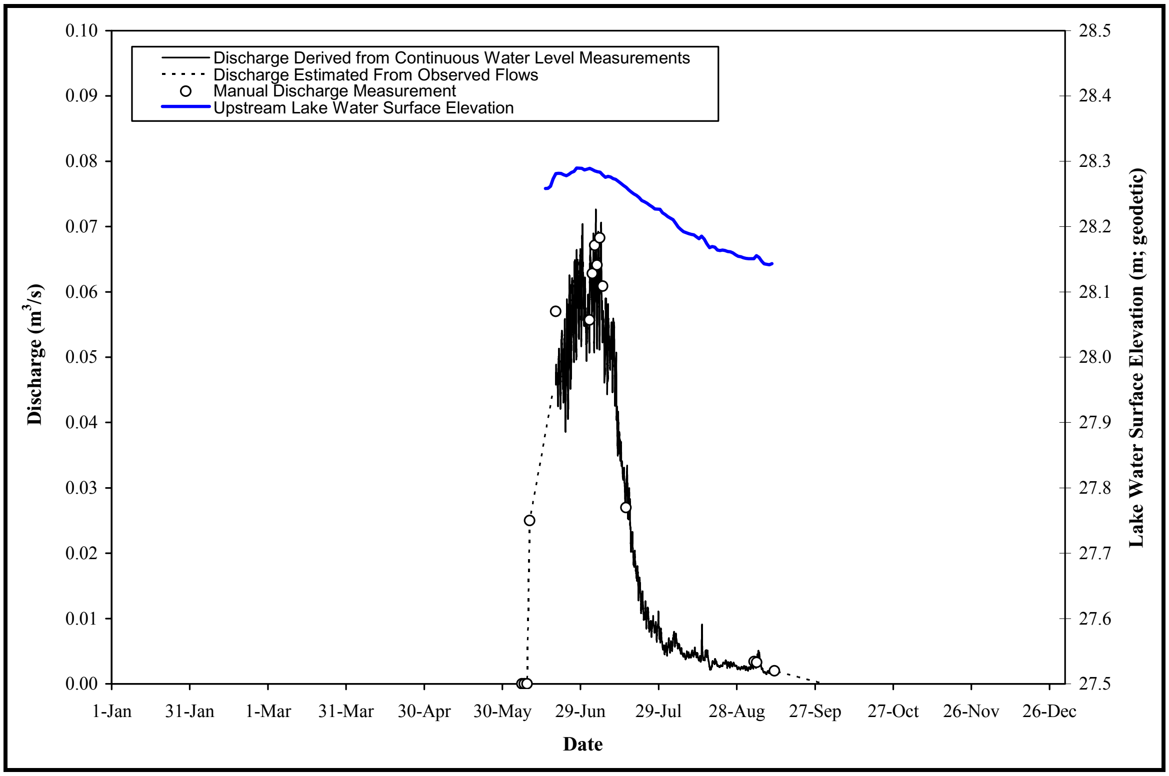
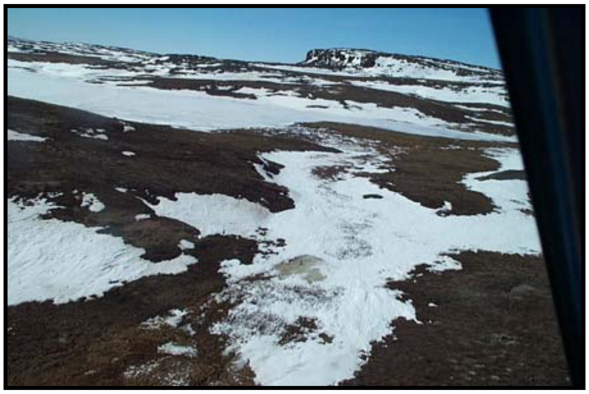


Figure II-2 Hydrographs of Tail Lake and Tail Creek Hydrometric Stations, 2004

Table II-2 Observations at Tail Lake and Tail Creek Hydrometric Stations, Spring 2004

Date	Activities	Discharge
8 May 2004	Installed transducer at frozen hole at Tail Lake.	n/a
5 June 2004	Checked transducer at Tail Lake; ice affected.	n/a
6 June 2004	Checked transducer at Tail Lake; ice affected.	n/a
7 June 2004	Checked transducer at Tail Lake; ice affected.	n/a
8 June 2004	Checked transducer at Tail Lake; ice affected.	n/a
9 June 2004	Checked transducer at Tail Lake; ice affected. Discharge measurement at Tail Lake outlet but Tail Creek station still snow-covered.	0.025 m^3/s
14 June 2004	No Golder personnel on site. Visit by helicopter pilot. Visible flow at Tail Creek station.	
19 June 2004	Checked transducer at Tail Lake; ice on lake but transducer not affected. Installed transducer in flowing water on Tail Creek; surveyed water level and measured discharge at Tail Creek.	0.057 m^3/s
2 July 2004	Surveyed water level and measured discharge at Tail Creek.	0.056 m^3/s
3 July 2004	Surveyed water level and measured discharge at Tail Creek.	0.063 m^3/s
4 July 2004	Surveyed water level and measured discharge at Tail Creek.	0.067 m^3/s
5 July 2004	Surveyed water level and measured discharge at Tail Creek.	0.064 m^3/s
6 July 2004	Surveyed water level and measured discharge at Tail Creek.	0.068 m^3/s



6 Jun 04 – Tail Lake Outflow view to NW (view downstream)

7 Jun 04 – Tail Lake Outflow view to SE (view upstream)

9 Jun 04 – MORNING Tail Lake Outflow view to SE (view upstream)

9 Jun 04 – EVENING Tail Lake Outflow view to SE (view upstream; downstream of previous photo)

14 Jun 04 – Tail Lake Outflow view from above (flow from left to right)

18 Jun 04 – Tail Lake Outflow view to SE (view upstream)

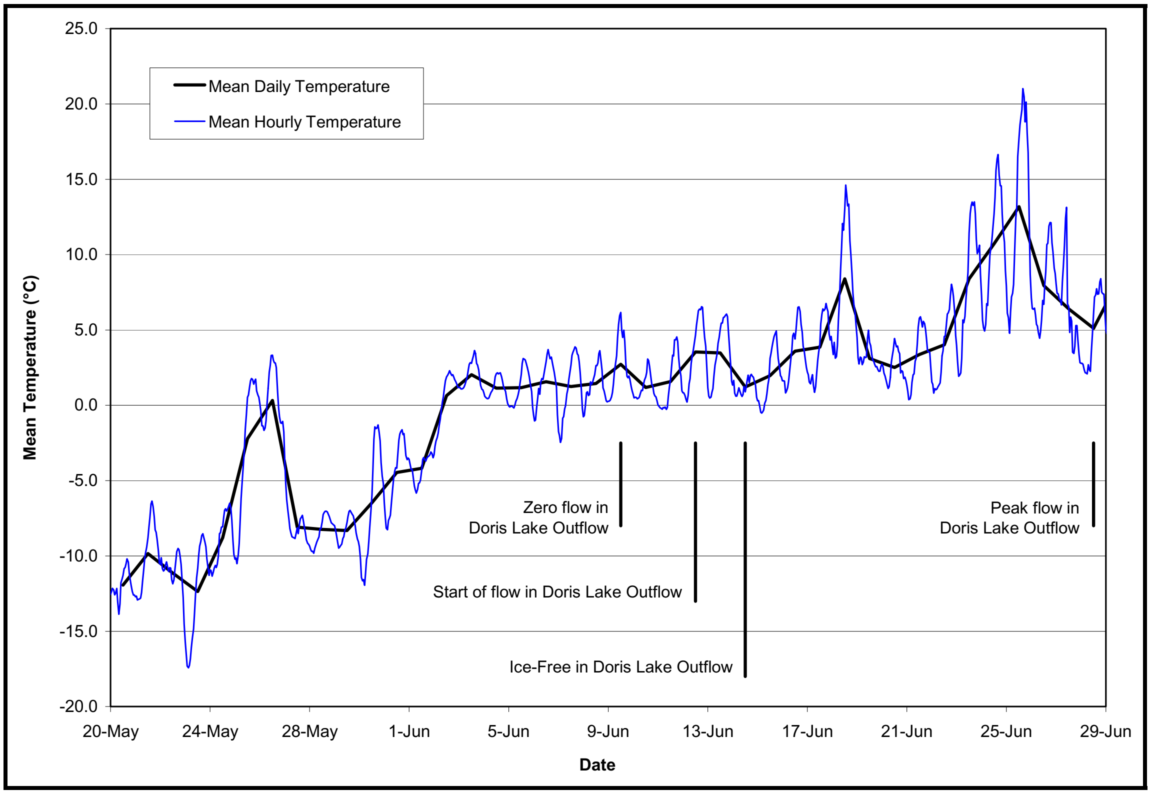


Figure II-3 Temperature Record from Doris Lake Climate Station, 20 May to 29 June 2004

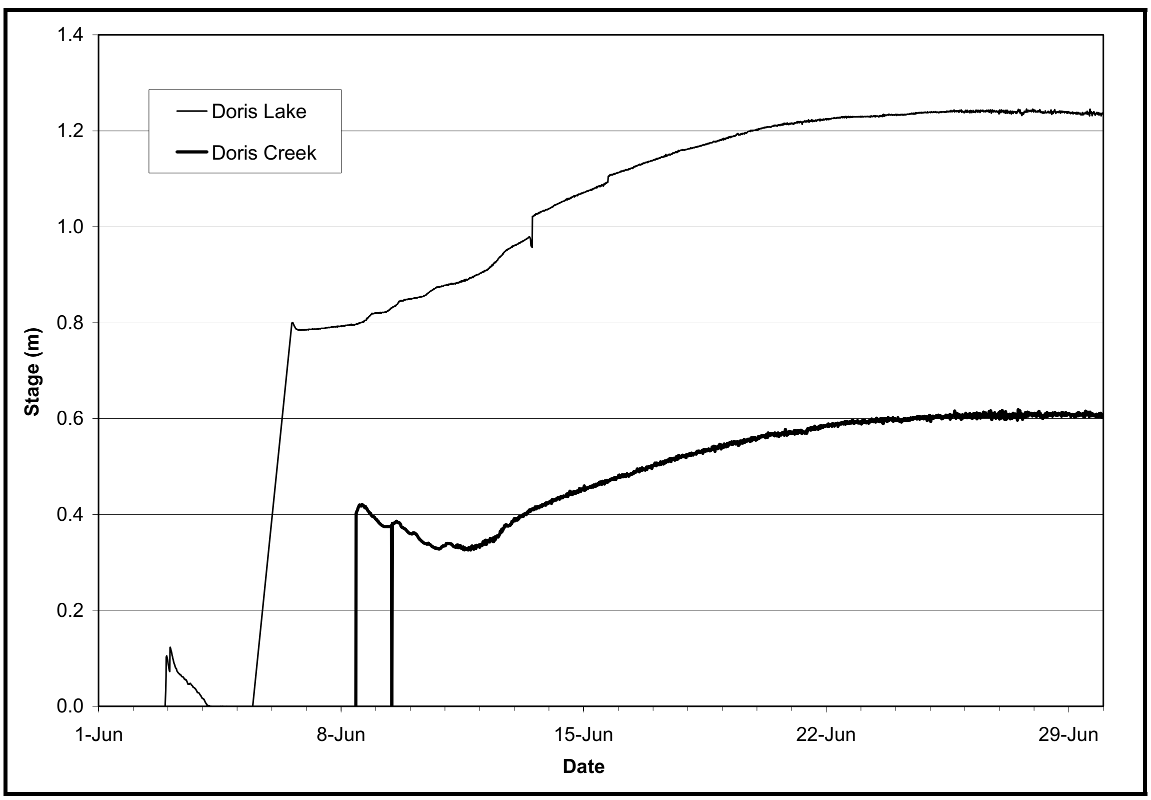


Figure II-4 Doris Lake and Doris Creek Hydrometric Station Transducer Readings, June 2004

2. Provide a qualitative description on the manual method of measuring Doris Lake outflows to determine spring discharge rates.

Detailed observations of flow during the melt period in 2004 indicate that:

- During the early melt period, flow is on top of bedfast ice in the channel;
- Melt of ice in the outlet channel is rapid; and
- Open channel flow prevails well before the spring snowmelt peak.

Additional observations from the baseline study and subsequent studies support the conclusion that this is typical of the spring melt characteristics for regional streams.

It is anticipated that environmental personnel on site at the mine will be able to perform manual measurements of discharges in the Doris Lake Outlet channel during the melt period. These will be used as a basis for specifying discharges from the Tail Lake facility. The channel is likely to be wadeable during all but the highest discharges. However, because a bridge will be built across the outlet channel, it will also be possible for personnel to perform discharge measurements from the bridge.

When it is confirmed that bedfast ice no longer remains, continuous measurements using an automatic hydrometric station with pressure transducer, data logger and stage-discharge rating curve will be used as a basis for specifying discharges from the Tail Lake facility.

3. Provide information on the continuance of snowcourse surveys undertaken by MHBL as part of on-going water management strategy.

Spring snow course surveys will continue to be undertaken during mine operations as part of the environmental monitoring program. The data collection method will be similar to that used for baseline data collection in the Doris Lake watershed in 2004 and 2005. Data from these surveys, which are typically be performed in late May or early June, will provide an indication of the amount of snowmelt runoff likely to occur in the late spring and early summer. This will allow early estimates of the amount of water that could potentially be decanted from the Tail Lake facility during the months of June and July.