2005 ABANDONMENT AND RESTORATION PLAN

LUPIN TAILINGS CONTAINMENT AREA

WATER LICENCE NWB1LUP0008

LUPIN MINE, Nunavut

KINROSS
Gold Corporation

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EXECUTIVE SUMMARY

This document is derived from the 2004 Lupin Abandonment and Restoration Plan, submitted to the Nunavut Water Board in February 2005. Following this submission, in April 2005 Kinross requested the Water Board and INAC to consider the mine site and TCA as separate entities for the remediation permitting process in order to expedite a decision on the remediation activities on the TCA portion. This was done because the TCA reclamation was much further advanced than that of the mine site area and Kinross believed that the Board had sufficient information to assess and approve the TCA portion of the remediation program. The Board received comments on this request from a number of interveners. A common thread in these comments was the desire of the interveners to be presented with a stand-alone plan for the reclamation of the TCA. As such, the information on the TCA reclamation activities, as presented in the February submission, has been consolidated in this document.

The Lupin Mine is owned by Echo Bay Mines Ltd., a subsidiary of Kinross Gold Corporation. Incorporated in 1993, Kinross is the world's seventh largest primary gold producer, with varying interests in 13 mines on four continents. Kinross acquired the Lupin Mine in the combination with Echo Bay Mines Ltd. and TVX Gold Inc. on January 31, 2003.

Lupin is located on the west shore of Contwoyto Lake, approximately 285 km southeast of Kugluktuk, Nunavut, the closest northern community. Due to its isolation, the mine site is totally self-contained, with all operating personnel living on site in bunkhouse accommodations. The only year-round access to the site is via aircraft. During February and March each year, the mine is supplied via a 570 km ice road, which runs from Tibbitt Lake, north of Yellowknife, to Contwoyto Lake.

Lupin is an underground mine and has been in operation since 1982, with temporary suspensions of activities between January 1998 and April 2000, and again between August 2003 and March 2004. The operation has produced over 3.3 million ounces of gold from 12.8 million tons of mined ore.

Throughout its operation, Lupin has been an innovator in such areas as:

- remote site construction and operation
- northern transportation infrastructure development
- creating employment relationships with northern communities
- mining in permafrost conditions
- the implementation of hydraulic drilling technology
- mechanized narrow-vein mining
- the utilization of paste backfill

Due to its location, approximately midway between Yellowknife and the Arctic coast, and its well developed infrastructure, including a 1,900-metre gravel airstrip, Lupin has also evolved to be an important transportation and logistical hub for the exploration and research community in the north.

The Lupin Mine is presently operating under Water License NWB1LUP0008, granted by the Nunavut Water Board in July 1, 2000 and extending to June 30, 2008. An Interim Abandonment and Restoration plan for the property was approved by the Nunavut Water Board following a public hearing in 2001. Annual reports submitted to the Water Board have described progressive reclamation activities carried out at the mine each year. On January 8, 2004, the Board requested a general revision to the A&R Plan to reflect the Care & Maintenance status in effect at the time and to specifically address a number of other items, particularly with respect to the proposed "Saturated Granular Zone Cover" concept for reclaiming the tailings containment area. The mine was removed from Care and Maintenance status in March 2004, when it resumed production. As such, a care and maintenance revision to the A & R Plan was not appropriate and the update was not submitted.

Mining and milling operations have now been suspended at Lupin Mine, as existing developed ore has been depleted. The property is on care and maintenance for an indefinite period while other mining and economic options are being assessed. This report provides technical descriptions of the reclamation activities that will be carried out within the Tailings Containment Area during this period, and those that are proposed in the event that mining operations are permanently curtailed. This report includes details on a number of studies that have been recently undertaken to support the saturated granular cover method for exposed tailings remediation.

The approach to the reclamation and closure of the Lupin site is to conduct the work in an efficient manner, and to follow the *Mine Site Reclamation Policy for Nunavut (2002),* as well as the *Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories (1990),* as specified in the Water Licence. The primary objectives of the proposed reclamation and closure work are in accordance with the Policy's first objective to "ensure the impact of mining on the environment and human health and safety is minimized".

The reclamation work will utilize the natural conditions as much as possible to ensure the secure, long-term closure of the entire mine site. Mine tailings will be covered by a one (1) metre layer of non-reactive esker material. The partially saturated condition of the cover will provide an effective barrier to oxidation of the underlying tails during the short period of thaw. This practice has been successfully implemented to remediate the mine tailings since the first cell (1A) was covered in 1988.

Following the final closure of the mine, some of the key reclamation measures that are proposed to take place on the TCA are:

1. Cover all exposed tailings with a layer (1.0 meter) of esker material to isolate the tailings from the environment.
2. Construct an engineered outflow spillway on Dam 1A, designed to provide environmental protection against an extreme flood (100-year event).
3. Contour cover material to direct snowmelt towards the internal lakes (Cell 4, Pond 1, Pond 2) so that all water will exit the TCA through the Dam 1A spillway.
4. Scarify all cover material and roads to enhance natural revegetation.

5. Removal of all buildings (arsenic treatment plant, tailings dump stations, powder magazines) and tailings pipe from the TCA and transport back to Lupin minesite for shipment off site or disposal in debris landfill.
6. Continue periodic environmental monitoring of the site to confirm long term stability and success of the reclamation measures.

Monitoring of the TCA is scheduled for a period of 7 years (a 2-year period of intensive reclamation work, followed by a 5-year post reclamation period). This work will include water quality, soil quality and ground temperatures monitoring, any required maintenance, general reclamation inspections and geotechnical inspections. The results of the monitoring programs will be reported to the Nunavut Water Board quarterly and annually.

1.0 INTRODUCTION

1.1 Kinross Environmental Policy

Kinross Gold Corporation recognizes that maintenance of environmental quality is vital to the Company's existence, progress, and continued development. The Company will maintain high environmental standards limited only by technical and economic feasibility. The Company will take positive action to protect the safety of its workers, conserve natural resources, and minimize the impact of its activities on the environment through diligent application of appropriate technology and responsible conduct at all stages of exploration, mine development, mining, mineral processing, decommissioning, and reclamation.

The purpose of Kinross Gold Corporation's Environmental Policy is to provide a measurable framework for the performance of the Company's activities in an environmentally responsible manner, ensuring compliance by the Company and its employees with all applicable environmental regulations and commitments.

1.1.1 Implementation

Kinross Gold Corporation will:

- Evaluate, plan, construct, and operate all projects and facilities to reduce adverse environmental impacts and to meet or exceed applicable environmental laws, regulations, and standards. In the absence of applicable regulations, the Company will apply cost effective best management practices to protect the environment.
- Require managers of all projects and operations to adhere to the Company Environmental Policy and to identify, evaluate, and minimize risks to the environment.
- Continuously review environmental achievements and technology to seek and implement methods for further improvement.
- Require all operations to have site specific emergency response plans which meet or exceed all applicable regulations.
- Conduct regular audits of environmental performance and emergency response plans to verify compliance with the Company's policy and applicable regulations. Identify revisions or improvements to current practices in order to minimize environmental impacts. Report findings quarterly to the Board of Directors.
- Educate employees in environmental matters and responsibilities relating to performance of their assigned tasks. Entrust all employees to maintain necessary environmental performance for their activities.
- Foster communication with shareholders, the public, employees, and government to enhance understanding of environmental issues affecting the Company's activities.
- Work pro-actively with government and the public to define environmental priorities. Participate in the development of responsible laws for the protection of the environment.
- Allocate sufficient resources to meet the Company's environmental goals. Annually

assess the projected costs of decommissioning and reclamation while funding "off balance sheet" an appropriate amount to ensure that there is sufficient cash reserves to pay for these costs upon closure.

1.1.2 Reclamation

Kinross places a high priority on reclamation, and is proud of its accomplishments. The work includes concurrent reclamation at active operations, where reclamation is integrated into the mine planning process, and the aggressive fulfillment of reclamation obligations associated with closed properties. This work is so important to the company that Kinross has formed a distinct business unit with dedicated staff and resources to aggressively campaign the reclamation and closure of sites where mining & processing operations have finished.

To manage this commitment, Kinross has formed the Reclamation Operations Business Unit with its own dedicated engineering & environmental staff, resources, and corporate structure to aggressively address restoration obligations at sites where mining and processing have finished. The results of these programs have been recognized by others within and outside the mining industry. Examples of significant recognition of Kinross' efforts are listed below:

- Manhattan Mine (**Nevada**) – US Bureau of Land Management Reclamation Award – 2004
- Round Mountain Mine – **Nevada** Excellence in Mine Reclamation 2003
- Sleeper Pit Lake - **Nevada** Excellence in Mine Reclamation 2002
- QR Mine – John MacDonald Mine Reclamation Award (**British Columbia**) – 2002
- Manhattan Mine Reclamation – **Nevada** Excellence in Mine Reclamation – 2000
- Hayden Hill Waste Rock and Lookout Pit Closure - **California** Mining Association Excellence in Reclamation Award – 2000
- Fort Knox - **Alaska** Department of Natural Resources Reclamation Award - Reclamation of legacy placer mining remnants in the Fish Creek – 2000

The reclamation of the Lupin Operation will be carried out to these same high standards.

1.2 Lupin Operation Background

The Lupin Mine is located on the west shore of Contwoyto Lake, approximately 285 km southeast of Kugluktuk, Nunavut and approximately 400 km northeast of Yellowknife, N.W.T. The coordinates are $65^{0}46'$ Latitude and $111^{0}15'$ Longitude, and the mine lies approximately 80 km south of the Arctic Circle. The location is shown in Figure 1, in Appendix 1.

The Lupin gold deposit was discovered in 1960 as a result of reconnaissance sampling and mapping programs conducted by the Canadian Nickel Company Ltd., a subsidiary of Inco Limited. Between 1961 and 1964 the Canadian Nickel Company Ltd. conducted exploration in the Lupin area, which included geological mapping, geophysical surveying, trenching, stripping and channel sampling.

In February 1979, Echo Bay obtained an option on the Lupin property from Inco and proceeded with an underground exploration program. The geological information indicated enough ore reserves to provide six years of production, based on the potential to develop in excess of two million tons of ore with a mill designed to process an average of 950 tons per day.

In August 1980, the decision was made to proceed with development and construction of the Lupin Mine. Construction was completed on schedule in March 1982 and preproduction commissioning began.

From 1983 through to 1993, the mine and mill operations were expanded to increase capacity to a nominal 2,300 tons per day. In December, 1994, the paste backfill plant was completed, which provided critical ground support in production areas while reducing the amount of tailings reporting to the Tailings Containment Area. Operations were temporarily suspended at Lupin between January 1998 and April 2000, and again from August 2003 to March 2004. Mill throughput in the last year of operation, March 2004 to February 2005, averaged approximately 1200 tons per day, significantly less than in previous years.

1.3 Licences

The Lupin Operation is presently permitted by Water Licence NWB1LUP0008 for water use and waste disposal in a mining and milling undertaking. The Licence was received from the Nunavut Water Board on July 1, 2000, and expires on June 30, 2008.

A list of the land leases pertaining to the Lupin Mine is presented in Table 1.

Table 1. Mineral and Surface Leases, Lupin

Name	Type	Desc.	Expiry	Area (ha)
2428	Mineral Lease	Lot 1 Group 1216	12-Jul-2013	2,831.59
3275	Mineral Lease	L. 1003 Quad 76E\11	27-Sep-2009	927.13
3276	Mineral Lease	L. 1002 Quad 76E\11	27-Sep-2009	891.92
3277	Mineral Lease	L. 1004 Quad 76E\11	27-Sep-2009	959.10
3278	Mineral Lease	L. 1001 Quad 76E\11	27-Sep-2009	1,148.09
76E/14-1-9	Surface Lease	Minesite, TCA	31-Mar-2012	1,035.79
76E/14-2-10	Surface Lease	Airstrip	31-Mar-2012	53.16
76E/11-2-4	Surface Lease	Quarry, access road	31-Mar-2012	137.80
76E/11-3-4	Surface Lease	Waterlot - dock	31-Mar-2012	0.43
76E/14-10-3	Surface Lease	Navigation aid	31-Mar-2012	0.09

1.4 Geology

The Lupin gold deposit is situated in an Archean metaturbidite sequence of the Contwoyto Formation, part of the Yellowknife Supergroup of supracrustal metasedimentary and metavolcanic rocks of the Slave Geologic Province. The rocks have been subjected to both regional and contact metamorphism and to several phases of deformation and intrusion.
The Lupin ore unit is composed of the Centre Zone, East Zone, West Zone and L19 Zone, all of which are contained within a continuous, isoclinally folded, steeply dipping unit of amphibolitic iron formation within the Contwoyto Formation. This unit has been followed for a strike length of 3000m and a dip length of 1500m. Several phases of deformation have resulted in steeply plunging fold noses and steeply dipping fold limbs. The resulting pattern is 'M' shaped, consisting of a northerly-plunging syncline and adjacent anticlines to the west and east. The West Zone forms the west limb of the west anticline, the Centre Zone the west limb of the syncline and the East Zone the east limb of the syncline. Most of the gold occurred in the West Zone and Centre Zone. A lesser amount was found in the East Zone. The L-19 Zone did not contain economic concentrations of gold and was not mined.

The iron formation is a well laminated unit and consists of both silicate facies and sulphide facies metamorphosed to an amphibolite + quartz rich rock. The gold is found primarily within the sulphide rich iron formation. The ore at Lupin consists of amphibole, quartz, garnet, pyrrhotite, arsenopyrite, minor pyrite and traces of chalcopyrite. The gold is fine grained (generally less than 100 microns in diameter) and is associated mainly with the pyrrhotite and arsenopyrite. Although not common, visible gold is sometimes found and is usually in close proximity to quartz veining. Also found in trace amounts are scheelite, apatite, epidote, calcite, tourmaline, and some arsenides (notably loellingite). Arsenopyrite occurs as metacrysts, up to 2 cm in diameter, which often have loellingite cores. Much of the gold associated with these arsenides occurs at the arsenopyrite - loellingite boundaries within these metacrysts. Gold is also finely disseminated within pyrrhotite and silicates, and is rarely visible to the naked eye.

The McPherson Zones (M1 and M2) are in iron formation lenses separate from the main Lupin ore unit, contain economic quantities of gold, and were mined. They trend parallel to the West Zone at approximately 60m and 80m east of it near the latitude of the shaft. The M1 and M2 Zones contain a higher proportion of pelitic beds than the main Lupin ore unit. Gold is locally present in the pelitic beds, and visible gold is more common in the M1 and M2 Zones than in mineralized zones of the main ore body.

Tailings are primarily composed of the gangue minerals amphibole and quartz, which account for over 80% of the volume. Pyrrhotite and arsenopyrite make up an additional 17% (Klohn 1995). The tailings have been shown through various studies to be capable of generating acid upon oxidation. The waste rock is composed mostly of quartzite, phyllite, and minor amounts of carbonate, and has very low sulphide content. Column leach studies have shown the waste rock to have little potential for development of ARD (Klohn 1992a).

1.5 Local Environment

1.5.1 Climate

Table 2 shows the monthly precipitation from snow and rain, as measured at the Lupin weather station, between 1982 and 2004.

Table 2 – Monthly Precipitation at Lupin, NU

Total Monthly Precipitation (mm water equivalent; 1 cm snow = 1 mm water)													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
1982	no readings taken			13.2	12.8	43.9	35.0	62.6	36.6	21.6	14.1	15.0	
1983	24.3	5.5	16.8	16.5	18.0	10.4	77.8	75.4	77.0	41.8	10.4	6.0	379.9
1984	6.8	19.4	16.2	19.3	17.8	60.0	69.6	53.7	19.8	25.5	13.2	9.2	330.5
1985	9.2	11.6	10.4	25.8	10.2	19.4	89.0	46.6	44.5	24.0	9.4	6.6	306.7
1986	20.0	9.2	4.6	19.7	29.2	17.5	18.0	100.8	30.0	28.0	13.6	12.8	303.4
1987	11.6	6.6	5.6	6.6	8.7	67.8	41.8	47.0	35.0	34.1	45.0	25.4	335.2
1988	1.6	3.6	4.4	6.0	10.8	50.3	32.0	18.7	43.4	32.2	22.2	8.2	233.4
1989	20.0	4.0	10.2	3.3	36.1	6.3	35.0	27.5	33.7	12.0	14.4	16.6	219.1
1990	11.8	6.0	12.0	8.3	2.4	23.5	23.3	54.0	48.5	20.1	9.2	14.7	233.8
1991	7.9	13.2	12.4	26.1	14.0	12.4	49.8	76.2	46.5	26.4	18.0	19.4	322.3
1992	11.8	8.6	9.8	20.4	21.5	22.2	14.8	47.0	31.2	43.8	15.4	4.2	250.7
1993	3.3	14.2	13.2	6.2	28.4	27.8	87.0	28.8	29.9	19.4	14.8	12.0	285.0
1994	3.4	2.2	22.0	8.2	15.4	39.2	13.8	47.2	43.4	29.2	11.0	14.8	249.8
1995	5.2	3.4	38.8	6.6	8.4	20.8	40.2	79.0	49.4	36.0	7.4	23.8	319.0
1996	5.8	18.4	4.4	8.0	24.8	54.0	57.5	130.8	68.8	13.0	13.6	6.6	405.7
1997	6.0	6.6	6.8	12.8	27.2	21.2	18.2	58.7	25.6	46.2	12.6	18.6	260.5
1998	5.2	8.2	5.6	17.8	19.2	38.4	57.4	55.2	62.6	52.2	17.0	21.6	360.4
1999	9.8	6.6	14.4	25.0	25.6	19.6	62.4	57.2	84.2	23.8	13.4	30.8	372.8
2000	3.8	5.4	8.0	12.4	18.6	4.6	27.2	49.2	58.6	44.2	14.0	7.8	253.8
2001	6.4	7.6	26.4	30.2	48.2	6.4	45.0	46.4	9.4	20.0	27.6	12.0	285.6
2002	7.6	2.2	6.2	15.8	4.4	43.6	67.0	93.8	52.2	15.2	20.2	11.4	339.6
2003	3.8	0.4	19.8	3.4	23.4	18.6	43.8	68.6	36.0	28.4	31.3	15.6	293.1
2004	10.8	12.4	9.2	19.6	6.0	21.2	12.2	111.0	61.2	30.0	30.2	3.4	327.2
Avg	8.9	8.0	12.6	14.4	18.7	28.2	44.3	62.4	44.7	29.0	17.3	13.8	303.1

Climate in this region is classed as semi-arid subarctic, with an average annual precipitation of just over 300 mm and a mean daily temperature of -11.0^{O}C. Average temperature for the months of May through September is 4.6 ^{O}C (Canadian Climate Normals 1961-2000). Precipitation is heaviest in the months June through September. Snowfall can occur during any month, although heaviest snowfalls generally occur in October. The average annual snowfall is 138.1 cm. The prevailing winds in the Lupin area are from the northwest.

Snowmelt is generally complete by the end of June. Break-up on Contwoyto Lake begins in mid-July, although in some years the lake is not ice-free until early August. Small lakes in the region are ice free by early July. Ice starts to reform on small lakes of the surrounded area in late August or early September. Complete freeze-over of Contwoyto Lake occurs in October.

Table 3 – Monthly Temperature at Lupin, NU

Mean Monthly Temperatures (deg. C) at Lupin, NU													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Avg**
1982	-36.0	-28.5	-27.5	-19.8	-5.6	4.9	11.5	7.3	0.9	-7.2	-26.0	-29.8	-13.0
1983	-28.8	-33.4	-28.8	-17.1	-14.0	5.3	10.3	9.3	2.4	-9.4	-13.9	-27.1	-12.1
1984	-32.2	-25.8	-25.2	-12.0	-3.9	8.1	12.7	9.7	-0.1	-9.2	-21.8	-32.4	-11.0
1985	-27.7	-34.7	-26.5	-19.6	-1.6	6.6	7.7	6.3	0.8	-10.0	-23.3	-25.1	-12.3
1986	-31.8	-26.9	-27.6	-19.0	-5.7	3.0	10.4	7.0	1.5	-9.6	-24.1	-24.9	-12.3
1987	-24.7	-25.5	-26.1	-15.4	-7.4	5.4	10.1	5.4	4.1	-8.1	-21.1	-19.5	-10.2
1988	-31.6	-31.7	-22.7	-15.4	-10.1	7.1	11.5	10.4	3.7	-8.3	-25.5	-27.5	-11.7
1989	-33.4	-22.5	-29.7	-15.3	-8.2	7.8	12.3	12.7	1.8	-8.0	-26.0	-29.1	-11.5
1990	-32.9	-34.6	-21.3	-14.6	-7.3	4.3	11.0	6.1	1.2	-9.3	-25.0	-31.2	-12.8
1991	-31.5	-30.6	-28.1	-13.9	-1.8	7.4	11.4	10.1	0.0	-10.6	-22.7	-27.8	-11.5
1992	-29.4	-29.0	-22.9	-17.5	-5.8	4.3	11.0	8.2	-1.2	-8.4	-18.5	-25.9	-11.3
1993	-25.6	-28.3	-21.4	-17.0	-5.7	4.7	10.4	9.2	0.3	-8.9	-21.9	-29.0	-11.1
1994	-34.5	-33.6	-21.7	-17.5	-2.5	8.1	13.9	10.5	2.2	-5.0	-18.5	-28.6	-10.6
1995	-24.9	-28.3	-25.6	-15.3	-7.2	8.5	8.9	8.7	0.8	-9.3	-20.6	-29.9	-11.2
1996	-31.7	-26.3	-25.8	-16.3	-7.1	9.8	14.2	7.5	5.2	-9.6	-20.4	-26.9	-10.6
1997	-30.3	-27.5	-27.6	-16.2	-6.5	6.0	13.4	9.9	4.8	-10.6	-15.1	-23.0	-10.2
1998	-33.5	-25.6	-22.0	-10.2	-0.4	8.3	13.8	11.4	3.5	-4.0	-12.9	-22.2	-7.8
1999	-28.6	-23.2	-19.6	-13.5	-5.0	6.8	8.4	8.7	2.3	-8.9	-16.9	-24.9	-9.5
2000	-26.2	-24.9	-22.4	-15.5	-3.9	7.4	15.0	9.0	1.1	-8.5	-18.8	-29.6	-9.8
2001	-25.5	-27.0	-23.8	-15.9	-4.6	3.9	12.3	8.5	5.9	-9.6	-20.5	-23.2	-10.0
2002	-28.3	-31.3	-25.5	-19.9	-8.3	7.3	12.1	8.1	2.5	-9.0	-17.4	-20.2	-10.8
2003	-27.3	-32.1	-26.1	-13.5	-5.2	5.6	13.5	10.3	3.7	-4.3	-18.9	-25.0	-9.9
2004	-32.3	-28.5	-28.4	-18.9	-11.1	5.2	11.6	6.2	0.8	-10.4	-21.7	-29.7	-13.1
Avg.	-29.9	-28.7	-25.1	-16.1	-6.0	6.3	11.6	8.7	2.1	-8.5	-20.5	-26.6	-11.1

The winter climate at this latitude is severe in intensity and duration and is followed by a short, warm summer. In winter, between 1 and 3 m of ice develop on the surface of the lakes and it is the rate of melting of this ice that greatly influences summer conditions. The interaction between climate and morphology of the individual lakes gives rise to great differences in the thermal regime of the lakes.

1.5.2 Topography

The site is in the tundra zone of the Canadian Shield, an area of continuous permafrost. Terrain in the vicinity of the site is generally low and undulating, ranging between 470 and 505 m elevation. Numerous shallow lakes and streams occur in depressions throughout the area.

1.5.3 Vegetation

The Lupin mine is located in the barren land tundra of Nunavut. It is typified as having a generous amount of low lying vegetation extremely tolerant and well adapted to the climatic conditions. Some of the more prevalent types of habitat that can be found throughout the area include upland and lowland tundra, wet meadows and gentle slopes.

Plentiful and diverse amounts of vegetation can be found everywhere consisting of grasses and sedges; ground cover such as mosses, labrador tea, cranberry, bilberry, bearberry, arctic white heather; in wet areas predominant species include cotton grass, bog rush, and other aquatic grasses; dwarf birch and willows populate trenches and colourful flowering plant species include fireweed, lapland rosebay, azalea and saxifrage to list a few.

1.5.4 Hydrology

Contwoyto Lake is the major water body in the region, with a surface area of approximately 95,900 ha and a drainage area of 8,000 km^2. Contwoyto Lake has two outlets, the Burnside River, which flows from the northwest end of the lake towards Bathurst Inlet, and Back River at the southeast end of the lake, which flows into Pellatt Lake. The main body of Contwoyto Lake lies to the east and south of the mine site. To the north of the mine, a portion of the lake extends to the west and south, terminating in a narrow bay (Sun Bay) which lies directly west of the mine site.

Aquatic habitat in the receiving environment immediately downstream of the tailings area is comprised of three shallow lakes (colloquially referred to as Dam 2 Lake, Dam 1a Lake, and Unnamed Lake), two streams (Seep Creek and Concession Creek), two shallow ponds, and two embayment areas of Contwoyto Lake (Inner and Outer Sun Bay). With the exception of Dam 2 Lake, all of the small lakes and ponds freeze to the bottom in winter. Much of Inner Sun Bay also freezes to the bottom. Due to low winter flows, both Seep Creek and Concession Creek freeze to the bottom in winter. As a consequence, over wintering habitat for fish is limited primarily to Outer Sun Bay and the main body of Contwoyto Lake (RCPL/RL&L 1985).

Concession Creek drains Concession Lake via Unnamed Lake to Inner Sun Bay. Seep Creek enters the Sun Bay drainage system along the east side of Unnamed Lake. Lower Concession

Creek (i.e., that section between Unnamed Lake and Inner Sun Bay) varies in width between 25 and 75 m, depending on seasonal discharges. Side channels are active during spring freshet. Stream depth generally is less than 1 m, except during spring freshet when depths approach 1.5 m. The substrate is primarily large boulder with large and small cobble occupying the interstices.

Seep Creek is approximately 6.5 km in length, flowing from its source in Dam 2 Lake and Dam 1a Lake (via separate branches which join about 2 km downstream) to Unnamed Lake. The stream channel in upper Seep Creek generally is poorly defined, often flowing through marshy areas, or between large boulders or through bedrock fractures. This section of the creek generally is less than 0.5 m in depth and less than 2 m wide. The dominant substrate type is boulders, although localized areas of cobble and gravel are present. Lower Seep Creek (i.e., the 400 m section upstream of Unnamed Lake) is characterized by a well developed channel varying in width from 1 to 4 m, although during freshet, maximum wetted width was about 20 m. The dominant substrate type is boulder, with localized areas of cobble and gravel (RCPL/RL&L 1985).

Inner Sun Bay (approximate area of 150 ha) is primarily shallow (mean depth of 1.7 m), with a maximum depth of about 6.5 m. Over 91% of the surface area is shallower than 3 m, and much of the bay freezes to the bottom in winter. Outer Sun Bay is deeper (greater than 10 m).

2.0 OPERATIONAL HISTORY

2.1 Construction

In the summer of 1980, prior to a production commitment, a 5,000-foot gravel landing strip capable of handling a C130 Hercules was prepared. Plant design was based on being able to air freight all the components to site. Mine site construction started in August 1980 and was completed on schedule in March 1982 when pre-production commissioning began. The transportation of personnel to the site was accomplished with a Convair 640, which also carried a total of 7 million pounds of supplies such as perishables and repair parts during construction.

During the twenty-month construction period, the Hercules aircraft made some 1,100 flights, carrying 25 tons of construction material per trip. This material included all the contained machinery and construction equipment, 2,200 tons of structural steel and the cement required to mix 9,500 cubic yards of concrete. The floor area of the main complex was 100,000 square feet. During peak periods, the construction crew numbered up to 400 people on site.

Engineering, procurement and construction management of the surface facilities was contracted to Bechtel Canada Limited, while the contract for mine development and underground construction was awarded to J.S. Redpath Limited. The Lupin Mine was constructed and commissioned for a total cost of $135 million dollars.

During 1983, a construction program was completed to expand the capacity of the mill from the original 1,000 tons per day, to a new nominal capacity of 1,200 tons per day. This construction phase included the installation of a rod mill in the grinding circuit, an additional 1,000-ton fine ore storage bin, additional filters and an extension to the maintenance bay.

From 1983 to 1993, the Lupin Mine underwent a number of other expansions and operational changes to increase milling capacity to a nominal 2,300 tons per day. The main production shaft was deepened on two separate occasions to a final depth of 1,210 metres below surface and the old sinking compartment was converted into a cage compartment. In April 2001, a production winze was commissioned between 1050 level and 1340 level. This infrastructure allowed mucking below the elevation of the crusher to be carried out more productively, thus extending the depth, and life, of the mine. The -15% decline drift, or ramp, which permits mobile equipment to access all the mine levels, extends from surface to the 1560-metre level. The lowest developed level in the mine is at the 1550-metre elevation.

2.2 Site Facilities

Other than the transportation requirement for materials and supplies necessary to sustain the workforce and industrial operations, the Lupin site is completely self-contained and relatively compact. There are two main areas of the camp - the residential complex consisting of accommodations, kitchen and recreation centre, and the industrial complex comprised of milling and maintenance areas, headframe, hoistroom, powerhouse, warehouse and office facilities. The freshwater pumphouse is situated approximately 1.6 kilometres northwest of the camp, on the shore of Contwoyto Lake.

In association with the above, there are a number of support areas consisting of shops and yards (maintenance, surface, backfill, carpentry), storage/laydown areas (cold storage buildings 1-3, explosives magazine, fuel tankfarms), camp sewerage facilities, mill tailings line, and a weather/aircraft control office with exploration shack. The Tailings Containment Area (TCA) is situated approximately 3 kilometres south of the mine site. The only physical connections between the TCA and the mine site are a road and the 8-inch diameter insulated tailings line, used to transport the tailings slurry from the mill to the deposition point in the tailings cells.

2.3 Mining

Shaft sinking began in 1982 to an original depth of 370 metres below the surface collar. The shaft has been deepened twice since then, first to the 780-metre elevation during 1984-86 and the second time to its final depth of 1,210 metres during 1988-90. The 2-drum ASEA production hoist, originally installed in 1987, was upgraded to 1,720 horsepower in 1992. This allowed 10-ton capacity skips to be hoisted in the two skipping compartments. In 1992, the manway compartment above the 250-metre level and the sinking compartment below the 250-metre level were converted to a cage compartment. The hoistroom was modified to accommodate a fully automated cage hoist.

The Lupin Mine is also serviced by an access ramp, which extends from surface to the bottom of the mine. For the most part, the ramp is a closed spiral and is located under the plunging south nose of the ore body. The 5m wide x 3.5m high ramp grades at -15% over its entire length. The termination of the ramp is at the 1,560m level horizon. The ramp provided for movement of men and materials within the mine and allowed for efficient deployment of resources as required.

A 1,000 horsepower, 84-inch diameter Joy axivane fan mounted on surface, supplies fresh air to the mine via a 3-meter diameter fresh-air raise. A similarly sized Joy fan is also mounted on surface, over a 3.4 metre x 3.4 metre raise, and helps exhaust contaminated air from the mine.

Almost all of the lateral and ramp development at Lupin was accomplished with electric-hydraulic drills and diesel scooptrams. A number of sublevels were developed with pneumatic drills and slushers during the last few years.

Standard mechanized drift dimensions were as follows:
Ramp: 5.0m wide x 3.5m high, -15%
Access Drifts: 4.6m wide x 3.5m high
CZ Ore Drifts: 4.0m wide x 3.5m high +2% grade
WZ Ore Drifts: 2.0m wide x 3.2m high +2% grade

Raises up to 20m in length (stope slots, millholes, vent raise extensions) were driven by conventional open raising methods, longhole drop raises or longhole inverse raises. Longer raises were driven with an Alimak or raise boring machine.

Production mining at Lupin began with sublevel longhole open stoping in the Centre and East Zones. Stope heights were typically 80m and were as long as the strike of the ore body. Every fourth sublevel was developed as an extraction horizon complete with a haulageway, drawpoints, ore pass and waste pass. All of the mining above 810m in these two zones was done by this method. The West Zone is the narrowest zone at Lupin. It was first mined by shrinkage and later by a “Raise Platform Mining” method, which involved driving closely spaced raises and then breasting between them from an Alimak raise climber. This method was in turn replaced with sublevel longhole stoping similar to the Centre Zone but utilizing much smaller equipment.

As mining progressed to greater depths and the accumulated volume of stope excavation increased, rock stress and ground control issues became an increasing concern. The stoping method was modified to integrate both waste and paste backfill into the mining cycle. Stope dimensions were decreased in both height and strike length as one technique used to control dilution. The method involved longitudinal retreat mining 20m high panels over a relatively short strike length (20m maximum in the Centre Zone and 15m in the West Zone), remote mucking the stope empty, then filling with paste before mining the adjacent panel. This mining method has been used at the mine since 1995.

The paste backfill plant was commissioned in October 1994 and was one of the first such systems operating in Canada at that time. The process involves taking the filter cake from the second stage filters in the mill (tailings), conveying it to the paste plant where it is mixed in a pan mixer with cement and water to create the paste. The paste is pumped to the shaft utilizing one of two positive placement pumps. Once delivered to the shaft, the paste flowed by gravity through the 6- inch diameter fill line and was distributed throughout the mine. Design capacity of the paste system was 120 short tons per hour. Between January 1995 and December 2004, over 1.8 million tons of paste backfill – over 30% of all tailings produced by the mine in that time period - has been placed in the underground stopes.

During the last few years of mining, the crown pillars of the Lupin orebody have been recovered. The crown pillars were the portions of the East, Centre and West zones between surface and 27-metre level, that were left behind when the initial mining was carried out. The East Zone crown pillar was recovered in 1997 and completely backfilled with waste rock and non-hazardous waste material in 1998. Mining of most of the Centre Zone crown was completed in 2003 and it was backfilled with pastefill that same year. A small portion of the Centre Zone crown pillar was mined during 2004 and remains open for the deposition of non-hazardous waste material. The West Zone crown pillar was mined between 1996 and 2004, and has been left open for the future disposal of demolition debris and soils. The crown pillar openings will be completely filled in, and the surface capping material contoured, during reclamation activities at the mine site.

2.4 Metallurgical Processing

The Lupin milling process remained basically consistent throughout the life of the mine. It utilized the Merrill-Crowe process for gold recovery, whereby a powdered zinc mixture is added to a gold bearing cyanide solution to precipitate out the gold. Lead nitrate is used in low doses to activate the zinc. The gold precipitate is then dried and melted in a furnace, and poured into dore bars. The crushing, grinding, pre-aeration, leaching, filtration and recovery stages are described below.

2.4.1 Crushing

The ore from the mine was crushed underground to 5.5 inches by a primary jaw crusher. It was then skipped to a 600-ton coarse-ore bin on surface. A vibrating feeder and conveyor belt transported the ore to a secondary cone crusher. After being reduced to -1.5 inch, the ore passed over a double-deck vibrating screen. Any material larger than 5/8 inch was fed into the tertiary cone crusher and re-circulated over the vibrating screen until it passed through the 5/8-inch openings. The ore passing this screen was conveyed to two 1, 000-ton fine ore bins, which fed the grinding circuit. The crushing circuit had the capacity to operate at a rate of 240 tons per hour.

2.4.2 Grinding

Liberation of the gold from the host rock was done by further reduction of the ore size. This was accomplished with a 9.5-ft. diameter x 12-ft. long rod mill feeding two 8-ft. x 24-ft. long ball mills in parallel. The ore was fed into the rod mill from the fine ore bins via belt feeders and conveyors. The ball mill discharge slurry was pumped to a common ball mill discharge or cyclone feed pump box, then to a cluster of cyclones which classifies the material. Cyclone underflow (+200 mesh material) was fed back into the ball mills. The cyclone overflow slurry (-200 mesh material) was pumped to the pre-aeration circuit at about 30% solids. The grinding circuit operated at a maximum rate of 2,300 tons per day, with the target-grind being 57% passing -400 mesh.

2.4.3 Pre-Aeration

The cyclone overflow was fed to the center well of the pre-aeration thickener, a 50-ft diameter shallow settling tank. The thickener overflow solution flowed by gravity to the recycle water tank and was recycled back to the grinding circuit. The thickener underflow slurry (60% solids) was pumped to the first of three 82,000 USG pre-aeration tanks. These tanks provided air to oxidize sulfide minerals, which would otherwise consume large amounts of cyanide and oxygen, thus hindering the leaching reaction. The circuit was tuned for efficient mechanical and chemical performance by operating under alkaline conditions (pH 10), adding lead nitrate reagent, and by using primary filtrate to dilute the thickener underflow density to 45% solids.

2.4.4 Leaching

The liberated gold particles were leached into solution through the reaction of cyanide, oxygen and water. Slurry from the pre-aeration circuit was leached in six consecutive agitated and aerated tanks. Lime was added to the circuit to maintain a constant pH of about 10. These six tanks in series gave the circuit 30 hours of retention time. The overflow from Leach Tank No. 6 feeds the cyanidation thickener. Thickener overflow solution is loaded with gold and flowed to the pregnant solution tank. The underflow, also containing some gold in solution, was pumped to the filtration circuit.

2.4.5 Filtration

A two-stage filtration system separated the dissolved gold from the waste solids of the cyanide thickener underflow. Each stage consists of four vacuum drum filters 8 ft. in diameter and 14 ft. long. In the first stage, the cyanidation thickener underflow slurry contacts the outside of the filter unit and the solution is drawn through the filter while the filter cake is washed with barren solution. The solution is returned to the cyanidation thickener or pumped to pre-aeration as dilution water. The filter cake passes through a repulper to a second stage. The second stage filter cake is washed with either barren or raw water and the solution is again returned to the cyanidation thickener. The filter cake is repulped with barren or raw water and flows by gravity to the tailings disposal pump box.

2.4.6 Recovery

The pregnant solution from the cyanidation thickener overflow was clarified and de-aerated, precipitated and refined to obtain dore bullion in a conventional Merrill-Crowe system. Three pressure clarifiers removed suspended solids from the solution, and then the oxygen was removed prior to precipitation in a de-aeration or Crowe tower. Zinc dust was added to the clarified de-aerated solution and the precipitated gold was collected in precipitation presses. The now barren solution was bled to tailings and recirculated throughout the plant. Once the filter press became loaded with precipitate, the feed was transferred to the other presses and the loaded press was emptied. After being mixed with suitable fluxes, the precipitate was smelted in the bullion furnace to produce dore bullion and slag. The slag was returned to the mill to be reprocessed. The bullion contained approximately 85% gold and 12% silver, the balance being base metals.

3.0 REQUIREMENT OF AN ABANDONMENT AND RESTORATION PLAN

Echo Bay Mines Ltd., Lupin Operation applied for and received a Water Licence renewal from the Nunavut Water Board effective July 1, 2000 through to June 30, 2008. Within Licence Number NWB1LUP0008, Part I Item 3 requires that a Final Abandonment and Restoration Plan be submitted to the Board.

3.1 Objectives of the Abandonment and Restoration Plan

This Plan has been prepared to indicate to the Board the direction and procedures that Kinross / Echo Bay Mines Ltd. intends to implement to fulfil obligations with regard to abandonment and restoration at the Lupin Operation. The objective of the plan follows the "*Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories, September 1990*" as specified in the water licence, and the more recent "*Mine Site Reclamation Policy for Nunavut (2002)*". Government regulations will be complied with to ensure that, once abandonment & restoration has been completed,

- there is no danger to public health or safety;
- the requirement for long term maintenance and monitoring associated with the tailings area is minimal or nil;
- contaminant loadings to the environment from the Tailings Containment Area are minimized or prevented;
- the cumulative degradation of abandoned areas affected by the mining activities is prevented, and natural recovery of disturbed lands is enhanced; and
- the affected areas will be returned to a condition that is compatible with the surrounding, original undisturbed area with respect to its future potential/productivity uses.

The Lupin operation has conducted progressive reclamation within the TCA since 1988. Kinross initiated a major tailings reclamation program in the summer of 2004, in which all the exposed tailings in the TCA will ultimately be covered by a 1-metre thickness of esker material. This project will operate each summer until all the exposed tailings in the TCA are covered.

4.0 ABANDONMENT AND RECLAMATION PLAN BACKGROUND

The following provides a quick reference background to the reclamation plan requirements for the Lupin Operation since construction/production began.

1983	Commercial production began and the first "conceptual" Abandonment and Restoration Plan was submitted to DIAND to fulfil requirements of Water Licence N7L2-0925 and Land Lease No.'s 3593 and 3594. Revisions were requested clarifying certain areas of the Plan.
1984	In December the A&R Plan was re-submitted in two parts; Part "A" was prepared by consultants Reid Crowther and Partners Ltd. and contained a review of current technologies for reclamation applicable to the Lupin Mine as well as potential problems and conditions that may develop as a result of the operation. Part "B" was prepared by Echo Bay Mines Ltd. and outlined the plan of action with respect to the conditional requirements outlined in the Water Licence and the Federal Land Leases.
1985	The A&R Plan was resubmitted to include revisions required under the amended Water Licence and was accepted with the exception of the plans for the Tailings Containment Area. Regulatory authorities indicated that it would be unwise to commit to a specific plan of action at that time due to advancing technology and the anticipated mine life.
1987 - 1995	Annual updates and revisions to the Plan were submitted for approval along with the results of various studies/reports undertaken during operations. A complete revision of the Plan incorporating new information/changes in scope was not requested until the 1995 Water Licence renewal.
1995-2000	Licence renewal granted on June 01, 1995 by the NWT Water Board and a revised "Interim" Abandonment and Restoration Plan was submitted in January 1996. Annual updates and revisions to the Plan were submitted to the Board for approval along with results of various studies completed to date. Transfer of authority to the Nunavut Water Board.
2000	Licence renewal granted on June 01, 2000 (NWB1LUP0008) by the Nunavut Water Board, with expiry on June 30, 2008.

2001	Approval of revised Interim Abandonment and Reclamation Plan.
2001 - 2004	Annual updates on progressive reclamation activities, and the results of various studies completed to date, were provided to the Board.

5.0 TCA RECLAMATION - SUPPORTING STUDIES

A number of studies were carried out in 2004 which support the tailings area reclamation plan that Lupin has developed. Summaries of the final reports for these studies are given below.

5.1 Saturated Granular Zone Cover

As part of ongoing restoration activities, and as described in the 1988, 1995, 2003 and 2004 Annual Reports to the Nunavut Water Board, Lupin has continued to cover the exposed tailings in completed cells with between 0.5m to 2.0m of esker material. To date, approximately 880,000 square metres of exposed tails have been covered. It is planned to cover the remaining exposed areas, approximately 650,000 square metres, in 2005 and 2006.

The previous abandonment and restoration plans prepared by Lupin proposed that the potentially acid-generating mine tailings would be encapsulated within permafrost upon closure of the mine. A suitably thick cover of esker material would be placed over the exposed tails, such that permafrost would aggrade through the tailings and into the base of the esker cover. The seasonal active layer would then be limited to within the inert esker cover. The permanently frozen condition of the tails would then prevent the oxidation of the sulphides contained in the tails and the mobility of any metals contained in the tailings pore water.

As indicated in Holubec (2005), the mean annual air temperature (MAAT) at Lupin has been rising since the first measurements were taken at the Contwoyto weather station in 1951 and the rate of increase has amplified since 1980, as has been observed in Alaska and the Northern Global hemisphere. Based on a general relationship observed between ground temperature and MAAT (Smith & Burgess, 2000), a ground temperature of 0º C is observed at a MAAT of –4.4º C. A trend line for MAAT data from the period 1960 to 2004 shows that the MAAT of –10.3º C observed at Lupin in 2004 will warm to -4.4º C (i.e. .0º C ground temperature) in about 110 years. However, the trend line for the 1980 to 2004 data shows that the -4.4º C point will be attained in only about 30 years.

The thawing index, which governs the thaw depth or thickness of the active zone, has been increasing corresponding with the MAAT. This trend indicates that the thawing index increased from about 850 degree-days to nearly 1000 degree-days from 1980 to 2004. The trends of the MAAT and thawing index indicate that the longevity of using permafrost encapsulation for the Lupin tailings may be limited to a lifespan of between 30 to 110 years.

Based on the possibility that this global warming trend should continue, and using design concepts described in MEND Report 2.21.1 (1992), MEND Report 6.1 (1993), and Holubec (2003), Lupin decided to change their tailings ARD mitigation strategy from one of permafrost encapsulation to that of encapsulation beneath a partially saturated granular cover.

Research on open water covers over tailings deposits has shown that the depth of the water cover is not governed by a criterion to create an oxygen barrier but to prevent the mobilization of the tails by wave action and ice scour (Atkins et al, 1997). Research done by Noranda Technology Centre (Li et al 1997) found that 0.3 m depth of stagnant water over tailings is sufficient to inhibit their oxidation. As well, Li reports that even a thin (2mm) laminar layer of saturated inert granular material at the tailings interface could significantly reduce the amount of oxygen reaching the tails. If the saturated granular layer were as thick as 10cm, *"the oxygen flux is then decreased by more than two orders of magnitude"*. Column testing by CANMET (MEND 2.21.1) demonstrated that a saturated zone within an esker cover provides the same benefit as an open water cover, whereby tailings oxidation is prevented even if the tailings are unfrozen.

The saturated zone cover design at Lupin consists of two layers:

- A surface layer that restricts the rate of evaporation of the saturated esker material at the base; and
- A basal saturated layer of esker material that prevents oxidation of the underlying tailings.

This thin partially saturated granular cover has many advantages:

- It provides an oxygen barrier that is not dependent on having permafrost within the tailings;
- It is not sensitive to annual temperature changes or global warming;
- It will support vegetation because the water table will be closer to the surface in a thin layer of esker material;
- It decreases the required volumes of esker material and thereby reduces the disturbance of the esker deposits.

From the initial tails cover program in 1988, Lupin had continued to monitor the covered tailings to assess the effectiveness of the covers. As a result, Lupin has collected an extensive database on the performance of covered cells in permafrost areas.

As described in later sections of this report, various studies (Golder 2004a) have determined that the physical and chemical durability of the cover material is acceptable, that a positive water balance will be maintained within the cover during drought conditions, and pore water expulsion potential from the compacted tailings during thaw conditions is not an issue.

Data collected from the monitoring programs over the past 16 years includes ground temperatures, water levels within the cover, water quality within the cover, slope of tailings surface, thickness of tails deposition, moisture content of the cover, and particle size analyses of tailings and cover materials. Also, test pits have been excavated through the cover to the tails surface to examine for evidence of cryoturbation, oxidation at the tailings interface, presence of ice lenses, and condition of the tails/cover interface.

Ground temperature monitoring has shown that the annual thaw depth through the esker cover into the tails varies from 0.2m to 0.9m below the tails surface, and that the unfrozen condition, in our present climate, lasts for less than 3 months. The thaw depth was seen to be greatly influenced by the thickness of the saturated zone within the esker material, such that the thicker the saturated zone was in the esker, the less the thaw depth penetrated into the tails. As explained above, this depth of thaw will increase if the global warming trend continues.

In 2002, nine water monitoring pipes were installed in Cell 1. Holes were dug through the esker cover and 15cm-diameter perforated pipes, lined with a geotextile filter, were installed so that their bases were approximately 15cm above the tails/esker interface. Water levels were measured in these pipes during the summer, from August 2002 to September 2004, when the saturated zone thawed. The results of this monitoring show that the saturation zone thickness in the esker cover of Cell 1 varied from an average of about 0.2 m around the perimeter of Cell 1, where tailings discharge took place, to an average of about 0.6 m in the central portion of the cell.

Nine test pits were dug with an excavator at several locations in Cells 1A, 1, 2 and 3 in September 2004 to gain information on esker cover thickness, presence and extent of a saturated zone within the cover, penetration of tailings into the esker material as evidence of cryoturbation, and the presence and degree of oxidation of tailings. The test pits were logged, photographed and selected samples were taken for moisture content and particle gradation determination. Esker cover thickness was observed to vary from about 0.9 to 1.3 m in areas where the tailings were not covered with a waste rock layer. In the two tests pits in the northwest corner of Cell 1, the esker cover was measured to be about 0.7 m. However, in this area the esker material was underlain by a layer of waste rock approximately 0.5m thick. In 8 of the 9 test pits, a saturated zone with free water was observed at the base of the esker material. The only pit not to show any saturation is located in Cell 3 in an area covered only 2 weeks prior to the pit excavation, so it did not have time to create a saturated zone by rainfall water infiltration.

No penetration of tailings into the esker material, or evidence of cryoturbation, was observed in any of the test pits. In the 7 test pits that encountered the tails interface, there was a clear horizontal linear boundary between the tails and sand, with no intermixing evident.

In two of the seven tests pits where esker material covers the tailings surface, minor oxidation of the tailings was observed. In both cases the tailings surface had been exposed for several years before a cover was placed and the depth of oxidation was judged to be less than 5 mm.

Moisture contents varying from 7.2% to 9.8% were determined from four samples of esker material taken from test pits in Cells 1A and 2. These samples were taken from vertical sections through the top 2/3rds of the esker cover in each pit, in the unsaturated zone. As stated earlier, the zone at the base of the esker cover contained visible free water.

Water quality within the saturated zone of the esker cover has been monitored since 1998. The results of this monitoring are compared to the quality of ponded water atop the esker cover in Cell 1, and that of Ponds 1 and 2, to show the improvement in water quality as it slowly filters through to the discharge point. (The concentrations shown are averages of the results obtained in each of the areas over this period.)

Table 4 – Water Quality Data Progression (average values)

Parameter	Units	NWB		Wells	Pit 2a	Cell 1	Pond 1	Pond 2
		Max Avg:	Max Grab:			ponded W		
Arsenic	mg/L	0.5	1	1.864	0.071	0.054	0.062	0.038
Cadmium	mg/L	n/a	n/a	0.003	0.002			
Copper	mg/L	0.15	0.3	0.171	0.283	0.027	0.049	0.013
Cyanide	mg/L	0.8	1.6	0.021	0.005	0.002	0.068	0.099
Lead	mg/L	0.1	0.2	0.062	0.006	0.002	0.001	0.001
Nickel	mg/L	0.2	0.4	1.212	0.875	0.123	0.094	0.087
Zinc	mg/L	0.4	0.8	0.425	0.437	0.123	0.262	0.193
pH		6.0 to 9.5	6.0 to 9.5	4.7	3.7	3.8	7.7	6.9

The results of the monitoring illustrate the following points:

- Water quality within the saturated esker zone generally exceeds the Nunavut Water Board discharge limits. However, the volume of water within this zone is small and will take considerable time to be flushed out.
- As the saturated zone water emerges at the Cell 1 pond, the water quality meets the NWB metals limits.
- Additional improvement in water quality, to that of meeting discharge standards, is found in Ponds 1 and 2.

The details of the many investigations in support of the saturated zone cover design are contained in the report "*Closure Plan for Lupin Tailings Containment Area*", completed by I. Holubec Consulting (Holubec 2005). This report is provided in Appendix 2.

5.2 Gravel Material Properties

Condition I.1.d in the Water Licence requires "*a comprehensive assessment of material suitability, including geochemical and physical characterization and availability for restoration needs, with attention to top-dressing materials, including maps, where appropriate, showing sources and stockpile locations of all borrow materials* ".

The Fingers Lake esker borrow pit, located approximately 3 km south of the TCA, has been the source of the esker material used for covering the cells since 1995, and will provide the cover material for the restoration of the remaining cells. A comprehensive assessment of the properties of the gravel material was conducted by Golder Associates in 2004. The following laboratory tests were completed on representative samples of the esker material:

- Grain size distribution and maximum and minimum density to generally characterize the esker material;
- Cyclic wetting and drying to assess the physical stability of the esker material;
- Chemical analysis of the tailings decant water; and

- Chemical analysis of leachate fluid from a mixture of esker material and tailings decant water to assess the chemical stability of the esker material.

The following conclusions are reported by Golder (2004a):

- *The results of sieve analyses indicate that the esker material is classified as gravely sand according to the Modified Unified Soil Classification System.*

- *The results of 20 cycles of wetting and drying indicate that the percentage of mass lost by the specimen over the course of the test was 0.31 percent. This value is considered to be within the accuracy of the testing method; consequently, the results indicate that the esker material is physically stable.*

- *Comparisons of the results of chemical analysis of the tailings decant water with that of the tailings decant water after it was leached through the esker material show negligible change in metals content. Based on these results, it does not appear that the esker material will physically degrade on exposure to the tailings decant water. Further, it appears that the chemistry of the tailings decant water will change relatively little if this fluid leaches through the esker material. It is, therefore, concluded that the esker material is a suitable cover material for the tailings deposition cells.*

The details of this study are contained in the report "Studies Related to Water Licence Requirements and in Support of Reclamation Planning", completed by Golder Associates (Golder 2004a). This report is provided in Appendix 3.

5.3 Cell / Pond Interaction

Condition G.1.d in the Water Licence requires a "*study of the potential for interaction between covered cells and flooded areas of the Lupin Tails Containment Area (TCA), including thermal analyses and modeling of the interaction between the ponds, the frozen-core perimeter dykes, and frozen tailings within cells, as well as the thermal effects of proposed pond elevations*".

This thermal analysis was carried out in a project conducted by Golder Associates in the summer of 2004. A number of scenarios were examined in the study. The effects of a fluctuating Pond 2 water elevation upon K Dam and the frozen tailings impounded by it in Cell 3, as well as the effects on Dam 1A, were evaluated. The results of the thermal analyses indicate that, after an elapsed period of 20 years, the thaw zone does not extend to the frozen tailings when as much as 8.5 m of water is impounded against the downstream face of K Dam. This is a conservative assessment, as it is only possible at present to store a maximum of 5.5 m of water against the dam. The extent of thaw progression should be greater in gravely sand esker material, silty sand till and run-of-mine waste than in frozen tailings. The results are, therefore, considered as reasonable and a somewhat conservative representation of the interaction between flooded areas and other internal dams within the TCA.

The results of this study are moot, however, considering that the elevation of Pond 2 will be regulated by a spillway constructed at Dam 1A, which will limit the water level in the pond to a maximum of 480m elevation. This is the elevation of the base of K Dam, so no water will be impounded against this dam. The base of M Dam is variable between 482m to 483m elevation, so no water will be impounded against this dam either.

The details of this study are contained in the report "Studies Related to Water Licence Requirements and in Support of Reclamation Planning", completed by Golder Associates (Golder 2004a). This report is provided in Appendix 3.

5.4 Pore Water Expulsion Potential

Condition I.3.b in the Water Licence requires "*an outline of methods to contain potential pore water expulsion from the TCA*".

This study was carried out by Golder Associates during the summer of 2004.

In order to design containment methods, the mechanisms that could potentially lead to the expulsion of pore water from the TCA must be analyzed. These were determined to be:

- Loss of pore water from the TCA via talik seepage at depth;
- Consolidation of unfrozen tailings situated against a perimeter dam (due to increased loading and/or thawing); and
- Leaching of pore water as a result of infiltration through the active layer within the tailings and cover.

The talik seepage mechanism refers to seepage of pore fluid through an unfrozen zone which has developed beneath a frozen core dam, where the unfrozen zone is the result of warming due to adjacent impounded water. Thermistors installed in all the dams which impound water in the TCA show that no thaw zones exist under these dams at present. The results of the thermal analysis conducted for the Pond/Cell interaction study indicate that, after 20 years with a maximum depth of impounded water in a pond, such a talik would not form. Golder (2004a) concludes that "*it is not anticipated that impounded water within the TCA would result in unfrozen zones that underlie the tailings impoundment structures. The potential mechanism of pore water expulsion from the TCA as a result of talik seepage is considered unlikely.*"

The consolidation mechanism refers to pore water expulsion resulting from consolidation of unfrozen tailings due to the loading from the overlying esker cover layer. The active zone within unfrozen tailings extends for a depth of 2 metres below the tails surface. Using known consolidation and physical properties of the tailings, and a 1-metre thick esker cover, the Golder study determined the release of tailings water from the pore voids due to consolidation to be approximately 0.03 m^3 of pore water for each 1 m^3 of tailings within the active layer, or 0.06m^3 of pore water for the 2 metre active zone depth. It was also determined that the tails would reach maximum consolidation, due to the loading of the overlying cover, within 30 days following the placement of the cover. This consolidation mechanism would only be active for a brief period and would not persist into subsequent seasons.

The thermal analyses conducted in the Golder study indicate that there is a potential of lateral pore water flow through the active layer and over the crest of the frozen dam core. This potential for lateral pore water flow and leaching is limited to the periphery of the tailings cells, adjacent to the impoundment dams, and would exist only when there is sufficient surface water infiltration (due to rainfall in the summer) to generate a significant lateral hydraulic gradient within the active layer. Two conditions must be present for this lateral flow mechanism to be active. First, sufficient infiltration must occur into the esker cover material to provide a water table within the active layer. Second, the water table within the active layer must be higher than the frozen core of the dam. The probability of the above conditions being present at the same time depends upon the climate, the amount of rainfall and its timing.

The highest net precipitation levels occur in May and June, due to the combination of spring freshet and rainfall. However, the active layer within the esker cover materials is shallow during this period and the potential for pore water to leach into the active layer water is, therefore, low. The maximum depth to the frozen dam cores beneath the dam crests is expected to be in later summer/early fall; however, based on the results of the climate and hydrology studies, evaporation typically exceeds precipitation during this period. Consequently, the potential for a water table within the active layer that is higher than the elevation of the frozen dam core is relatively low. The conclusion that can be drawn from this is that expulsion of pore water from the TCA via leaching and lateral flow would occur only with a combination of warm spring/summer and high precipitation events in the late summer/early fall, and the extent of the leaching would be limited to the periphery of the tailings cells adjacent to the dams.

Although the potential for expulsion of pore water from the TCA via the lateral flow and leaching mechanism is low, a number of approaches may be considered to further reduce it. The first approach would be to limit the active layer in the esker covered tails at the periphery of the cells by providing an additional metre of esker cover, a few metres wide, at the upstream edge of the cell, adjacent to the dam. This would maintain the tailings in a frozen state and raise the active zone to within the esker cover. The other approach would be to raise the height of the dam crest, so as to raise the level of the frozen core to an elevation above the level of the active zone in the tails. The thermal models indicate that more material would be required to carry this out than for the first alternative, and dam stability could also be affected due to the increased loading.

Implementation of the first alternative was performed as follows: A peripheral strip of esker was added to the upstream edge of Dam 3D, adjacent to Cell 1, during the cell covering program in 2004. Another peripheral strip was added to the upstream edge of Dam 6, at the west edge of Cell 3. K Dam, which separates Cell 3 from Pond 2, was constructed with an impermeable liner, and therefore does not require additional material. Additional strips of esker cover will be added to unlined dam/cell peripheries during 2005.

The details of this study are contained in the report "Studies Related to Water Licence Requirements and in Support of Reclamation Planning", completed by Golder Associates (Golder 2004a). This report is provided in Appendix 3.

5.5 Climate and Hydrology Study

The granular esker material that is being used to cover the exposed tailings serves two purposes. It provides a cap on the exposed tails, thereby preventing wind dispersal of dried tailings dust, and the saturated base of the cover provides a barrier to oxidation of the underlying tails. It is critical that a positive water balance is maintained within the cover system for the oxidation barrier to be effective.

A climate and hydrological study was carried out by Golder Associates during the summer of 2004. The objectives of this study were twofold:

- Summarize the historical climate conditions of the Lupin Mine TCA; and
- Estimate the probability of maintaining a positive water balance over the surface of the TCA.

The water balance for the study area at Lupin was assessed on the basis of regional as well as site-specific information on temperature, precipitation (rainfall and snowfall), evaporation and runoff. Climatic data have been collected at the Lupin weather station, under contract to Environment Canada, on a daily basis since 1982. Monthly summaries of the temperature and precipitation data for Lupin are presented in Tables 3 and 4, in Section 1.5.1. An evaporation station has only recently been installed at Lupin, so mean annual and mean monthly evaporation data were derived from data recorded at the Norman Wells Airport, which is located at the same latitude as Lupin and has a similar precipitation profile. Differences in mean temperature between Lupin and Norman Wells did not allow for direct transfer of evaporation data. A relationship between mean monthly temperature and total monthly evaporation was established for Norman Wells. This relationship was used to calculate pan and lake evaporation for Lupin using mean monthly temperatures. Evaporation was only calculated where the monthly mean temperatures were greater than zero.

For the purposes of the water balance analysis at Lupin Mine, it was assumed that the amounts of snowfall "under-reported" and snow accumulation lost to sublimation were comparable and, thus, no adjustments to the recorded snowfall values were deemed necessary.

A monthly water balance was conducted based on a 21-year series of monthly precipitation and evaporation data derived for the study area. The objective of the analysis was to characterize the availability of inflow into, or the runoff from the TCA.

Golder (2004a) reached the following conclusions in the study: *"The water balance results indicate that there are relatively high probabilities of surface moisture deficit during any one summer month at the Lupin Mine TCA. However, the results also indicate that the probability of surface moisture deficits in two consecutive summer months is relatively low. More specifically, the results indicate that the cumulative surface moisture deficit in two consecutive summer months is unlikely to exceed 50 mm. Given the proposed cover thickness of 1 m, the probability of drying out the entire cover is considered low. In other words, it is considered likely that partial saturation can be maintained within the cover system for the given climate and hydrological conditions at the Lupin Mine area, and the cover layer is anticipated to perform as an oxidation barrier."*

The details of this study are contained in the report "Studies Related to Water Licence Requirements and in Support of Reclamation Planning", completed by Golder Associates (Golder 2004a). This report is provided in Appendix 3.

5.6 Ecological Risk Assessment

The main purpose of the granular cover is to isolate the underlying tailings from the surface environment. This will prevent wind dispersal of dried tails, minimize contact with the fauna, and prevent oxidation of the tailings by creating a barrier layer of saturated sand over the tails. In order to gain a better understanding of the ecological implications of this reclamation strategy, a risk assessment was conducted to evaluate the likelihood of adverse ecological/environmental effects occurring as a result of the mobility of the tailings fluids within the TCA. Aquatic risks were not evaluated because Ponds 1 and 2 are not intended to be aquatic habitat, and spillways will be constructed to prevent fish movement into the ponds. The ecological risk assessment, conducted by Golder Associates (2004b), examined:

- The identification of potential ecological receptors
- The identification of constituents of ecologic concern
- The identification of toxicity and bioavailability of constituents of concern
- The identification of potential exposure pathways, including potential migration into the surrounding ecosystem through overtopping of, or limited transmittal through, the containment structures
- Ecological risk analysis and assessment, including a discussion of the uncertainties associated with the assessment, and
- Remediation alternatives, if necessary.

The following wildlife receptors were evaluated in the risk assessment:

- muskoxen (*Ovibos moschatus*);
- caribou (*Rangifer tarandus*);
- grizzly bears (*Ursus arctos horribilis*);

- wolverine (*Gulo gulo*);
- fox (*Vulpes vulpes*);
- wolves (*Canis lupus*);
- hare *(Lepus arcticus*);
- arctic ground squirrel (*Spermophilus parryii*);
- ptarmigan (*Lagopus lagopus*);
- rough legged hawk (*Buteo lagopus*);
- snipe (*Gallinago gallinago*); and,
- long-tailed duck (*Clangula hyemalis*).

The risk assessment focused on the potential risks to wildlife health due to exposure to food (vegetation, invertebrates and prey, as applicable), water and incidental soil ingestion. Risks to human health were also evaluated based on consumption of caribou that may have the potential to be exposed to metals and cyanide from the TCA. Humans are not expected to be directly exposed to metals and cyanide in the TCA by incidental ingestion of tailings or by drinking effluent.

Exposure to metals and cyanide by wildlife that may inhabit areas near the mine, and by people that may consume caribou meat, was estimated by determining the following:

- the concentrations of substances in soil, sediment, plants and water;
- the types of receptors (i.e., wildlife) that could be in the vicinity of the mine or consume organisms that spend time in the area;
- the pathways by which receptors may come in contact with substances (i.e., incidental ingestion of soil, ingestion of food and water);
- the amount of time receptors may spend within the mine site (i.e., days/year);
- typical soil, sand, water and food ingestion rates and body weights for wildlife receptors;
- typical meat ingestion rates and body weights for human receptors; and,
- the quantity of metals that receptors are likely to take into their bodies by each pathway.

In the risk assessment, the hazard potential of substances was estimated by considering the following:

- determining whether the quantity of substances in soil, sediment and water exceeds applicable regulatory guidelines;
- reviewing the toxicity information associated with each substance; and
- determining the total amount of exposure from all applicable pathways that would be unlikely to cause adverse health effects in receptors (toxicity benchmarks).

Results of this ecological risk assessment show that:

- Exposure to humans and wildlife via water from within the capped tailings is not significant. Based on the results of the engineering feasibility of covering exposed tailings with esker material, it is not expected that any appreciable amount of pore water will seep into the ponds. Nor is it expected that water at the tailings interface will move upward into the root zone of plants growing at the surface of the esker material (Golder 2004a).

- There is no risk to human or predator health due to the ingestion of meat from caribou that migrate through the TCA. Conservative assumptions and many layers of safety were used to estimate exposure and to derive toxicity benchmarks. This means that there is a high degree of certainty that risks have not been underestimated and that all potential receptors would be safe from exposure to metals from the study area.

- A potential for risk was identified for individual shorebirds and waterfowl (snipe and long-tailed duck) due to potential exposure to arsenic and cyanide in invertebrates in Ponds 1 and 2. However, it is very unlikely that substantial numbers of invertebrates are present in the ponds, and the numbers that might be present are unlikely to fully support dietary needs of the birds. None of the sediment samples taken from Ponds 1 or 2 for this study were seen to contain any benthic invertebrates. Risks to populations of shorebirds and waterfowl, as opposed to individuals, are unlikely due to the low numbers of birds that make use of the ponds as a resting place. Based on a literature review, 15 pairs of shorebirds and 8 pairs of ducks may use the Lupin Mine TCA as a nesting and feeding area during a given season. Again, because conservative assumptions and many layers of safety were applied to the wildlife health risk assessment, it is unlikely that any significant risk exists to shorebirds and waterfowl.

The details of this study are contained in the report “Ecological Risk Assessment for the Lupin Mine Tailings Containment Area”, completed by Golder Associates (Golder 2004b). This report is provided in Appendix 4.

6.0 ABANDONMENT AND RESTORATION PLANNED ACTIVITIES

The goal of the restoration practices in the TCA is to minimize or preferably eliminate degradation of disturbed areas and to initiate, encourage and accelerate the natural recovery.

Conducting reclamation activities concurrent with the mining operations has been an important part of the Echo Bay and Kinross Environmental Policies. These activities have been ongoing since the late 1980's, and have been described in the annual submissions to the Board. Examples of this are the mitigation work completed on past spill locations, covering portions of the exposed tailings containment area with esker material, demolition/salvage of un-needed structures, etc.

6.1 TCA Infrastructure

Arsenic Treatment Facility - This facility, a steel frame/metal clad building, is located at the Tailings Containment Area. It was used for mixing of reagents (ferric sulphate and lime) for water treatment operations during the early 1990's and has been inactive since 1996. All components were flushed after use, but will be rewashed and the structure will be removed from the TCA and salvaged, if economical, or disposed of within the surface landfill located at the mine site.

Tailings Lines - The eight-inch insulated pipeline between the mill complex and the Tailings Containment Area extends for six kilometres to the impoundment, and for an additional 2.5 km within the impoundment. See Figure 5 in Appendix 1 for tailings line route location. Various small buildings along the line house valves for either dumping of the line to controlled sumps or switching flow direction.

The eight-inch line will be flushed thoroughly with clean water prior to being dismantled, along with the associated buildings. If salvageable, the pipe will be sold or reused in another application. If salvage is not viable, the piping will be disposed of by burial in the surface landfill.

In addition to the tailings line, there are two dump stations (shallow sumps) located along the tailings line route (Figure 5). These stations allowed for the emergency dumping of tailings line contents in the event of an unplanned mill shutdown. These stations will be cleaned of the small amount of tailings materials, which will transported and disposed of at the TCA. The sump berms will be flattened and pushed into the depressions. The former sump area will then be covered by a 1-metre thick layer of esker material, contoured and scarified to promote re-vegetation.

Roads - A considerable amount of roadway exists at the TCA to connect the various perimeter and internal dams. All roadways will be generally left intact with the exception of areas where drainage is controlled by culverts. The removal of culverts and the backsloping of the opening would ensure that minimal erosion takes place and proper drainage is achieved. Any other areas where water has pooled along the roads during spring melt would be opened up to provide unimpeded drainage. In order to promote natural ingrowth of vegetation, the road surfaces would be ripped/scarified to provide microclimate sites for seed deposition.

6.2 Tailings Containment Area

6.2.1 General Description

The Tailings Containment Area (TCA) is located approximately six kilometres south of the Lupin mine, and covers an area of about 361 hectares within the 750 hectare lease. The containment is divided into three main components: solids retention cells (1-5), polishing ponds (Pond No.1 and Pond No.2) and the End Lake area (not used). The disposal area would be considered as a "High Impact" facility as it meets at least one of the listed criteria (ie. greater than 100 hectares) listed in the "Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories".

A detailed history of the design and operation of the TCA is contained in the Holubec (2005) report, attached as Appendix 2 to this document.

The cells within the impoundment allow for separation of the liquid from the solid tailings as well as providing treatment through natural degradation. Cell 4, which is used as the initial polishing pond, receives decant water from the cells and retains solutions for approximately ten months prior to transfer by gated culvert into Pond No.1. Water is retained for another year in Pond 1, prior to siphoning into Pond 2. Pond No.2 then retains the water for an additional eleven months prior to discharge to the environment.

The TCA is impounded through natural terrain relief and a series of engineered retaining structures (Figure 3 - Lupin Mine Tailings Area, 2004, Appendix 1). The main water retaining perimeter dams are Dam 1a and Dam 2, which contain Pond 2, and Dam 4 in Cell 4. Dams 5 and 6 within Cell 3 are low level dams. No tailings or water has been impounded against Dams 1B, 1C, or 5 and no water head will be placed on these structures upon closure. The tailings impounded against Dam 3 (Cell 1A) and Dam 6 (Cell 3) were covered by 1 metre of esker material in 1988 and 2004, respectively.

All perimeter dams have been designed with a synthetic liner for initial control of seepage and temperature monitoring of the dams shows that the cores remain frozen year-round. K-Dam, which is an internal structure, was also designed with a synthetic liner for initial seepage control. A tailings beach, approximately 10 metres in depth, has been placed on the upstream side of this dam and temperature monitoring indicates that the core remains frozen year-round.

Tailings Cells 1 and 2 are separated from Pond 1 by Dam 3D. The stability of this esker fill dam was enhanced in 1995 by the addition of a 10-metre wide downstream berm, constructed of

75,000 cubic metres of quarried waste rock, placed at a slope between 1.5H:1V to 2.0H:1V. The addition of this waste rock has also increased the erosion protection of the dam.

Ponds 1 and 2 are separated by J-Dam, which was constructed with esker material and mine development waste rock. Two 18-inch diameter syphons have been placed over this dam to allow the annual transfer of water from Pond 1 to Pond 2. Following the final transfer of water to Pond 2, and as one of the final activities during closure, J Dam will be breached and a spillway established at elevation 481.0m to permit a controlled flow of water into Pond 2.

6.2.2 Impoundment Stability

The perimeter and internal structures that were originally constructed to impound water or tailings solids within the TCA will become essentially earthen embankments after the completion of abandonment activities. The perimeter dams that currently impound water are Dam 1A, Dam 2, and Dam 4. With the construction of spillways through J Dam and Dam 1A, and a natural flow of water from the Cell 4 pond, water in Pond 2 will not encroach on either Dam 1A or Dam 2 and will only reach the toe of the internal dam N Dam. Dam 4, which presently separates Long Lake from the Cell 4 pond, will have water against each toe, but this is a wide (>45 metres toe-to-toe) structure that will be further enhanced by additional riprap on the sides to bring the slope to at least 2.5H:1V.

Dam Safety Guidelines were developed by the Canadian Dam Association (1999) to apply to dams that are at least 2.5 m high and which have at least 30,000 m^3 of reservoir capacity. The guidelines also apply to tailings dams if the reservoir contents could be released and have an unacceptable impact on the environment. If a dam falls under the dam safety guidelines, it has to meet the physical stability criteria given by a minimum factor of safety for static condition of 1.5, and generally 1.1 for seismic conditions.

The construction of the impoundment structures has been assessed with respect to present conditions and long term stability on final abandonment. Stability analyses of the main perimeter dams (1A, 2, and 4) were conducted as part of a Dam Safety Review in 2004 (Golder 2004c).

Material parameters for unfrozen construction materials were used in the analyses, as opposed to using parameters for frozen materials. This was done to ensure that results would be conservative and to reflect the possibility of long-term global warming. A very conservative assumption for seismic amplification safety factor of 4 (i.e. g = 0.064) was used for the perimeter dams. Also, the analyses assumed that groundwater levels corresponded to the tailings pond elevation at the crest of the dam, dropping through the dam to the toe drain. This too is a conservative assumption, as there is currently significant freeboard on all 3 dams and on abandonment there will be no head at all.

The stability analyses indicate that all 3 perimeter dams presently satisfy the criteria for stability in the Dam Safety Guidelines for both static and pseudo-static loading conditions. Results of the stability analyses can be seen in the following table.

Table 6 – Results of Perimeter Dam Stability Analyses

Dam	Calculated Factor of Safety		
	Static	**g = 0.016**	**g = 0.064**
1A	1.61	1.54	1.33
2	1.69	1.61	1.41
4	1.74	1.67	1.49

These results, calculated using very conservative assumptions, show that there is no concern for the stability of these perimeter structures following abandonment.

The physical stability of Dams 3D, K, M and N do not have to meet the minimum CDA factor of safety for static condition of 1.50 since they will not fall under the dam classification (retaining water) after abandonment. Highway embankments that are 4 to 5 m high are normally designed with a minimum Factor of Safety (FS) greater than 1.3, so this FS would be more appropriate for the perimeter dam application. Regardless, a minimum FS of 1.5 will be expected of the internal dams after abandonment. The stability of these dams was analysed by Holubec Consulting, as part of a report on the overall history and closure of the TCA (Holubec 2005). The stability of the structures was analysed for three conditions:

- Present - frozen core and foundation.
- Existing structures - thawed core and foundation due to global warming
- Closure design - thawed core and foundation due to global warming.

Results of the stability analyses of the 3 main dams can be seen in the following table.

Table 7 – Results of Internal Dam Stability Analyses

Dam	Existing frozen dam		Thawed dam with different ground water levels			Closure geometry Berm slopes		
	Thru Rock berm	Thru Esker Section	Hi WL	Lo WL	Likely	Static		Seismic
						2h:1v	2.5h:1v	2.5h:1v
K Dam		8.8	0.96	1.21		1.63	2.11	2.02
3D Dam	1.4	8.5			1.51		2.04	1.95
M Dam		8.1			1.32	1.62	1.91	1.82

The existing structures have very high minimum factors of safety (8.1 to 8.8) under the present frozen condition. K Dam shows the worst "thawed condition" FS. Depending on assumed groundwater surface within the dam, the minimum factor of safety would be between 0.96 (high groundwater level) and 1.21 (low groundwater level). Placing a rockfill stabilizing berm on the existing downstream face however will raise the minimum factor of safety to 1.63 for a downstream slope of 2 horizontal to 1 vertical (2H:1V), and to 2.11 for a slope of 2.5H:1V. Riprap will be added to the downstream face of K Dam to flatten the slope to 2.5H:1V.

Dam 3D and M Dam show higher "thawed condition" factors of safety with their present geometries, but these dams will also be enhanced by adding riprap to the downstream faces in order to reduce the slopes to between 2H:1V and 2.5H:1V.

Seismic stability analyses were also conducted on the final closure design geometry. The results shown for final slopes of 2.5H:1V show the static minimum factors of safety to drop about 5% when earthquake acceleration is applied to these earth structures. Considering that much lower minimum factors are accepted for earthquake loading, the final closure design structures will have very satisfactory minimum factors of safety.

The details of this study are contained in the report "Closure Plan for the Lupin Tailings Containment Area", completed by Igor Holubec Consulting (Holubec 2005). This report is provided in Appendix 2.

6.3 ARD (Acid Rock Drainage) Potential of Tailings

Extensive studies completed in the past have shown that the Lupin tailings, given the proper conditions, will oxidize and produce the byproducts necessary for the formation of acidic runoff. Typical Lupin tailings contain approximately 3% sulphur (total) and have a Neutralizing Potential to Maximum Potential Acidity (NP/MPA) ratio of less than three.

Included in these studies were a 1991-1992, 30 week column leach program (kinetic test) and a follow-up16 week leaching program in 1993 on mitigative measures for Cell 5 (then known as Area 3) tailings (Klohn 1992a). In addition, a 1992 study was completed on the assessment of water chemistry and remedial measures for the Lupin Tailings Management System with regard to the affects of the (formerly) exposed tailings within Pond 2 (Klohn 1992b and Klohn 1993). One of the results of this study was the decision to build M Dam, which now separates Cell 5 from Pond 2, and prevents any further contamination of the Pond by the inflow of raw tails.

In 1994, Echo Bay Mines Ltd. retained the services of Klohn-Crippen Consultants Ltd. for the engineering, geophysical and data interpretation of a test plot area on Cell 1 (Klohn 1995). Results of the geophysical portion of the study were inconclusive, however considerable background information was generated with regard to the chemistry of the tailings prior to covering.

In 1995, a continuation of the 1994 study incorporated the more standard physical measurement techniques of thermistors, frost probing and frost tubes at the study area. The scope was broadened when the decision to expand the esker cover program was made and Cell 1 was covered. This data, along with that generated by the additional thermistors installed in the following years, provided excellent information of the thermal response of the covered tails.

Because of the potential for acid generation from the tailings, all exposed tails will be covered by a 1-metre layer of non-reactive, highly durable, saturated esker material. This layer will prevent any contact with the surface environment and the saturated zone at the tails interface will provide an effective barrier to oxidation.

6.4 Planned Restoration Activities

Restoration for the Tailings Containment Area will involve two physical methods for remediation and control of potential contamination from the materials that are held within its boundaries. These methods are:

1. maintaining water cover over areas that are currently used for water retention and low elevation tailings deposition (ponds); and
2. mechanical covering of the higher elevation areas containing tailings (cells) with esker material.

Of the 750 hectares within the lease area, an estimated 177 hectares has been affected directly by the deposition of tailings solids. The closure concept adopted by Kinross in the restoration of this area is to encapsulate the tailings (which are potentially acid generating) within a water saturated esker material cover. This would effectively isolate the tailings from the environment and limit oxygen transfer through to the sulphide contained in the tailings and so prevent acid generation.

These cells, with their respective disturbance coverage areas and approximate watershed, are listed in the following table along with the two ponds and their intended surface areas at closure.

Table 8 - Lupin Tailings Containment, Areas

LOCATION	SURFACE AREA m^2	WATERSHED AREA m^2
CELL NO.1	330,000	410,100
CELL NO.1a	61,900	63,800
CELL NO.2	169,000	208,550
CELL NO.3	458,150	667,600
CELL NO.4	447,600	543,220
CELL NO.5	365,200	558,050
POND NO.1 (elev 481)	218,000	451,820
POND NO.2 (elev 480)	1,627,000	2,120,660
TOTAL	3,676,850	5,023,800

In the TCA, the total watershed area is such that accumulation of spring meltwater takes place. Even though a close to neutral evaporation environment exists, the large watershed results in an average annual increase in pond water elevation of approximately 0.5 metres.

At final closure, a system of riprap spillways will be constructed to permit natural water flow to the environment. Typical water elevations in the ponds, prior to and after annual discharge, are shown in the following table:

Table 9 – TCA Water Elevations

	Before Discharge (el.)	After Discharge (el.)
Cell 4	486.8	485.0
Pond 1	484.6	481.0
Pond 2	483.0	480.0

Currently, a gated culvert controls the flow of water between Cell 4 and Pond 1. The topographic channel between these two ponds is at 485.0m elevation and will provide a natural gradient when the culvert is permanently removed during closure activities. Ponds 1 and 2 are separated by J Dam, and water is presently transferred between the two ponds by using a syphon. After the final transfer of water into Pond 2, J Dam will be breached and a spillway will be constructed at an elevation of 481.0m. Limiting maximum water level to this elevation will reduce the impoundment of water against Dam 3D and maintain a natural gradient for flow from the Cell 4 watershed. The final elevation of the water in Pond 2, following the syphon discharge to the environment, will be at a maximum of 480.0m elevation. After final syphon discharge, the syphons will be removed and a spillway will be constructed through Dam 1A at an elevation of 480.0m. This would allow any accumulated water from spring freshet and seasonal rain to leave the impoundment area and flow through its original natural course via Seep Creek and eventually into Inner Sun Bay of Contwoyto Lake. At a maximum water elevation of 480.0m, no water will be impounded against the sides of Dam 1A, Dam 2, or M Dam.

Prior to activation of the spillway, an evaluation of the water chemistry will be made to ensure that when outflow occurs, all water quality guidelines are met. The outflow would amount to an estimated annual average water volume of approximately 250,000 m^3, the majority of flow occurring in June and early July. As there is an elevation difference of approximately 3 metres from the planned outflow to the receiving stream, the channel will be easily designed to prevent the migration by fish species (eg. arctic grayling) into the containment area through the use of a natural vertical barrier.

In addition to maintaining a water cover in the current holding pond areas of the TCA, the areas that will require the esker cover at closure are limited to the tailings cells where direct deposit of tailings solids takes place. Because there is very little additional watershed associated with the closed cells and the esker cover will be contoured to promote controlled drainage, flooding and erosion will not be a concern and the moisture retention of the cover assists the insulating value at depth and prohibiting oxidation of the underlying tails.

In general, with all the cells being situated around the perimeter of Ponds 1 and 2, there is a natural slope and drainage that results in collection within the ponds. The accumulated snow and its associated runoff naturally flows towards the two Ponds. Presently in Cell 1, runoff enters Pond No.1 at the eastern end where a slight depression in the Dam 3D access road has been made to allow flow.

The source of esker material for the cell cover, as well as most of the TCA construction programs at Lupin, has been the Fingers Lake Esker, located approximately four kilometres to the southeast of the TCA. This borrow source has been used for construction of K dam, Dam 4, Dam 5, Dam 6, Dam 3C and 3D, L dam and M dam, as well as an underground backfill program which utilized over 300,000 m^3 of material. The variety in the size and segregation of the material allows for selection to suit the construction required without additional screening. Historically there has been in excess of two million cubic metres of material removed from this source. Visually, this has impacted only a small fraction of the material present and the amount of material remaining (in the nearest section of the esker) is more than adequate for the 650,000 square metres of exposed tails that remain to be covered at the TCA. Drilling associated with the installation of a thermistor (2000) at the esker had shown depths greater than 10 metres, with no major ice lenses encountered.

In addition to covering all exposed tailings, a major program of dam enhancement is planned during the closure activities. The sides of all the dams will be brought to at least a 2.5H:1V slope by the addition of quarried waste riprap. This will significantly enhance both the stability and erosion protection of all the dams.

Presently, the only perimeter dams that impound water are Dams 1A, 2, and 4. After construction of the Dam 1A spillway, Dams 1A and 2 will no longer impound water, as the base of both dams is at the 482m elevation and the water level will be maintained at or below the 480m elevation. The upstream and downstream sides will be re-sloped to provide geotechnical stability and erosion protection. The upstream side of Dam 4 is already at a minimum of 3H:1V slope, and as much as 4.5H:1V at the west abutment. With the amount of waste rock present on the upstream side, Dam 4 is essentially a shoreline.

The sides of the internal dams will also be re-sloped to a minimum of 2H:1V. Pond 2 is currently in contact with the sides of K Dam, M Dam, and N Dam, while Pond 1 water contacts Dam 3D. The downstream side of K Dam, currently built with a slope averaging 1.6H:1V, will be enhanced with riprap to a 2.5H:1V slope to provide additional geotechnical stability to the dam. The dam base is at 482 metres elevation and, since the final water elevation in Pond 2 will be at 480 metres, no water will be impounded against the side at closure. Pond 2 will also not be in contact with M Dam at closure. The sides of M Dam are built at a slope averaging 1.5H:1V, and stability will be enhanced by adding riprap to achieve a final 2H:1V slope. N Dam is a low containment at the north east end of Pond 2, adjacent to the end of M Dam. This dam will be in contact with Pond 2 and additional riprap armour will be placed on this dam, to achieve a 2H:1V slope (the slope is currently 1.8H:1V). Dam 3D separates Pond 1 from Cells 1 and 2. It is already a substantial structure, over 30 metres wide, having been reinforced with over 75,000 cubic metres of riprap in 1995. It is geotechnically stable and does not require any additional material.

6.5 Water Quality

As discussed in Section 5.1, water quality within the saturated zone of the esker cover has been monitored since 1998. To supplement this data, nine water monitoring pipes were installed in Cell 1 in 2002. Holes were dug through the esker cover and 15cm-diameter perforated pipes, lined with a geotextile filter, were installed so that their bases were approximately 15cm above the tails/esker interface. Water samples were extracted from the wells and sent for analysis. Table 4 shows the improvement in water quality as it slowly filters through from the pores in the saturated zone within the esker, to its emergence within Cell 1 ponded water, passing through Pond 1 and reaching Pond 2, from where it has been periodically siphoned out.

The results presented in Table 4 illustrate the following:

- Water quality of the saturated esker zone is marginally above the Nunavut Water Board (NWB) License. The volume of water within this zone is small and will take considerable time to be flushed out;
- As the saturated zone water emerges in Cell 1 pond water, the quality meets NWB metals discharge limits;

- Additional improvement in water quality is found in Ponds 1 and 2. Values of the water quality parameters in Ponds 1 and 2 vary from a half to about a fiftieth of the concentration levels of the water within the saturated zone of the esker.
- The existing water quality in Ponds 1 and 2 is for a tailings surface area that has, until the summer of 2004, been predominantly exposed and affected by windblown tailings dust as well as runoff from the cells. The present tailings surface area is now 58% covered by a layer of esker sand. Completing the cover for the whole area by 2006 will show considerable further water quality improvement in Ponds 1 and 2.

Further details of the water quality assessment are contained in the report "*Closure Plan for Lupin Tailings Containment Area*", completed by I. Holubec Consulting (Holubec 2005). This report is provided in Appendix 2.

6.6 Alternative Covers

An all inclusive water cover option for the closed cells had been considered. However, the additional cost of raising perimeter dams to provide the required water depth and freeboard, the added stability risk of water retaining structures, and the need for continued monitoring indicated that other options would be more practical.

Investigations into alternatives to the granular saturated zone cover option have been considered. Among these is the incorporation of an ice lens or layer, under the placed cover, to reduce heat transfer and thereby maintain cold conditions below the cover. This could be accomplished by constructing the insulating layer during the winter, over entrapped ice and snow. The problem with this alternative is that the esker can only be farmed during the summer, while it is thawed. Winter conditions would require blasting of the esker material, and would result in a very inefficient placement of the cover.

Another alternative considered was the use of coarse waste as the cover medium. This cover incorporates the concept of convective heat transfer to promote more rapid freezing of the tailings while preventing summer thaw. Rather than using a well graded fine grained material, such as the esker material, this alternative utilizes a 1 to 2 metre thickness of poorly graded, open-work waste rock to create a natural thermosyphon. Optimum size of the waste pieces would be in the order of 30 to 50 cm diameter, with minimal fines, to provide for large void spaces. The disadvantage of this alternative is that the resulting landscape would be impassable for animals and resistant to revegetation, since it is effectively a boulder field. Also, drilling, blasting and hauling of rock are significantly more expensive than farming esker material.

6.7 Revegetation

The harsh environments associated with the area can make it difficult, if not impossible, to carry out a successful revegetation program. The research department of Alberta Environment

(Alberta Environmental Centre) has completed studies on indigenous plants for high alpine reclamation projects. Their studies have shown that the native plants are better adapted and provide a more consistent cover over the long term than introduced species. An assumption that local species will later re-invade an area revegetated with generic commercial mixes and take over the site is not always correct, as some foreign species can be competitive and persistent. A variety of alpine grasses are commercially available but they have not been tested in arctic environments.

The technology for commercial seed production is available to some extent, however the resources are small and a number of years are required in order to produce enough supply for any major project. As well, a seed mixture is the preferable method of revegetation, which requires additional preparation.

The areas at the Lupin site which may require revegetation enhancements are limited in type (covered tailings, abandoned roadways etc.), most being raised above the surrounding terrain, windswept and dry. The lack of suitable growth medium and unavailable soil amendments for post use reclamation make it much more difficult. The esker deposit is the major material type that would be used in restoration activities and lacks the organic/nutrient content that the surrounding vegetation has established. This is another reason why the native grasses etc., have considerably more success at re-establishment. The tailings cells that were covered by esker material in 1988 and 1995 have both started to re-vegetate on their own.

The procedure of scarifying reclaimed surfaces, as carried out successfully on Cell 1A, the old airstrip, and the East Zone crown pillar cover, will be continued in order to provide a microclimate for natural plant growth. Providing a rough surface enhances seed entrapment, moisture retention and wind protection.

An alternative to natural re-establishment and alien species use is the practice of native sod transplanting. This procedure involves the transplanting of blocks of soil to the restoration area which contain both the plant species and associated microflora. These "sod islands" provide a nuclei that plants and microorganisms can emigrate from. Many plant species produce rhizomes, suckers or shoots that are responsible for propagation. This is especially true in harsh, northern conditions where seed production may be minimal due to the short (and variable) growing season, moisture (lack of or excess) and other variables.

Sod transplanting may be a viable method of revegetation, and has been successful on Cell 1A, however, in an area with minimal growth medium in combination with a shallow active surface layer, the placement of sod for the restoration of one site may not justify the removal of sod from another established area.

For areas that have been restored with the use of esker material, the best practical technology available is to provide the most suitable substrate by surface preparation. This includes addition of heavy (large grain sized quarry material), surface scarification and contouring to provide proper drainage patterns to avoid erosion and ponding of water.

7.0 RIP RAP QUARRY

A rip rap quarry will be developed within the footprint of the TCA to provide the course broken rock needed to enhance dam stability, provide additional armour for the faces of the embankments, and for use as inert cover material. Approximately 100,000 cubic metres of broken rock will be required. The quarry location, refer to Figure 3 – 2004 Lupin TCA, will be on a hilly barren outcrop of phyllite just north of Cell 3 and east of the perimeter road.

Four rock samples were taken from the area and tested for ARD potential. The table below lists the results of this testing. All samples show that the rock will be well suited to be used as cover material and will not be a concern for possible ARD generation.

Sample	Fizz	NNP	NP	pH	MPA	NP:MPA	S%
50133	1	3	5	7	1.6	3.20	0.05
50134	1	14	15	8.6	0.6	24.00	0.02
50135	1	5	5	7.8	0.5	16.00	0.01
50136	1	8	8	8.1	0.5	26.88	0.01

An area of approximately 25,600 square metres (160m x 160m) will be excavated by blasting to a depth of 2.5 metres. There is little to no overburden in the footprint of the quarry area, so stripping will not be required. Access to the quarry site is immediately off the road to the west of K Dam, so any affect on the tundra will be minimized.

As the quarry location is a hill top, there will be little to no depression remaining after completion of the operation. The quarry will essentially remove the top of the hill. All drainage off the existing hill drains into Pond 2. The quarry will be configured such that this drainage pattern will not change. Quarry activities (drill, blast, muck, haul) will take place during the summer of 2006.

8.0 CLOSURE MONITORING PLAN

The Guidelines for Abandonment and Restoration Planning in the Northwest Territories (1990) state that *"the goal of restoration is to prevent progressive degradation, and to enhance the natural recovery of areas affected by mining"*. This closure monitoring plan will measure the effectiveness of the reclamation activities, and provide the means of assessing when the activities have reached the stated goal.

8.1 Timeframe

The frequency of data collection will vary depending on the phase of reclamation activity. During the 2005 care and maintenance period, when reclamation activities are continuing, regular monitoring will be carried out, appropriate to the activity being monitored. During the final reclamation phase, when demolition and cleanup activities in the mine site area are underway, this rigorous monitoring schedule will be continued. Some of the monitoring activities will be dictated by provisions in the present water licence, i.e. daily and weekly water sampling at SNP stations during TCA water effluent discharge to the environment. Ground temperatures (thermistors) and water levels and quality within the TCA area will also monitored on a frequent basis. The present operation plan is for Lupin to remain on care and maintenance status at least throughout 2005. Reclamation activities, such as placing the gravel cover on the completed Cell 3 and Cell 5, will continue during 2005.

Once the reclamation and closure activities have been substantially completed, the frequency and type of monitoring will be reduced, and will focus on assessing the performance of the reclamation measures. As the site will be abandoned after the final demolition phase, periodic site visits will be scheduled for these assessments. This closure phase of monitoring is anticipated to last for 5 years after site abandonment.

8.2 Data Collection and Reporting

The following components will be monitored over the reclamation and closure periods:

- Water quality of effluent discharge and surrounding lakes, as per parameters stated in the water licence;
- Seasonal water levels;
- Thermal condition of the earthworks and tails;
- Geotechnical inspections of earthworks, as appropriate.

As required by the Metal Mining Effluent Regulations, an environmental effects monitoring study design was recently submitted to Environment Canada. The components of this biological monitoring study design include a site characterization, a fish population study, a fish tissue study, and a benthic invertebrate community study. The study will be carried out in the summer of 2005 in reference and exposure areas of the TCA.

Figure 9 (Appendix 1) shows the locations of the various sites that will be used in the water quality monitoring program. Figure 10 shows the location of the thermistors, as well as of the major earth structures, within the TCA that will continue to be monitored.

In addition to the tailings cell cover program, other remediation activities, such as scarification of unneeded roads and abandoned storage areas, removal of associated culverts and removal of obsolete tails line and structures from the TCA may be conducted in 2005. The progress of all reclamation activities will be monitored, documented, and reported to the Nunavut Water Board in the normal monthly reporting process.

Monitoring results will be reviewed by Kinross as the data is received. Where action is required to correct any deficiency identified by the sampling results, that action will carried out in a timely manner. Throughout the reclamation phase, reporting to the NWB will be done as required by the water licence, in the case of effluent release, and at least quarterly for the other components. Throughout the closure phase, monitoring will take place quarterly and will be reported on as such. A comprehensive annual report will be prepared for submission by March 31 of the following year, which will describe the reclamation activities conducted over the previous year, the results of the current monitoring programs, a compilation of data from the monitoring programs, and a presentation of the plan of activities for the coming year. As the monitoring demonstrates that the reclamation program is achieving its objectives and that the area is environmentally stable, Kinross expects that long term monitoring requirements will be reduced.

8.3 Water Quality Management and Monitoring

8.3.1 Current Status

Water management and monitoring at the Lupin site is a requirement of the water licence. A total of 8 Surveillance Network Plan (SNP) station locations with sampling frequencies and sampling parameters are specified in Schedule 1 of the current water licence. Part D of the water licence specifies the conditions applying to waste disposal, including the maximum average allowable concentrations of various parameters. Sample collection and reporting from the majority of these stations is normally done just prior to, during, and just after discharge to the environment.

Lupin last discharged from the TCA to the environment in September 2002. The mine was put on care and maintenance in August 2003 and resumed production in March 2004 at a significantly lower mining rate, so the capacity of the water retention ponds was sufficient to handle the reduced load. The only discharge to take place at Lupin during this period was the annual decanting of the sewage lagoon, details of which were included in the monthly SNP reports to the Board.

Water analyses have been performed by an outside, accredited laboratory since 1998. Prior to that time, an internal Lupin lab processed all the samples, with check analyses sent to an outside lab on a regular basis.

Table 10 lists the location of the current SNP monitoring stations. These locations are illustrated in Figure 9 (Appendix 1). UTM coordinates are provided for each sample point to ensure consistency in the sampling location (in Sun Bay, for example).

Table 10 – Water Quality Monitoring Stations Location

Station No.	Type	UTM Coordinates		Location Description
925 - 01	SNP	7294940N	490040E	Freshwater intake from Contwoyto Lake
925 - 10	SNP	7289704N	485907E	Pond 2 discharge at Dam 1A
925 - 14	SNP	7293018N	490182E	Decant structure from the sewage lakes disposal system
925 - 20	SNP	7290077N	480314E	West end of Seep Creek before discharge into Unnamed Lake
925 - 21	SNP	7290020N	479760E	North end of Concession Creek before discharge into Unnamed Lake
925 - 22	SNP	7291356N	479200E	Inner Sun Bay near centre
925 - 24	SNP	7292964N	478947E	Inner Sun Bay near narrows
925 - 25	SNP	7293182N	478450E	Outer Sun Bay

8.3.2 Reclamation Period Monitoring - Care and Maintenance

Discharge from the TCA and the sewage pond to the environment will take place during the summer of 2005. During this discharge period, all monitoring requirements and frequencies stipulated by the water licence will be carried out. In addition to this monitoring, Lupin will also be conducting a biological, effluent and water quality monitoring program as required, adhering to EEM requirements. The study design for this program has recently been submitted to Environment Canada for approval. Following the suspension of operations in February, 2005, it is anticipated that the property will remain in care and maintenance and no further mill effluent will be added to the TCA. If the decision is made to resume mining, Cell 4 has the capacity to accept tailings.

8.3.3 Reclamation Period Monitoring – Demolition Activities

If no further mining options are available, the activities necessary to remove the Lupin TCA infrastructure could commence in 2006, based on approval of a final site closure plan. These activities include:

- demolition of all structures and removal to debris landfill located at mine site,
- development of a waste rock quarry in the TCA,
- complete the esker material cover on Cell 5 and any remaining exposed areas,
- final discharge from Pond 2 to the environment,
- removal of syphons from Dam 1A,

- final discharge from sewage pond to the environment,
- removal of syphons from lower sewage dike,
- spillway construction on Dam 1A and sewage dike,
- drainage culvert removal from roads,
- scarify all roads,
- demobilize all salvage and equipment (winter road 2007).

Discussion of the non-TCA related reclamation activities can be found in the 2004 Lupin Abandonment and Restoration Plan submitted to the Board in February 2005

Application for Closed Mine Status will likely be made from Environment Canada once approval for the closure plan has been received. A Final Study Design will be submitted within the required 6 month period after application for Closed Mine Status, as per the MMER requirements. As stated in Section 8.2 above, an MMER study design was recently submitted to, and approved by, Environment Canada. This study will be carried out in 2005. Because the mine will have ceased operation by the time the study is conducted, and because of the similar components of the two studies, the current EEM study design will be re-submitted as a Final Study Design, and the results submitted as a final report.

During the 2006 discharge period, all monitoring requirements and frequencies stipulated by the water licence will be carried out. The environmental site assessment of the mine site area, scheduled to be carried out in 2005, will identify areas of the Lupin site that may require specific remediation. All remediation work will be carried out in these areas in 2006, and the remediation programs will be closely monitored to ensure conformation with the appropriate guidelines, and documented. The monthly reports to the water board will contain the details of all remediation activities and monitoring results.

8.3.4 Closure Period Monitoring

Once the final demolition and remediation activities have been completed at the TCA, the site will be completely abandoned. Monitoring activities through the closure period will extend for a five-year duration and will focus on collecting information necessary to evaluate the effectiveness of the reclamation activities. As there will no longer be personnel at the site, water quality monitoring and geotechnical assessments of the spillways during the first 2 years of the closure period will be conducted during monthly site visits between June and September, when there is open water. If the results of the site assessments over this initial 2-year period are acceptable, the frequency of site assessment and sampling will be reduced to discrete visits in July and September in subsequent years.

9.0 LUPIN MINE RECLAMATION BUDGET

Table 11 - LUPIN MINE RECLAMATION BUDGET 2004 A & R PLAN June 2005

ITEM	Detail	Year 1	Year 2	Year 3	Total
	ARD Study	$20,000			$20,000
	MMER Initial Study	$100,000			$100,000
	MMER Final Study (Closed Mine)	$0	$100,000		$100,000
	Instrumentation	$33,000	$20,000		$53,000
	Annual Geotechnical Inspection	$12,000			$12,000
	Environmental Site Assessment	$250,000			$250,000
	Other Environmental Studies	$55,000	$75,000		$130,000
	Environmental Consulting	$25,000	$20,000	$20,000	$65,000
	Saturated Zone Cover Assessment	$15,000			$15,000
Studies	**Sub-total**	**$510,000**	**$215,000**	**$20,000**	**$745,000**
	Dam 1A Spillway	$15,000			$15,000
	Sewage spillway	$5,000			$5,000
	Raise caps	$5,000			$5,000
Design	**Sub-total**	**$25,000**	**$0**	**$0**	**$25,000**
Quarry	Layout quarry (drill/blast)	$0	$14,000		$14,000
Quarry	Mob / demob equipment	$0	$50,000	$50,000	$100,000
Quarry	Road use fee	$0	$24,000	$24,000	$48,000
Quarry	Quarry rip-rap	$0	$500,000		$500,000
Quarry	Haul / place rip-rap on embankments	$0	$500,000		$500,000
Dumps	Drill/blast WZ sills - Construct WZ dumps	$50,000			$50,000
Spillways	Construct spillways Dam 1A and J	$0	$100,000		$100,000
PAG	PAG Disposal	$0	$250,000		$250,000
Contam Soil	Contaminated soil	$75,000	$300,000		$375,000
Misc	Cover/contour dump ponds	$0	$50,000		$50,000
Misc	Scarify / contour roads	$18,000	$18,000		$36,000
Landfill	Cover Placement	$0	$200,000		$200,000
Earthworks	**Sub-total**	**$143,000**	**$2,006,000**	**$74,000**	**$2,223,000**
	Demolition (direct costs)	$0	$3,600,000		$3,600,000
	Demolition (indirect costs)	$0	$2,008,925		$2,008,925
	Mobilization	$0	$175,000		$175,000
	Road Use Fees Demolition Eqt	$0	$44,000	$44,000	$88,000
	Fuel for Demolition Eqt	$0	$377,400		$377,400
	Demob	$0		$160,000	$160,000
Demolition	**Sub-total**	**$0**	**$6,205,325**	**$204,000**	**$6,409,325**
	Mob/demob recovery equipment	$89,900			$89,900
	Transport Camp 2 to Lupin	$188,000			$188,000
	Summer check & remediation	$20,000			$20,000
	Assemble Camp 2 at Lupin	$20,000			$20,000
	Relocate telecom equipment	$20,000			$20,000
Final Camp	**Sub-total**	**$337,900**	**$0**	**$0**	**$337,900**

	TCA Cover	$2,212,000	$1,940,240		$4,152,240
	Fuel	$537,641	$283,361		$821,002
	Survey, ground	$16,000	$12,000		$28,000
	Survey, air	$0	$18,640		$18,640
	Demobilization	$0		$89,700	$89,700
	Cell 1 cover	$0	$85,000		$85,000
	Road Use Fee	$0		$70,000	$70,000
TCA Cover Project	**Sub-total**	**$2,765,641**	**$2,339,241**	**$159,700**	**$5,264,582**
	Refridgerant	$0	$50,000		$50,000
	Lab Chemicals	$0	$50,000		$50,000
	Batteries	$10,000	$10,000		$20,000
	Nuclear Gauges (10)	$50,000			$50,000
Haz Mat Disposal	**Sub-total**	**$60,000**	**$110,000**	**$0**	**$170,000**
	Water sampling (compliance)	$35,000	$35,000	$25,000	$95,000
	ABA / metals / HC	$30,000	$70,000	$20,000	$120,000
Laboratory	**Sub-total**	**$65,000**	**$105,000**	**$45,000**	**$215,000**
Misc Parts and Supplies		$800			$800
Community Relations		$20,000	$20,000		$40,000
Administration	Labor / admin / taxes / leases / etc.	$1,318,651	$1,051,118	$293,983	$2,663,752
Accomodation & Travel	Accom / power / travel / winter road	$3,374,523	$3,587,387	$707,495	$7,669,405
TOTAL		**$8,620,515**	**$15,639,071**	**$1,504,178**	**$25,763,764**

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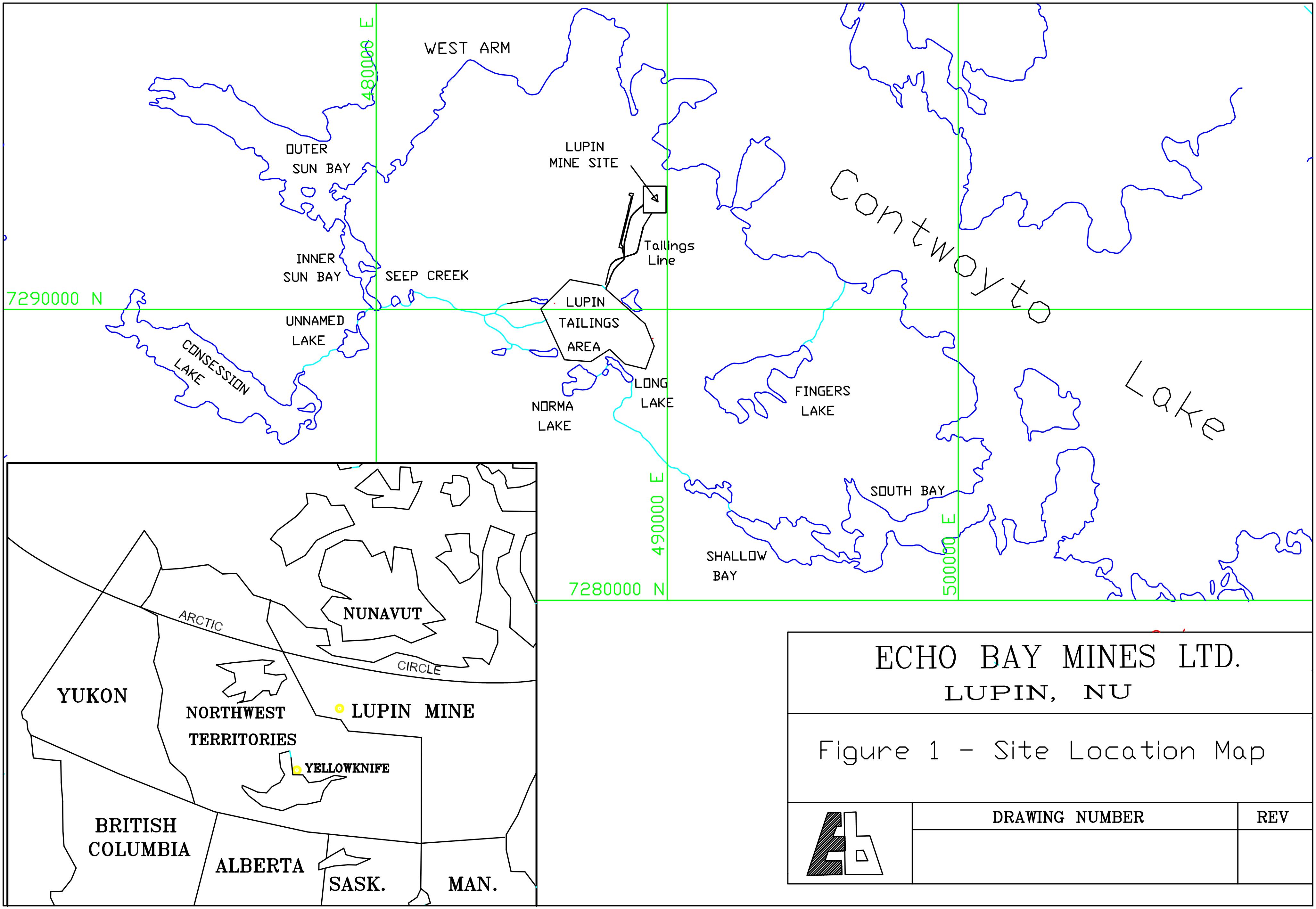
APPENDIX 1

FIGURES 1 TO 7



ECHO BAY MINES LTD.
LUPIN, NU

Figure 1 - Site Location Map

DRAWING NUMBER	REV

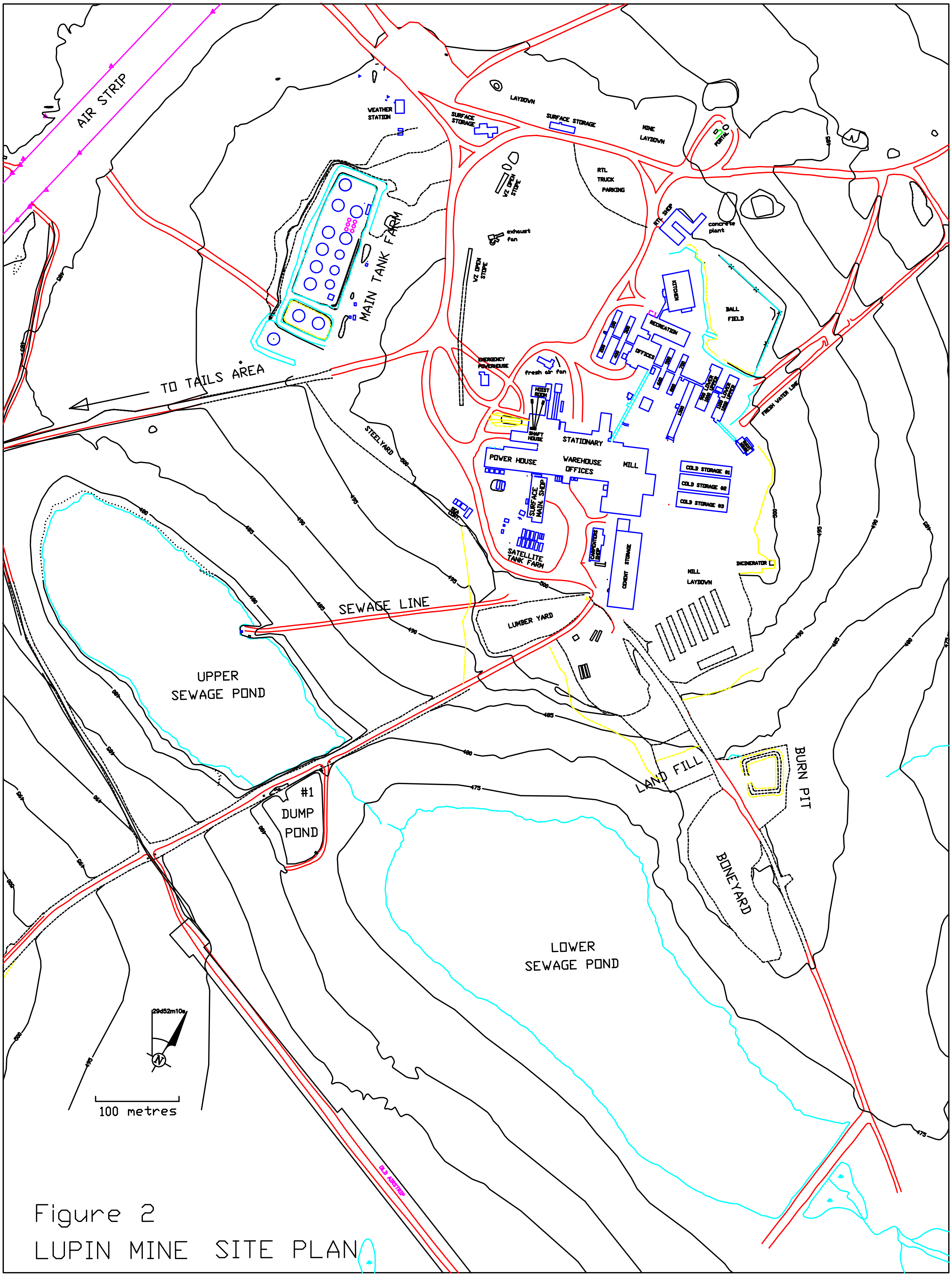


Figure 2
LUPIN MINE SITE PLAN

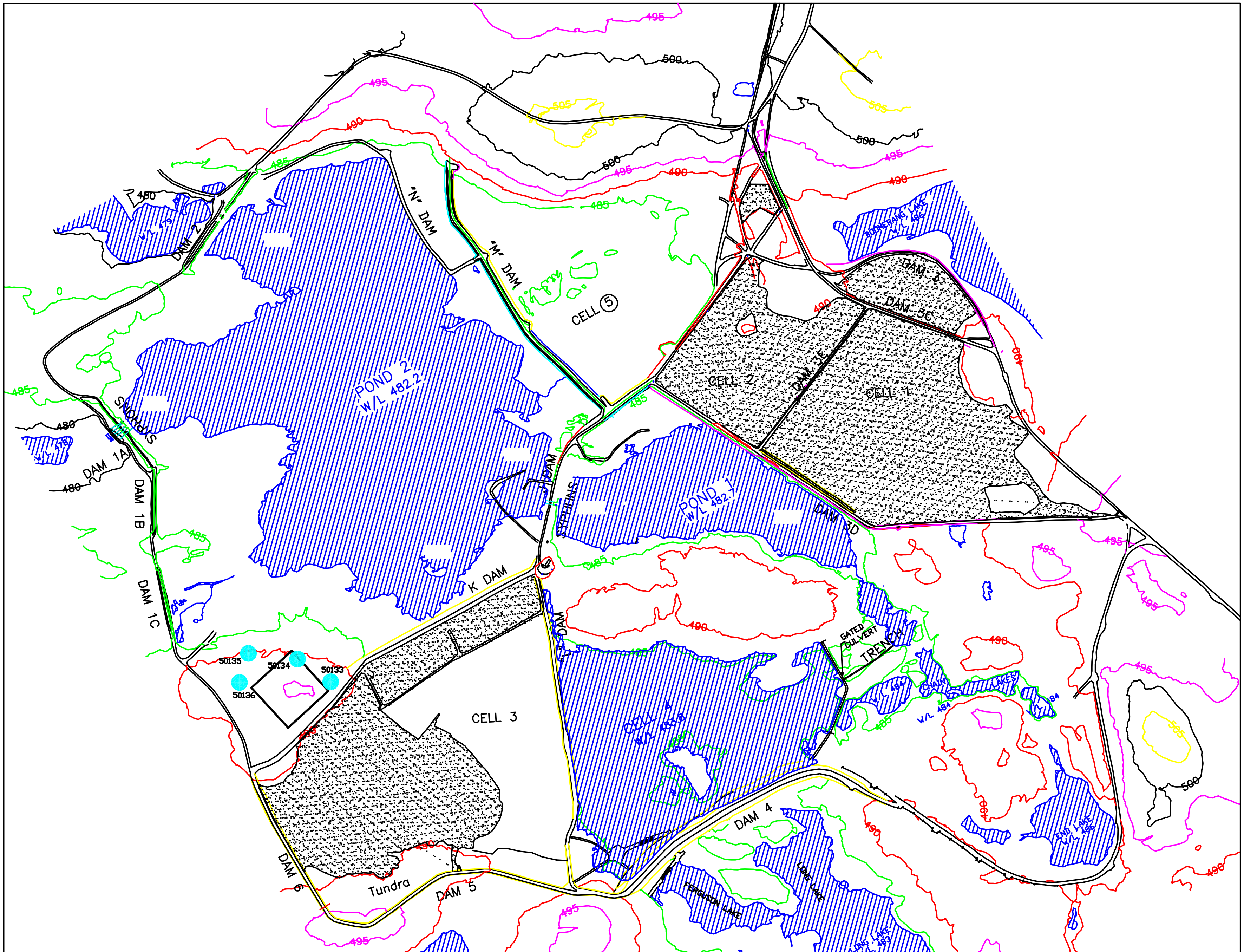


Figure 3 – Lupin Mine TCA 2004

MAP SCALE

0 50 100 200 METERS

REVISIONS No	DATE	MADE BY	DESCRIPTION
1			
2	Aug/04	CMT	Cell 4 water
3	Jun/04	CMT	Pond 1,2 water levels
4	Oct/03	CMT	Updated Cell 3a, 3b
5	Feb/98	S.B.L.	Updated 1997 work

DATE	DRAWN BY	CHECKED	APPROVED

2004 Lupin TCA.dwg

KINROSS GOLD CORPORATION
EBM – LUPIN MINE

OFFICE	DEPARTMENT
LUPIN	DEVELOPMENT

LUPIN MINE
TAILINGS AREA

MAP INDEX NUMBER	SCALE	DRAWING NUMBER

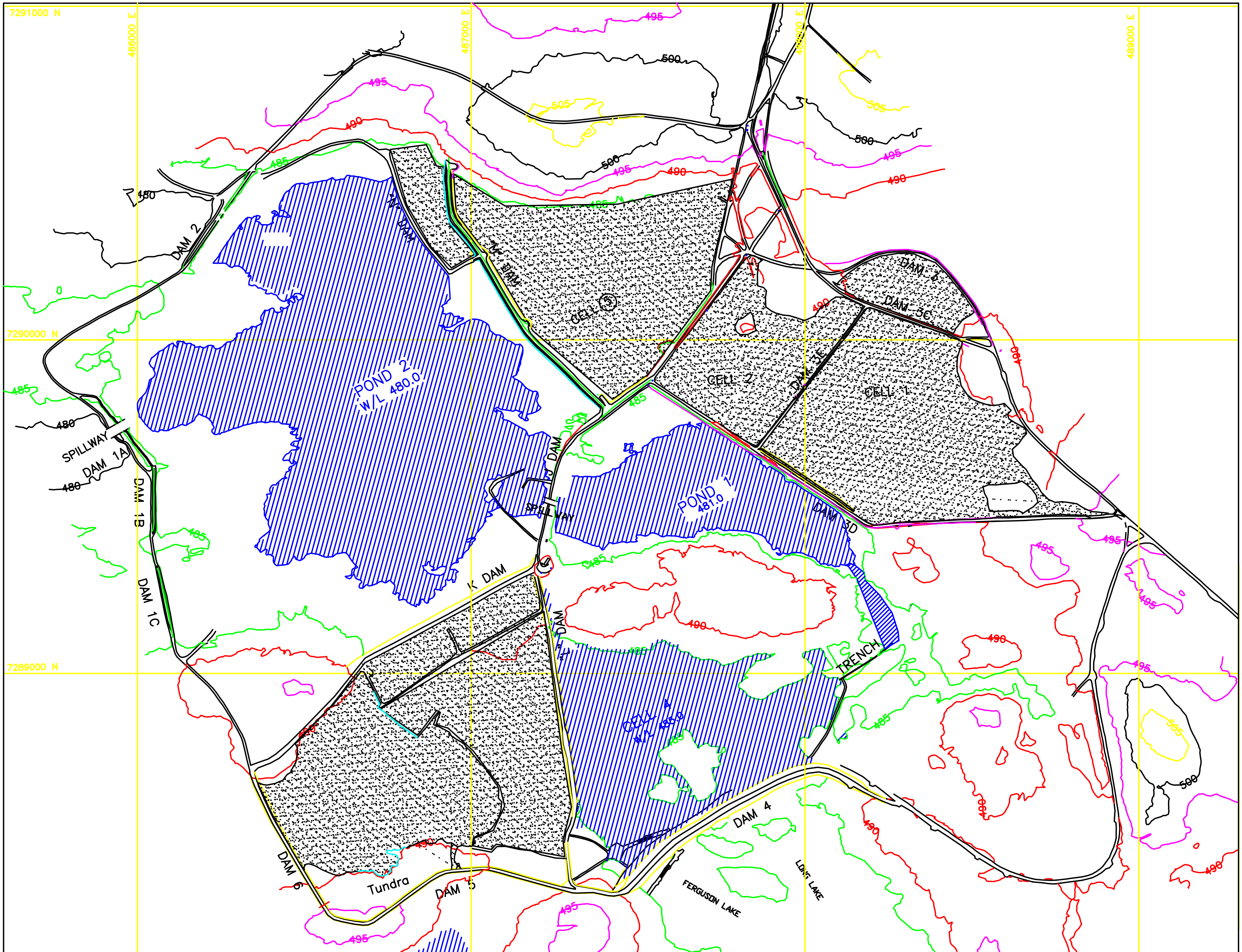


Figure 4 – Lupin Mine TCA Final

MAP SCALE

0 50 100 200 METERS

2004 Lupin TCA.dwg

REVISIONS

No	DATE	MADE BY	DESCRIPTION
1			
2	Aug/04	CMT	Cell 4 water
3	Jun/04	CMT	Pond 1,2 water levels
4	Oct/03	CMT	Updated Cell 3a, 3b
5	Feb/98	S.B.L.	Updated 1997 work

DATE	DRAWN BY	CHECKED	APPROVED

KINROSS GOLD CORPORATION
EBM – LUPIN MINE

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LUPIN	DEVELOPMENT

LUPIN MINE
TAILINGS AREA

MAP INDEX NUMBER	SCALE	DRAWING NUMBER

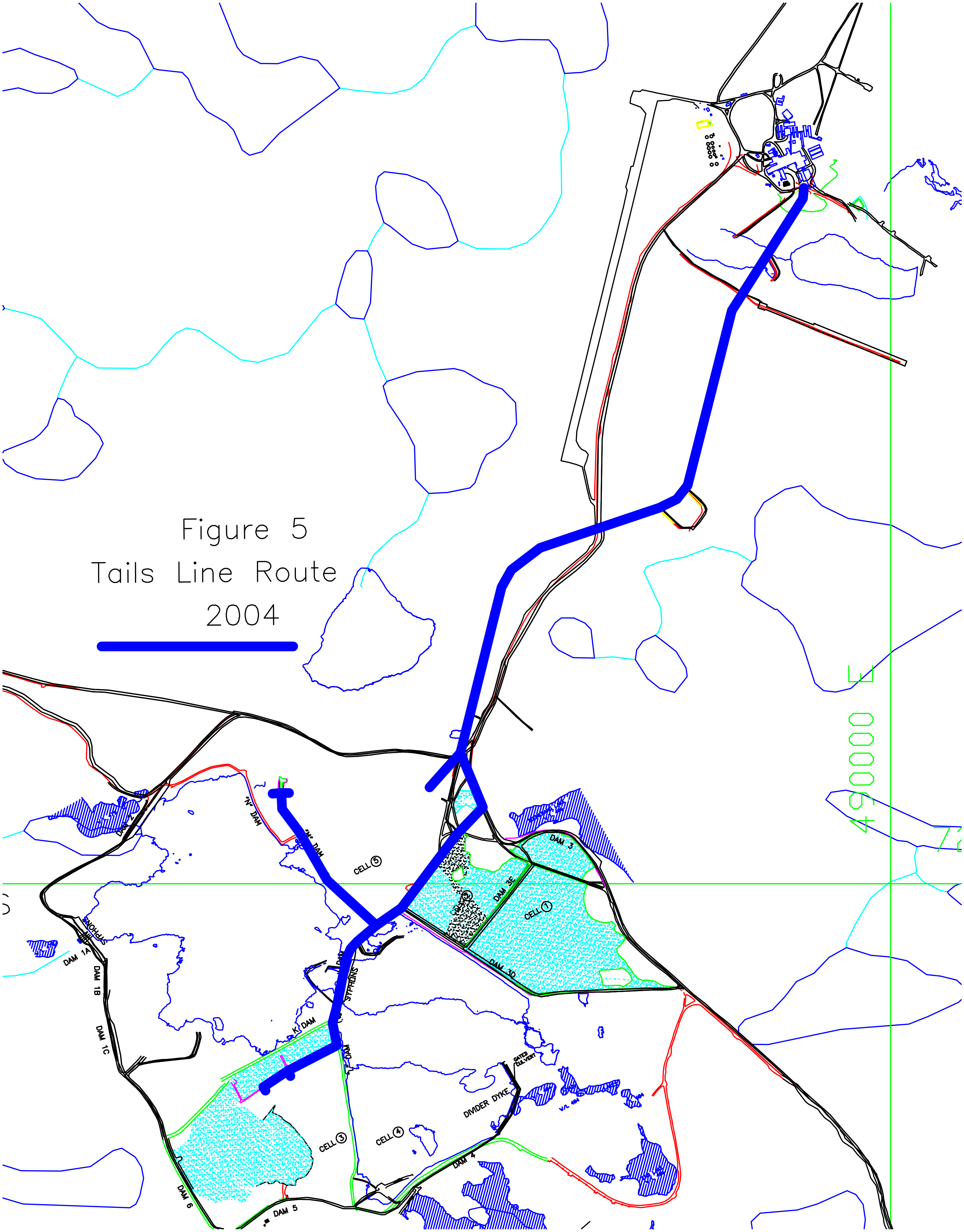

Figure 5
Tails Line Route
2004

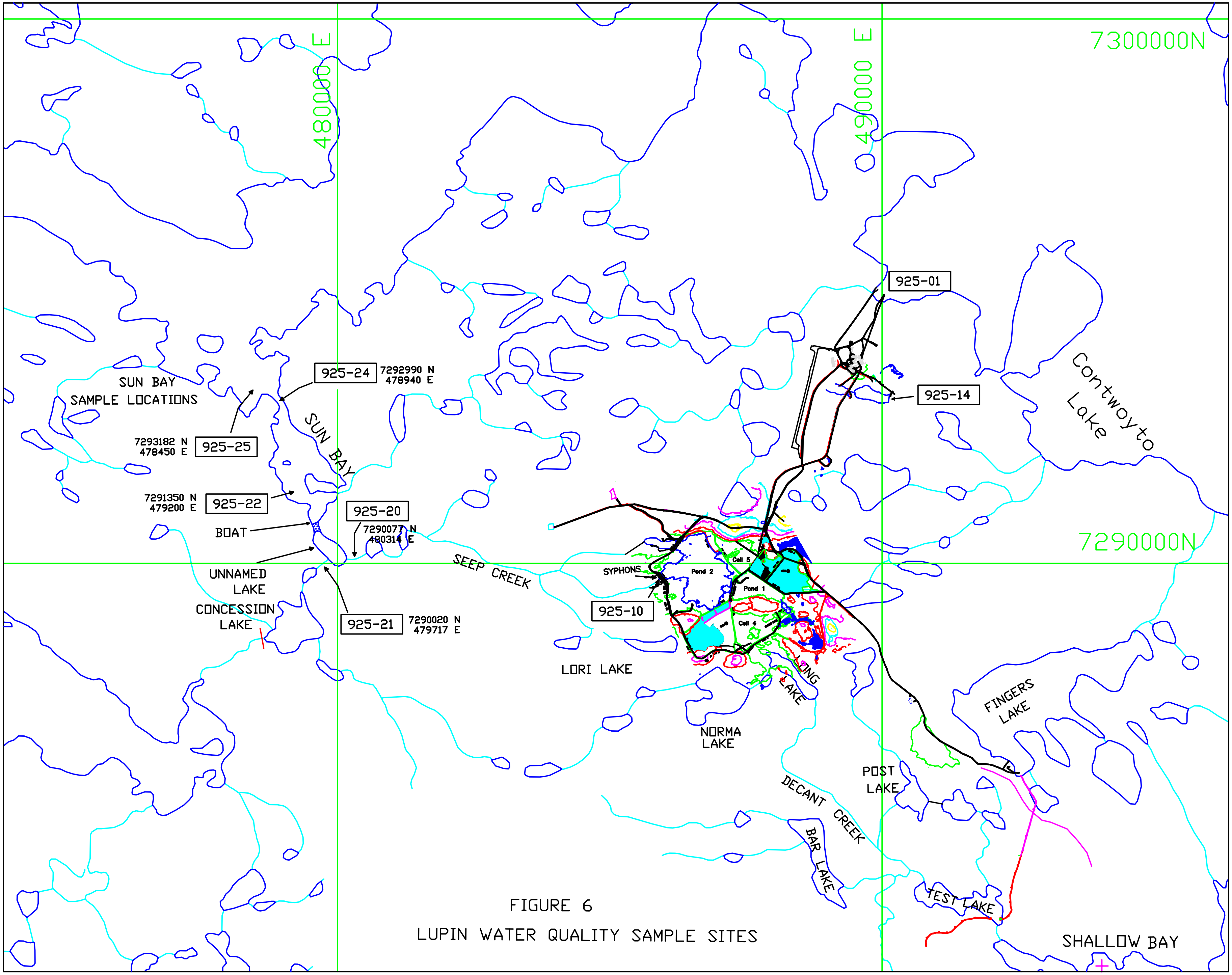

FIGURE 6

LUPIN WATER QUALITY SAMPLE SITES

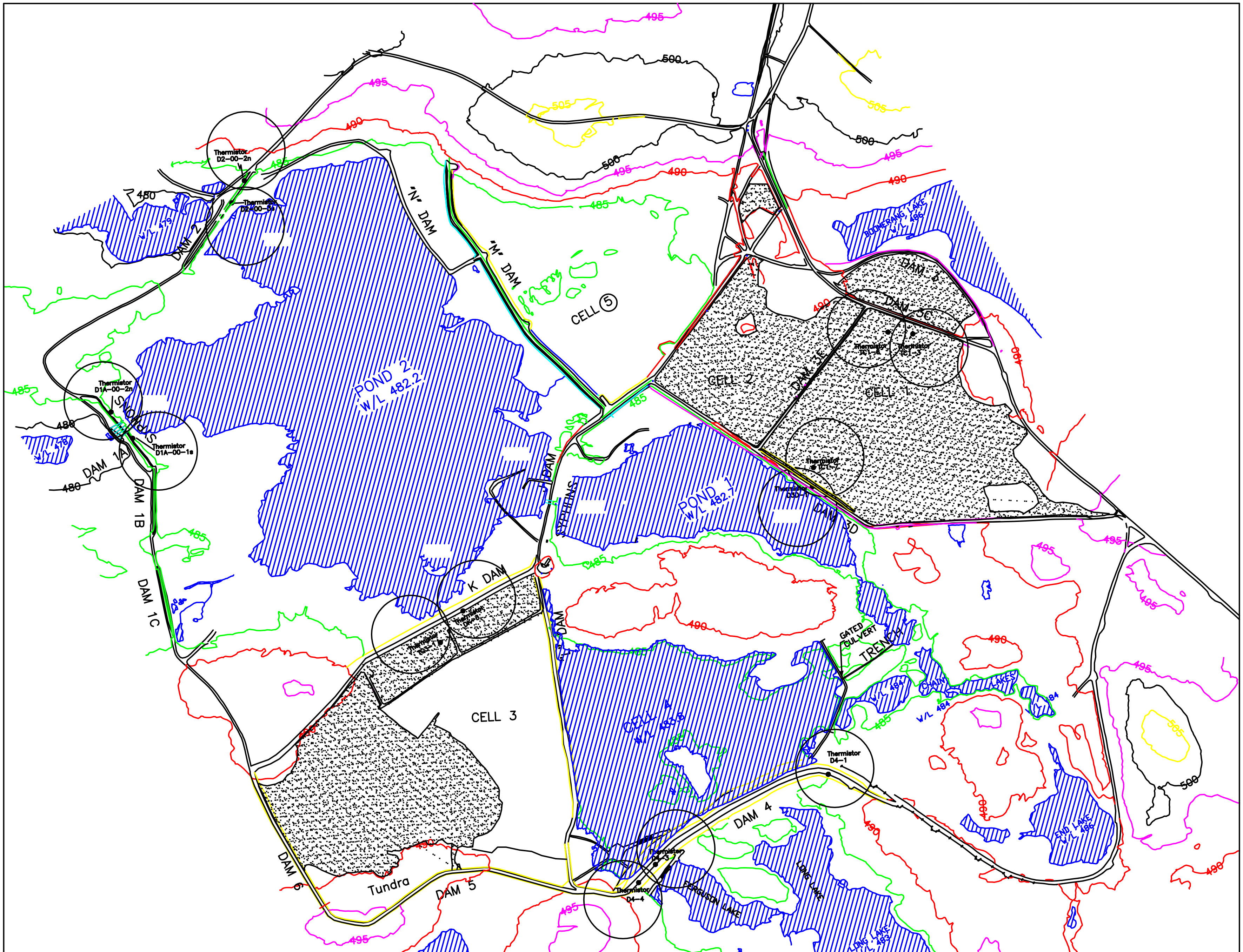

Figure 7 – TCA 2004 Thermistor Locations	MAP SCALE: 0 50 100 200 METERS				KINROSS GOLD CORPORATION EBM – LUPIN MINE	LUPIN MINE TAILINGS AREA

REVISIONS

No	DATE	MADE BY	DESCRIPTION
1			
2	Aug/04	CMT	Cell 4 water
3	Jun/04	CMT	Pond 1,2 water levels
4	Oct/03	CMT	Updated Cell 3a, 3b
5	Feb/98	S.B.L.	Updated 1997 work

DATE	DRAWN BY	CHECKED	APPROVED

2004 Lupin TCA.dwg

OFFICE	DEPARTMENT
LUPIN	DEVELOPMENT

MAP INDEX NUMBER	SCALE	DRAWING NUMBER