LUPIN MINE, NUNAVUT
PHONE (780) 890-7000
FAX (780) 890-8766

9818 INTERNATIONAL AIRPORT
EDMONTON, ALBERTA
T5J 2T2

ECHO BAY MINES LTD.

April 29, 2001

Our File: Lupin Water Licence
Your File: Water Licence No.NWB1LUP0008

Executive Director
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU
X0B 1J0

Nunavut Water Board
23 2001
Public Registry

Dear Sir:

RE: Lupin Mine, Nunavut
Interim Abandonment and Restoration Plan
Water Licence NWB1LUP0008

As required by Part I, Item 1 of Water Licence NWBLUP0008 and in accordance with an extension granted to April 30, 2001 please find attached three copies of the document entitled "Interim Abandonment and Restoration Plan, Lupin Mine, Nunavut". This document, previously submitted in January, 1996 was reviewed and revised where applicable to reflect the current status of the Lupin Operations and the renewal of Licence NWB1LUP0008.

Should you have any questions or comments regarding the attached information, please do not hesitate to contact the undersigned at (780) 890-8794.

Yours truly,

D. Hohnstein
Environmental Coordinator, Lupin

INTERNAL
FC
LA May 24/01
OM

Attach.

cc: B. Danyluk
H. Ducasse
B. Lowe

INTERIM ABANDONMENT AND RESTORATION PLAN

WATER LICENCE NWB1LUP0008

LUPIN MINE, Nunavut

ECHO BAY MINES LTD.

Prepared: April 28, 2001

Table of Contents

Table of Contents (cont.)

List of Figures

1.0 INTRODUCTION

1.1 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 1 requires that an "Interim" Abandonment and Restoration Plan be submitted to the Board in accordance with the "Guidelines For Abandonment and Restoration Planning for Mines in the Northwest Territories, September 1990".

This submission has therefor been prepared for approval by the Board.

1.2 Objectives of the Abandonment and Restoration Plan

The Plan has been prepared to indicate to the Board, the direction and procedures that Echo Bay Mines Ltd. intend to implement to fulfil obligations with regard to abandonment and restoration at the Lupin Operation and associated facilities. The objective of the plan, following the guidelines, is to comply with current government regulations to ensure once abandonment & restoration has been completed;

- there is no danger to public health or safety;
- to minimize the requirement for long term maintenance and monitoring associated with all of the mine facilities;
- to minimize or prevent contaminant loadings to the environment from the closed facilities which may be related to continued leaching of contaminants from tailings disposal (Tailings Containment Area) and waste rock areas and its development of acid rock drainage; and abandoned areas of chemical/materials storage;
- to prevent the cumulative degradation of abandoned areas affected by the mining activities and enhance the natural recovery, where appropriate, of disturbed lands, and;
- ensure that 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 Mine has proven and probable reserves to extend throughout the duration of the current Water Licence. The final three years of operation would be at a reduced tonnage, without the addition of reserves from either the current ore body or other potential satellite deposits. With this in mind, Echo Bay Mines Ltd.'s approach is to actively carry out reclamation activities as opportunities become available. This provides an additional time frame to evaluate current technologies and plan for final abandonment.

1.3 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°46' Latitude and 111°14' Longitude, approximately 80 km south of the Arctic Circle.

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 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 have expanded to increase capacity to a nominal 2,300 tons per day. In December, 1994, the Paste Backfill Project was completed and is now providing additional mine safety and underground support while reducing the amount of tailings reporting to the Tailings Containment Area. In March 2000, Echo Bay Mines Ltd. resumed production at the Lupin Mine after approximately two years of suspended operations.

1.4 Geology

The gold mineralization at Lupin is confined to a folded and metamorphosed iron formation and the mineralization may be termed "stratabound". The iron formation horizons consist of both silicate facies and sulphide facies metamorphosed to an amphibolite + quartz rich rock. In plan view the gold bearing iron formation appears as a Z-shaped structure made up of three zones; the West, Centre and East zones. Total strike length of the three zones is in excess of 900 meters, confirmed to a depth of 1800 meters below surface.

The mineralogy of the ore at Lupin consists mainly of amphibole, quartz, occasionally garnet, pyrrhotite, arsenopyrite, minor pyrite and trace chalcopyrite. Also found in trace amounts are scheelite, apatite, epidote, calcite, tourmaline, and some arsenides

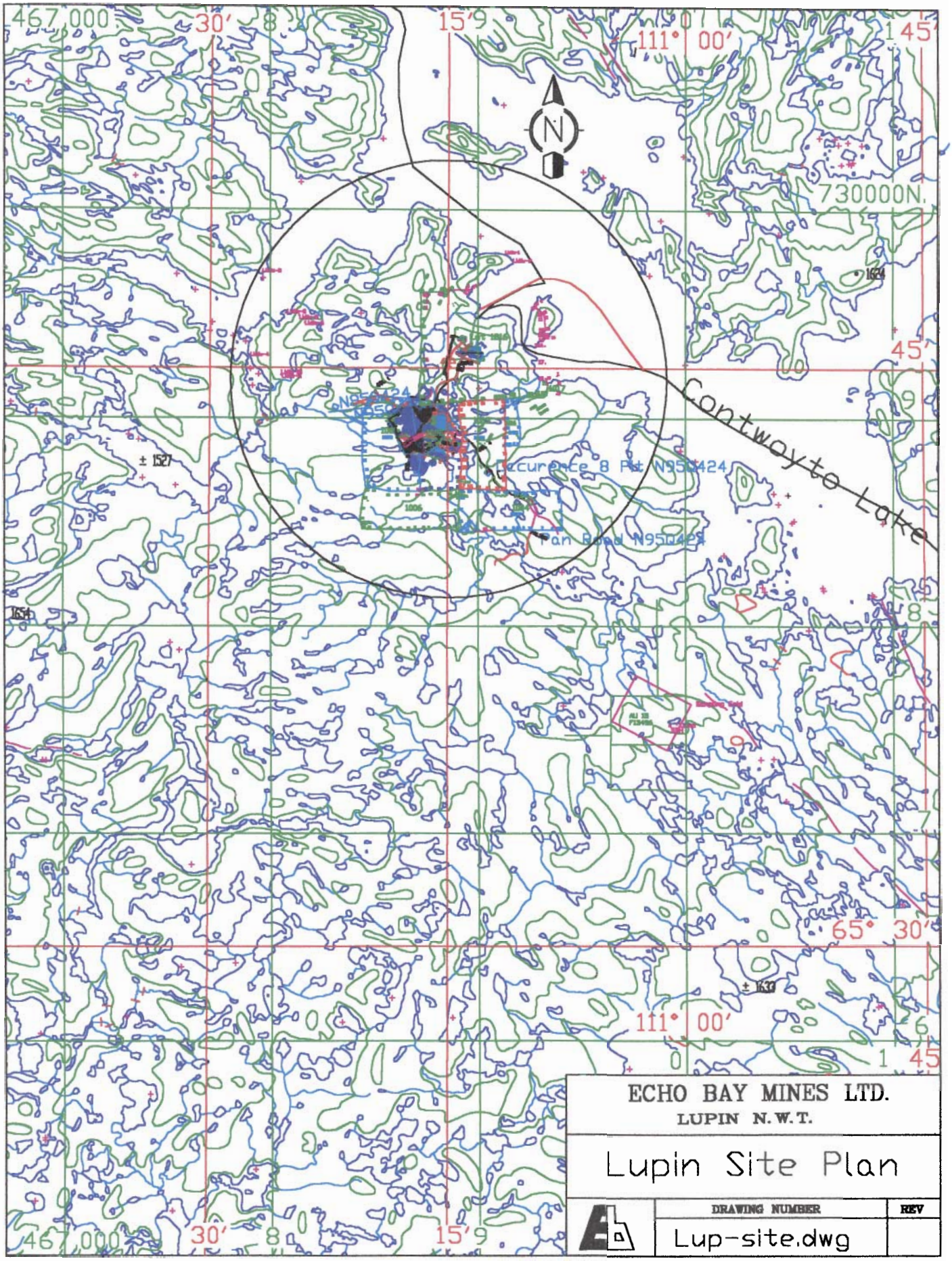


Figure 1; Site Location Map

(notably loellingite). The gold is fine grained, generally less than 100 microns in diameter, and is associated mainly with pyrrhotite and arsenopyrite. Although not common, visible gold has been reported, usually in close proximity to quartz veining.

The ore at Lupin, with its small percentage of sulphide, has been shown through various studies to be capable of generating acid upon oxidation. The waste rock produced in the mining process contains very little sulphur (approx. 0.5%) and is considered to have very little potential for acid production.

1.5 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; the residential complex consisting of accommodations, kitchen and recreation centre, and the industrial complex comprised of milling and maintenance areas, headframe, hoistroom, powerhouse, freshwater pumphouse, warehouse and office facilities.

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, Tailings Containment Area and a weather/aircraft control office with exploration shack.

2.0 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 D.I.A.N.D. to fulfill 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.

3.0 ABANDONMENT STRATEGIES

The decision for abandonment of the operations is influenced by a number of factors, many of which are external and out of the control of the operator. These may include, but are not limited to: the presence of economic ore reserves; the market value of the final product; the costs of producing the product and the success of ongoing exploration programs of both the owner/operator as well as that of other organizations working within a reasonable range of the current operation.

There may be many options at closure regarding the final end use of the facilities. The extent to which a shutdown takes place and eventual abandonment occurs must be thoroughly evaluated.

The guidelines suggest at least three generally agreed upon scenarios that may occur as a result of mining operations; these are described below.

3.1 Planned Shutdown - Short Term

A planned shutdown would occur in the event that mining/milling has stopped due to economic, operational or regulatory requirements (as in 1998-2000). It is expected that in this type of situation the time frame is temporary and there is every intention to resume operations. As was

demonstrated with the temporary shutdown which occurred in 1998, all facilities would be decommissioned and prepared in such a manner as to allow a safe and efficient start up once operations were to resume (a very detailed account of all decommission activities was submitted to the Board in 1998).The facilities would be maintained through a scheduled care and maintenance program with the appropriate minimum staff on site. The required monitoring and administrative activities would continue with regard to leases and licences where applicable.

3.2 Long Term Shutdown

A long term shutdown would take place when the ore reserves of the Lupin ore body have been depleted and/or remaining reserves can not be economically recovered in the foreseeable future. Moving into the final abandonment stage is not considered due to the possibility of utilizing the infrastructure and surface facilities to accommodate satellite ore-body milling, custom milling, sale, etc.

The facilities would be placed in a state of suspended operation whereby all potential for hazards are removed. Most chemical supplies, explosives and petroleum products inventory would be brought to a minimum through scheduled use, reducing the risk of long term storage at the site.

A salvage program may be initiated, where appropriate, to begin the process of restoration that would normally occur during the final abandonment stage.

A modified monitoring program would be maintained for the Water Licence and minor reclamation work would commence. Administrative duties would continue to maintain applicable leases and licences.

3.3 Final Abandonment

Final abandonment would proceed in the event that the project has been completed, economic ore reserves have been exhausted and the possibility of continued use of the facility for purposes other than mining are non-existent. A formal notice of abandonment may have been filed during the final stages of mining or during long term abandonment once a decision for final abandonment had been made.

It is expected that the decommissioning of the site would extend over a period of two to three years with removal of reclamation equipment on a short term winter road during the final season. The fate of the 6400 ft runway would be decided upon at completion after assessment of logistics support requirements in the north.

Post closure monitoring during the reclamation activities would be followed by a minimum of 3-5 years additional monitoring with respect to the tailings impoundment. This would provide an evaluation of water quality, permafrost migration, stability of reclaimed (covered) areas as well as the performance of the system with regard to overall water balance of the TCA.

The detailed specific abandonment and restoration activities are covered in Section 4. These include a description of the facility, areas of concern and the appropriate action that would be undertaken in the event of final closure.

4.0 ABANDONMENT AND RESTORATION PLANNED ACTIVITIES

The facilities and specific disturbed areas of concern with regard to the Lupin Operation that require abandonment/restoration activities and special management are covered in the following section. The goal of specific restoration practices 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 is an important part of Echo Bay Mines Ltd.'s Environmental Policy. There may be some aspects of the reclamation activities identified in this plan that will take place prior to closure which may not have been indicated as an immediate concern. Examples of this are the reclamation work completed on past spill locations and covering portions of the tailings impoundment to facilitate study prior to closure, etc.

Prior to backfilling and sealing any raises or portal all non-hazardous wastes generated through the closure activities that are considered to be uneconomically salvageable (buildings, equipment etc.) would be dismantled and disposed of via these routes into the mine workings. All materials would be previously washed (eg. mill components) and inspected (eg. mobile equipment for batteries, lubricants, other hazardous materials) prior to disposal. Backfilling of the opening would utilize remaining waste-rock from surface and esker material for final cover to incorporate the material within the permafrost.

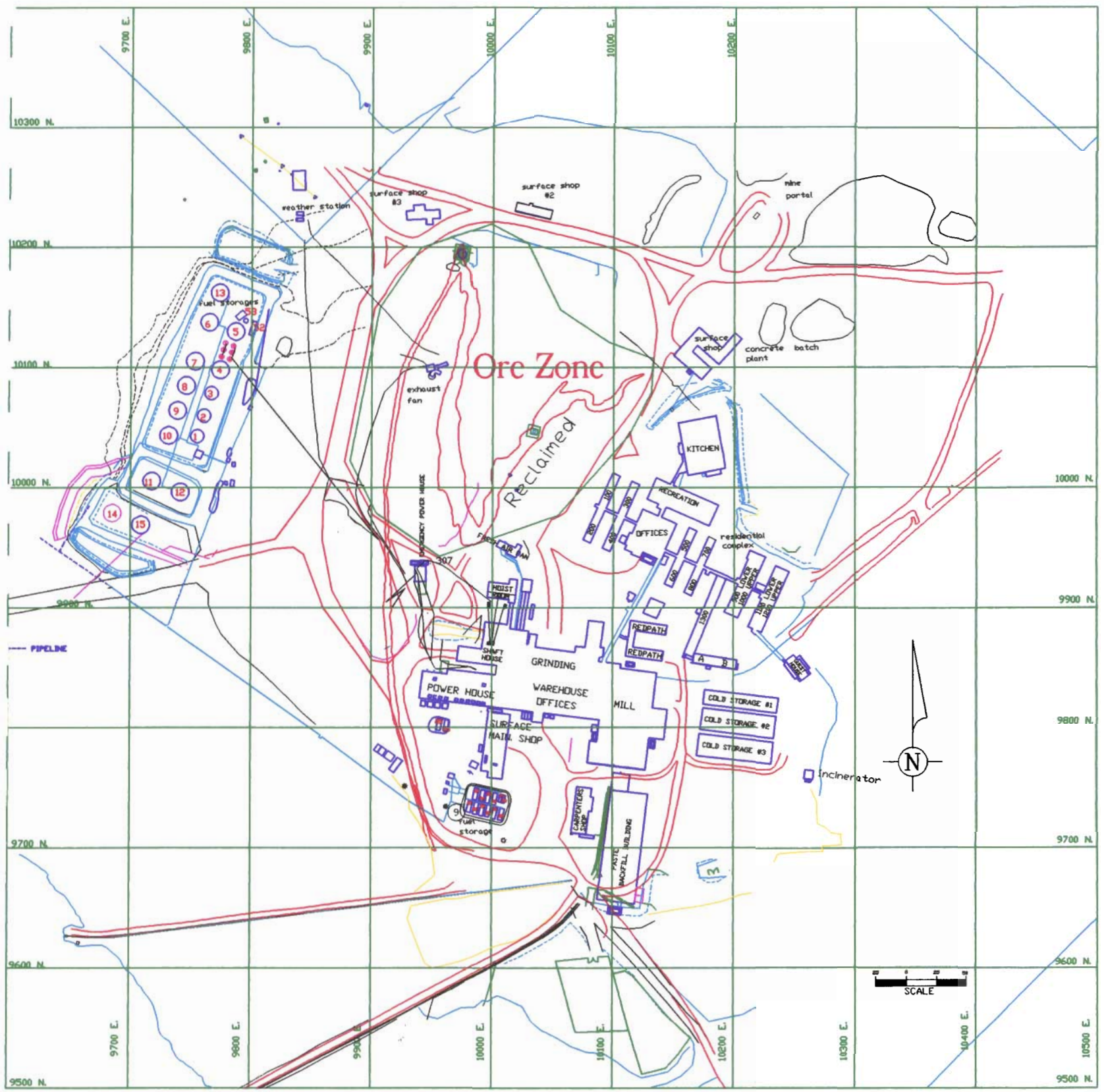
4.1 Buildings and Contents

4.1.1 Mill Complex; Mill, Administration, Maintenance, Powerhouse, Warehouse

Mill - Upon cessation of operations, the mill portion of the complex will be given a complete wash down with the intent of gold recovery (visible gold that settles within the system) and removal of any residual contaminants (from chemical use) to the tailings impoundment. The crusher area is currently washed down on a regular schedule and will also be completed at closure.

All equipment and internal components from the mill would be dismantled and removed from the building. These would either be transported off-site for use at other Echo Bay facilities or salvaged where possible. Non-hazardous materials with no salvage value will be deposited at the open stope and buried. The metal frame structure will be dismantled and salvaged where possible. Any concrete walls/footings will be bulldozed level and used to infill the mill sumps or removed to the mine workings.

(FIGURE 2) GENERAL SITE PLAN



D:\ENVIRNMT\00\MILLSITE.DWG

Paste Backfill Building - As part of the mill, this building would undergo similar cleanup procedures with all residues reporting to the tailings sump and being disposed of at the tailings containment. The larger cement storage building is simply a steel clad shelter and designed to house the cement supply for the paste system. Equipment from the plant would be removed for resale, salvage or disposal. The steel frame structure would be dismantled and stored for shipment off site or disposal within the mine workings.

Administration/Warehouse - These areas will have all salvageable/hazardous materials removed prior to dismantling. Demolition will take place in a similar fashion to the mill building and all materials that cannot be salvaged will be disposed of into the mine workings.

Powerhouse - the powerhouse facility will remain operational for a reasonable time frame to support the reclamation process. A staged dismantling and removal of salvageable equipment will take place ending with limited power generation in the latter stages. The emergency power house will remain to provide minimal power requirements once major power consumers are removed (ie. mills, hoist). Early removal of emergency power can take place if portable power generation is available during final closure.

Power distribution throughout the site is both above and below ground. Power lines would all be removed for salvage or disposal. Transformers containing low level PCB's were transported off site for destruction in 1994. No other PCB material is known to be at Lupin.

4.1.2 Other Major Buildings

Maintenance/shops - All outbuildings will be evacuated, inspected for hazardous materials and dismantled for salvage or disposal. These include the carpentry shop, surface shop, mobile maintenance, 777 shop, cold storage buildings and cement storage.

Arsenic Treatment Facility - This facility, a steel frame/metal clad building, is located at the Tailings Containment Area. It is used for mixing of reagents (ferric sulphate and lime) for water treatment operations. All components (always flushed after use) and the structure will be removed from the TCA and salvaged if economical or disposed of within the mine workings.

ANFO Storage - The explosives storage magazine consists of a steel frame/metal clad building as well as numerous Sea-Containers. After removal of remaining ANFO, the main building would be dismantled and transported to the Lupin site. The Sea-Containers would be decontaminated if required at the tailings ponds and stored at the main compound for transportation uses.

Any remaining ANFO would be evaluated for use at other sites, returned to the supplier or will be disposed of by controlled burning at the site. Proper site selection and approval through consultation with authorities prior to burning would take place.

Accommodation Facilities - The major component of the accommodations is the sleeping and eating quarters which consist of over 200 modular units and separately framed areas to form the complex. The other components consist of recreation and gymnasium facilities which are steel frame/metal clad construction.

The steel frame buildings would be dismantled and removed from site or disposed of within the stope. The re-sale of the accommodations is highly unlikely unless they are to be used in-place. There has been little interest in the past for used accommodation trailers at Lupin. In the event of disposal on site, the units would be evacuated of all salvageable items and potential contamination prior to burning. The remaining residues would be removed to the mine workings.

4.2 Infrastructure Support

4.2.1 Freshwater Supply

The freshwater for the site is obtained from Contwoyto Lake approximately 1.5 km from the complex. A causeway/breakwater extending out into the lake supports a pumphouse building and docking facilities. See Figure 5 in appendix.

Upon closure the building, electronics, pumps and approximately 1.5 km of six inch insulated pipeline will be removed and salvaged where possible. The docks will be removed, however the breakwater and causeway will be left in place due to the increased disturbance that the lake would incur during removal. Non-salvageable materials would be disposed of within the mine workings.

4.2.2 Tailings Lines

Currently two steel tailings lines exist between the mill complex and the Tailings Containment Area. The initial six inch line and the newer eight inch line, both of which are insulated, extend the entire six kilometre distance to the impoundment. The eight inch line extends further within the impoundment for an additional 2.5 km. See Figure 7 in appendix 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 entire length of six inch line and associated buildings are to be removed from the tailings line route prior to closure. The eight inch line will be flushed thoroughly with clean water prior to being dismantled along with associated buildings. If salvageable, the pipe will be sold or reused in another application. If salvage is not viable, the piping would be disposed of within the mine workings.

In addition to the tailings lines there are two dump stations (shallow sumps) located along the tailings line route (Figure 7). These stations allow the emergency dumping of line contents in the event of an unplanned mill shutdown. These stations will be cleaned of all existing tailings materials which will be disposed of at the TCA. Berms would be flattened and pushed into the depressions to become consistent with the surrounding topography.

4.2.3 Fuel Storage

The fuel storage facilities at Lupin include both a main and day tank farm which consist of eleven 350k gallon storage tanks for diesel fuel and one 350k gallon tank for Jet-A; three 187k gallon and three 18k gallon P50 fuel tanks. It is expected that most of the fuel will be consumed during the final reclamation activities. Any remaining fuel will be removed from site to other consumers. The empty tanks would then be disposed of after consultation with regulatory authorities.

The tank farm areas would be stripped of any fuel laden sand to be disposed of at the TCA. Fuel rich material may be ignited prior to disposal in a separate, isolated area. Materials (esker sands) that contain residual hydrocarbons may be subjected to landfarming for natural remediation or burial. The technology is currently in the developmental stage for microbial action in northern climates but may be applicable when abandonment at the Lupin site takes place.

The underlying plastic liner material would be cleaned if necessary and disposed of within the mine. Foundation material would be surveyed for hydrocarbon contamination and handled accordingly with the same options as the sand at the surface. The remainder of the site would be graded to conform with the surrounding natural topography.

4.2.4 Chemical Storage

The mine site carries an inventory of chemicals which include; cyanide, lime, lead nitrate, zinc dust, flocculants and ferric sulphate in major quantities and miscellaneous refinery reagents in much lesser quantities. It is expected that the majority of reagents will be consumed through normal usage during final operations. Inventory that remains would be sold to an alternate user or returned to the supplier. Any chemicals that could not be removed through these methods would be disposed of in an environmentally acceptable manner after consultation with the appropriate authorities.

The grounds in the immediate vicinity of the chemical storage areas including the floors of the cold storage buildings are comprised of crushed waste rock. These areas would be sampled and contaminated materials either treated in-situ or removed to the tailings impoundment for disposal.

4.2.5 Roads and Airstrips

A considerable amount of roadway exists at the mine with the largest portion being the access to the explosives magazine and the access road to the Fingers Lake esker. All roadways will be left intact with the exception of areas of drainage control 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 of water pooling along the roads during spring melt would be opened up to provide unlimited drainage.

The roadways are probably the third most prominent feature change (next to the TCA and Mine Site) at the mine and will remain clearly visible for an indefinite period of time. In order to promote natural ingrowth of vegetation, the road surfaces would be ripped/scarified to provide microclimate sites for seed deposition.

The old airstrip used during construction had been used as a laydown area since the new airstrip was built. This area was slowly phased out as a storage location and in 1998 the gravel/esker fill strip was graded to conform to the natural landscape with cuts and backsloping applied where necessary to promote natural drainage and reduce erosion. The surface was prepared as per the roadways utilizing a grader with a ripping attachment.

The main airstrip is 6400 feet in length and is constructed of crushed waste rock produced from development underground. The drainage course in the area has been altered slightly in a lateral direction, however all runoff from both the east and west sides of the strip report in a northerly direction, eventually to Contwoyto Lake.

Removal of the airstrip will not be carried out however, access roads will be cut and backsloped to allow uninhibited drainage along its parallel. All ancillary equipment including signs, marker lights, strobes (associated wiring) and weather station/traffic control building will be dismantled and removed. The major components consisting of the radio beacon VOR (VHF Omni Range) and tower (Non-direction Beacon) will removed unless other arrangements are made through the Department of Transportation and/or the City of Yellowknife.

4.2.6 Sewage and Refuse Disposal Facilities

The existing sewage facilities consist of several lift stations within the camp and an 800 metre six inch insulated steel pipeline to the first of two sewage lakes. A "permeable" type dam with an emergency overflow exists between the first and second lake. Annual discharge from the second lake is controlled with a gated culvert and the use of a syphon. See Figure 6 in appendix.

Upon closure, the steel pipeline would be flushed with clean water, dismantled and removed from the site for reuse or sold for salvage if economically feasible. Components with no salvage value would be disposed of within the mine workings for burial.

The dam structure between the upper and lower lakes would be breached at the culvert location (lowest natural location) and backfilled with rip-rap (waste rock) to provide erosion control. Dam slopes would be graded to reduce erosion at the water level. The control culvert at the lower lake would be removed (again the lowest location) and the dam graded to reduce erosion and improve aesthetics.

The refuse disposal area used at the site is located to the southeast of the mine and north of the second sewage lake. All non-burnable waste (scrap metal, plastics, residue from burning) is disposed of and buried with waste rock on a regular basis. It is expected that a portion of this facility will remain active until restoration is near completion. At this time the area will be graded with waste rock/esker sands to promote diversion of surface runoff, prevent water ponding on the surface and provide erosion control around the perimeter.

4.2.7 Quarry; Fingers Lake Esker

The quarry material used for road and dam construction as well as the cover projects in the TCA is obtained from the Fingers Lake esker located approximately 11 kilometres from the mine or 3 km from the tailings impoundment. The frozen nature of the material within the esker dictates that only shallow layers of material can be removed during excavation and hauling. In general this results in a larger area of the esker surface being disturbed but allows for easier restoration work on cessation.

After any seasonal use of the esker for ongoing operations, the disturbed areas of the esker are contoured with the remaining ground for erosion control and to limit ponding of water at the surface. After completion of restoration plans at the mine and tailings impoundment, the final contour of the esker will be developed to be compatible with the natural topography and control potential erosion through sloping. The surface will be "roughed" with dozer cleats or otherwise scarified to enhance the natural re-establishment of indigenous vegetation.

4.3 Underground Mine

The Lupin underground workings include a 1210 metre vertical shaft and a decline to a depth of 1250 metres. A secondary hoist system (WINZE) will be operational in 2001 allowing hoist access to 1340 metres. The current mine depth is 1410 metres with potential deepening to 1640 metres. Incorporated into the underground facility are maintenance shops, electrical shop and a primary crushing station. Once mining has been terminated, all equipment will be considered for recovery and shipment to another site for reuse or sold for salvage value.

Where salvage is not economical, all equipment and materials will be inspected for, and any hazardous materials (eg. batteries, fuel, lubricants etc.) removed, prior to being abandoned within the mine. The hazardous materials, as mentioned, would be disposed of (or shipped off site) in an environmentally acceptable manner after consultation with the proper authorities. Any materials acceptable to being left within the mine will be moved to the upper levels to be contained within the permafrost region.

Materials to be left in-place, as is, are those related to the structure of the mine and shaft/raises, the shop facilities and crusher facilities (with motors etc. removed). Any materials being moved to the underground openings will be placed in the permafrost region to limit contact with water that may collect within the lower levels. If it is determined that rockfill bulkheads be placed at various levels to encourage water movement away from the disposal levels, then construction of these may take place prior to final closure of the mine.

All portals, raises, shafts or other entrances to the underground mine will be sealed using engineered concrete plugs and caps to prevent access. Where applicable, these areas will also be backfilled and graded to conform with the surrounding area.

4.4 Waste Rock

The waste rock generated at Lupin contains very little sulphide and is considered to have a low potential for generating acid. The sulphide content of 0.5% or less and the presence of an excess neutralizing potential compared to maximum potential acidity lowers the concern for ARD.

The production of waste rock was considerable during the early development stages of the mine and a stockpile was generated. In the latter stages of the mine life excess waste rock generation has been lower and the waste rock produced is normally moved to other areas of the mine as backfill material wherever possible. Very little development is currently taking place within the waste.

Waste rock has generally been used throughout the site as roadbed materials, in dam construction, airstrip stabilization, underground backfill or for other purposes such as building foundation preparation. At closure, there is not expected to be a large waste rock stockpile. Any remaining waste will be hauled the short distance to the open crown pillar and used to backfill

the opening. If for some reason all waste rock cannot be accommodated within this area, then the remaining stockpile will be graded to conform to the surrounding terrain.

4.5 TAILINGS CONTAINMENT AREA

4.5.1 General Description

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

The cells within the impoundment allow for separation of the liquid from the solid tailings as well as providing the first initial treatment through natural degradation. A reduction of up to 90% (with regard to cyanide) in contaminant levels is achieved within this first stage of storage. Pond No.1 receives water from the cells and retains solutions for nearly eleven months prior to transfer/treatment into Pond No.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 - 2000). The main water retaining dams are those in Pond No.2 (labelled Dams 1a, 1b, 1c and Dam2) and for the present, Dam4 in Cell No.4. With future tailings solids deposition, Cell No.4 may receive enough solids to beach Dam4 and restrict water access. Dams No.5 and 6 within Cell No.3 are low level dams. A water head is not expected on these structures upon closure.

All perimeter dams have been designed with a synthetic liner for initial control of seepage and are expected to freeze through the core during operations. The KDam, 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 No.1 and 2 are separated from the remainder of the impoundment by Dam3d. This dam was constructed as a "permeable dam" and allows solutions from the two cells to report to Pond No.1. This esker fill dam has a downstream slope constructed of quarry rock placed in 1995 for stability and erosion protection. The last of the structures, the JDam, separates the two ponds for treatment purposes.

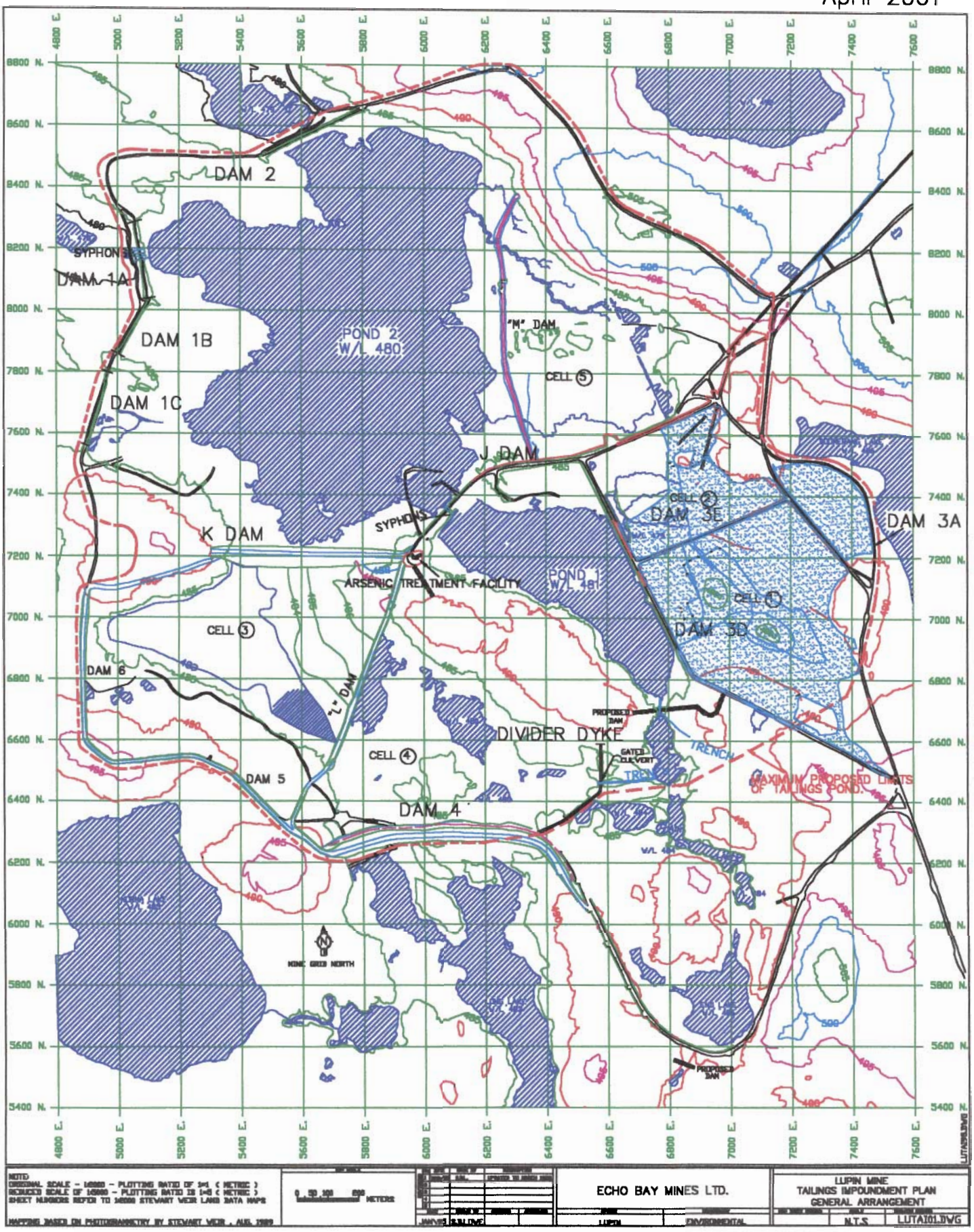


Figure 3; Lupin Mine Tailings Area– 2001

4.5.2 Impoundment Stability

There are several engineered dams utilized in the design of the TCA that are of a concern during closure and abandonment. These dams have been constructed with synthetic liners for the initial control of seepage and will ultimately freeze through to the core as a result of permafrost migration.

Temperature monitoring was extensive for the perimeter dams of Pond No.2 during 1984 through to 1990. Additional thermistors have been installed in Dam4 (constructed in1992) during 1995 and will provide information on the performance of the permafrost concept.

A qualified geotechnical engineer performs annual inspections of the facilities during the operations and will be retained to conduct these inspections post-closure until it is determined that risk is not a factor in the closure of the TCA. At present, the downstream slopes of these dams have not been a concern. This may change as the facility continues to mature and solids levels (and liquid levels during closure) rise yearly. The long term stability of the dams would always be re-assessed during the inspections.

4.5.3 ARD (Acid Rock Drainage) POTENTIAL

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 NP/MPA (Neutralizing potential/Maximum Potential Acidity) ratio of less than three. A ratio of greater than three (as in the Lupin waste rock with a sulphur content of <0.5 %) indicates a low potential for acid generation and no concern with respect to ARD.

Since the most recent Licence renewal for the Lupin mine in 1990, Echo Bay Mines Ltd. has increased its Research and Development activity with regard to the Acid Generating Potential of the mill tailings and mitigative measures/abandonment plans for eventual closing of the containment area.

Included in these studies was a 1991-1992, 30 week column leach program (kinetic test) and a follow-up16 week leaching program in 1993 on mitigative measures for an area that is currently producing acidic water within the impoundment. As well, in 1992 a 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 exposed tailings within Pond No.2. Please refer to the list of studies included in the appendix which covers all environmental related studies during the this period.

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 No.1. This program did not return first year results as anticipated. The project leader, and two of the main contributors left the firm resulting in problems with interpretation of data. Echo Bay Mines Ltd. felt that the information gathered using the geophysical techniques were incomplete and not appropriate for baseline reference (general information was excellent, however because of missing information and improper calibration of equipment, additional pre-studies are required). The body of the study is excellent in that considerable background information has been gathered with regard to the chemistry of the tailings prior to covering.

In 1995, a continuation of the 1994 study commenced incorporating 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 No.1 was covered. Thermistors and frost tube locations have been installed through a contract to Seacor Environmental Engineering Inc. and the initial installation summary report has been completed.

4.5.4 Planned Restoration Activities

Restoration for the Tailings Containment Area will involve the consideration of two physical methods for remediation and control of potential contamination from the materials that are held within its boundaries. These methods include 1) flooding of areas that are currently used for water retention and low elevation tailings deposition and 2) mechanical covering of the higher elevation areas containing tailings (cells) with esker material.

The tailings cells are areas that have been disturbed by tailings solids deposition and will require remedial action to prevent further contamination through leaching to the water system and surrounding environment.

Of the 750 hectares within the lease area, an estimated 171 hectares will be affected directly by the deposition of tailings solids. The closure concept adopted by Echo Bay Mines Ltd. in the restoration of this area is to encapsulate the tailings (which is potentially acid generating) within permafrost and water saturated soils. This would limit oxygen transfer through to the sulphide contained in the tailings and prevent acid generation. Water movement and mobility of any contaminants will also be restricted through the frozen ground.

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.

Lupin Tailings Containment Area

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	301,815	558,050
END LAKE *	74,100	1,236,250 est.
POND NO.1	276,720	451,820
POND NO.2	1,627,000	2,120,660
TOTAL	3,746,285	5,958,210

Note - The End Lake area will only be used for tailings deposition if the need arises. Current plans do not incorporate this area and the above table shows surface elevation at closure of 484.5m.

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 closure, the Pond No.1, Pond No.2 and End Lake areas of the TCA will be allowed to naturally rise in water level to eventually cover an area of approximately 198 hectares. The maximum water limit would be controlled via an overflow channel designed in bedrock north of Dam1a set to an elevation of 484.5 metres. This would allow the excess 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. Water levels would increase approximately four meters within the Pond areas and one meter in the End Lake area (Figure 4; Lupin Mine Final Tailings Estimate) from the current 2000 conditions.

An estimated 5-8 years of natural infiltration is required to increase the water elevation to the 484.5m level, one metre below the lowest point on any dam. During this time an evaluation of the water chemistry will be made to ensure that when overflow occurs, all water quality guidelines are met. The overflow would amount to an estimated 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 5 meters from the planned overflow 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.

tailsend.dwg

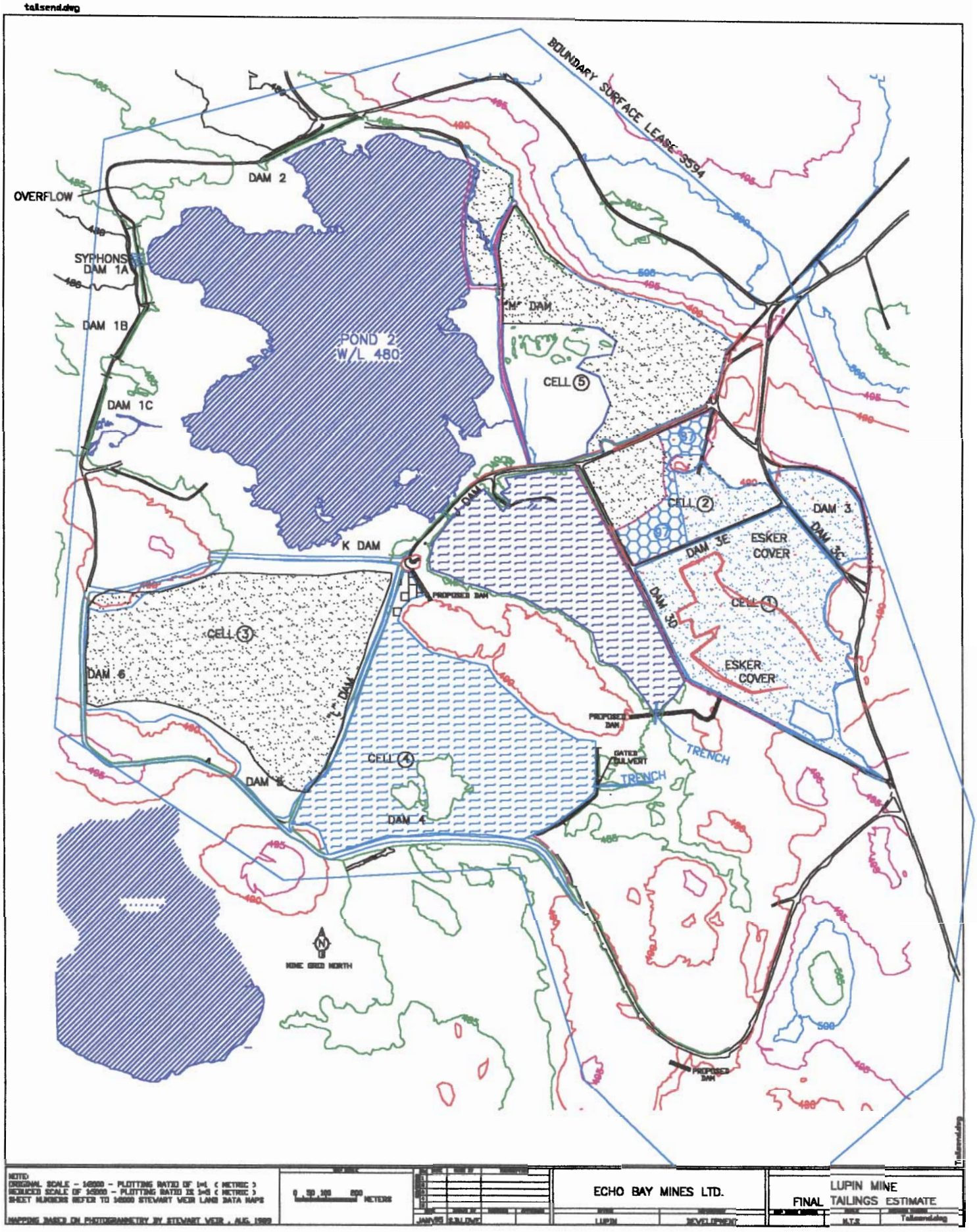


Figure No. 4; Lupin Mine Final Tailings Estimate

In addition to the water cover of 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. Based on previous temperature evaluations of esker covered tailings, an estimated maximum cover of 1.75 metres may be required to maintain frozen conditions within the tailings. Further delineation of the cover depth continues to be studied with the current thermistor program initiated in 1995 within cells 1 and 2 along with additional replacement thermistor strings installed in November 2000.

This cover, combined with a mean annual temperature of -12 C and near-net evaporation, produce a climate where the thaw zone of the esker cover on tailings is limited (less than 2 meters). Because there is very little additional watershed associated with the closed cells, flooding and erosion would not be a concern and the moisture retention of the cover assists the insulating value at depth.

In general, with all the cells being situated around the perimeter of Ponds No.1 and 2, there is a natural slope and drainage that results in collection within the ponds. With proper grade control, accumulated snow and its associated runoff naturally flows towards the two Ponds. Presently in Cell No.1, runoff enters Pond No.1 at the eastern end where a slight depression in the Dam3d access road has been made to allow flow. Cell No.2 has not been completed covered so runoff enters the south corner where it is either syphoned off or seeps through the dam. Upon closure it is expected that all cells, given their proximity, will be graded slightly from the perimeter to the interior so all runoff will report to either of the two ponds.

The source of esker material for most construction at Lupin has historically been the Fingers Lake Esker located approximately five kilometres to the southeast of the TCA. This borrow source has been used for construction of the Kdam, Dam4, Dam5, Dam6, Dam3c and d, Ldam and Mdam, as well as an underground backfill program utilizing 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 the 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 considered to be more than adequate for the 1.3 million square metres that requires covering at the TCA under the proposed esker cover scenario. Drilling associated with the installation of a thermistor (2000) at the esker had shown depths greater than 10 metres in an area that was expected to be shallow.

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 along with the added stability risk of water retaining structures and maintaining water balance indicated that other options might be more suitable. The use of a water cover in strictly defined areas (ie individual cells) has the potential of lowering capital costs and isolating each component from the tailings area as a whole.

Additional investigations into alternatives to the "dry cover" option are currently being undertaken that will assist in reducing both the complexity of the abandonment and the related financial burden. Among these are the enhanced insulation of the esker cover through incorporation of an ice lense or layer to reduce heat transfer and thereby maintain cold conditions below ground. A second is the use of graded (screened) materials in order to provide a layer effect assisting to entrap a cold air layer which could maintain a lower annual temperature at the depth of the tailings. This has been referred to as a 'Natural" thermosyphon, similar in function to the engineered structures used in construction for cooling the ground at depth. The natural construction would function by allowing the cold arctic air through a coarse rock layer and containing it to assist freezing of the finer cover and tailings at depth. Some examples of this natural "phenomenon" are coarse gravel borrow pits and coarse gravel base construction methods (which do not incorporate synthetic insulation).

In conjunction with the investigations into the final cover of choice for the Lupin Tailings Containment Area, there has been some concerns raised over the potential for post closure groundwater contamination. The geographic region in which the Lupin Mine is located is considered to be that of continuous permafrost. In the past, the permafrost depth has been noted to be in the range of 400-500 metres. There is an active thaw zone on the surface that ranges from one half metre or less (glacial till tundra with heavy organic layer) to five metres or more (fractured bedrock outcrops) depending on the ground conditions.

The region surrounding the Lupin TCA is generally composed of the glacial till (with organics) with some bedrock outcrops. With these features and the associated permafrost, the groundwater movement is limited by the low permeability of the frozen soils and the active layer achieved during the summer. Measurements of the active layer in the areas surrounding the TCA have been limited in the past. Studies (evaporation) carried out by the University of Waterloo during 1991-1993 included data regarding the active layer and groundwater movement in a study area nearby. Water table wells were installed in this area to monitor the development and movement of the water table during spring and summer. The nature of groundwater flow in the active layer is such that it occurs as a thin perched reservoir layer above the frost table. During the summer thaw, the frost table (or thaw layer) deepens and the groundwater with its associated flow follows. For this reason, the wells need to be installed to maximum depth in the late fall to be available for monitoring the following spring.

The Lupin TCA is located in an area that is near and part of the headwater flow to Seep Creek. The original small lakes that made up a portion of the TCA collected spring runoff and provided spring freshet water to the Seep Creek drainage. To the west and south of the TCA are two larger lakes that may have provided some spring surface water flow but are currently isolated by Dams 3 and 4. With the TCA located in the higher elevations, the groundwater flow from the facility would be in the direction of the Seep Creek basin. Again, in order to monitor any flow of sub-surface water, wells would need to be installed during the late summer prior to local freezing.

4.6 Revegetation

The Lupin mine is located in the barren land tundra of the Northwest Territories. 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.

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 now through the work of the AEC for use in these applications.

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 enhancement 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. Esker sand 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 procedure of scarifying surfaces must be done to the extent of providing the required microclimate for natural plant growth. Providing a rough surface enhances seed entrapment, moisture retention and wind protection. An additional enhancement can be made through the use of a heavier substrate which will naturally provide limited plant habitat.

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 microorganism 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, 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 providing proper drainage patterns to avoid erosion and ponding of water.

4.7 Post Closure Monitoring

4.7.1 Permafrost and Temperature Monitoring

Monitoring of the effectiveness of the restoration activities is expected to continue beyond the cessation of operations and into actual closure. Monitoring is currently underway with regard to the cover materials used within the tailings containment cells. This was preceded by 10 years of permafrost monitoring of the perimeter dams, six years on an esker covered portion of Cell No.1 and five years monitoring of dam core temperatures of an internal dyke similar in construction to the newly built Dam4.

The present monitoring program is focused on Cell No.1 and Cell No.2 which have had esker material applied to the surface at a depth of 1.25-1.5 metres. Thermistor strings with tips at 0.25 metre intervals (for the first 2.5 metres) will measure temperature and frost tubes installed adjacent to the thermistors provide a physical measurement of the active layer. This information will compliment the temperature data obtained. The previous cover area received an application of generally less than one metre esker cover and had thermistors installed at one meter intervals. This did not provide an adequate amount of data on the actual freeze/thaw interface.

In November 2000, replacement thermistors were installed in Dams 1a and 2 as well as the Fingers Lake Esker. Replacement instrumentation remains to be installed within the No.1 Cell, Mdam and possibly the baseball field (made from run of mine waste rock). Data is to be gathered from these newer installations to supplement information compiled to date and confirm previous estimates on active zones at the Dam locations.

4.7.2 Engineered Facilities

The stability of the tailings impoundment engineered structures will be monitored on an annual basis as required within the Water Licence. It is expected that these inspections will continue beyond closure to include the period of water balance once overflow has been achieved in the system. The dams retaining solids will also be included in the inspection for monitoring of long term stability.

4.7.3 Water Quality Monitoring

Water quality monitoring within the tailings impoundment is necessary to track the performance of the system and/or identify any anomalies that may arise. The water fill phase of the ponds is expected to provide time in which to develop a contingency plan should monitoring indicate that the water quality will not meet discharge requirements. During the preceding licence term, treatment at the TCA has been reduced to that of the addition of lime to the ice in the spring prior to spring melt. The treatment facility, which was originally designed for the addition of ferric sulphate for the removal of arsenic, has only been used for supplemental addition of lime since 1997. The water quality within Pond No.1 had improved during the years prior and treatment for the removal of arsenic was not required. If the trend to lower levels continues during the current operations, then it can be expected that during closure and subsequent infilling of the TCA, water quality would not change significantly. Lime addition might be required for pH control.

Water quality monitoring would also be carried out at the sewage lakes system, the main site facilities pad runoff and leachate from the waste rock piles or building foundations. The main Lupin site is situated on high relief and surface runoff collects in two directions 1) to the sewage lakes and 2) to Contwoyto Lake in the vicinity of the pumphouse. Monitoring of general site conditions and runoff may be required during the period leading up to the final A&R plan being prepared. Dependent on results from the initial survey of the site following restoration work, and remedial action required at that time, follow-up monitoring may be required at the various petroleum/chemical storage areas that existed prior to the closure.

LIST OF STUDIES UNDERTAKEN DURING LICENCE TERM 1990-1994

ABANDONMENT/RESTORATION

Acid Rock Drainage Study - March, 1992; Klohn-Leonoff for Echo Bay Mines Ltd. Static tests of Tailings and Waste rock for chemical characterization; a 30 week column leach program (kinetic test) testing cover materials in cold and room temperature environments.

Assessment of Water Chemistry and Remedial Measures for the Lupin Tailings Management System - July, 1992; Klohn-Leonoff for Echo Bay Mines Ltd. Review of water chemistry, past treatment conditions and affects of the exposed tailings area along the N.W. corner of Pond No.2 were investigated.

Column Leaching Study; Evaluation of ARD Control Measures - December, 1993; Klohn-Leonoff for Echo Bay Mines Ltd. Investigation of ARD control measures for the tailings deposition area utilized between 1982 and 1985.

Echo Bay Mines Ltd., along with various consultants, have completed the design study and recommendations regarding implementation of a Paste Backfill Process at Lupin. The utilization of tailings material underground will provide additional control and prevention in the difficult task of dealing with material that, given the proper conditions, has the potential to generate acid.

Echo Bay Mines Ltd. plans to retain the services of Klohn-Crippen (Klohn-Leonoff) to assist in the continual development of the tailings management plan. This is to include a Test Cover Plot and monitoring program within the filled portion of Cell No.1; initiated in 1994. As well, an assessment of an area covered with esker material in 1987 adjacent to Cell No.1 will be completed.

Evaporation Studies At The Lupin Mine Site Using Stable Isotopes, 1991-94; Department of Earth Sciences, University of Waterloo. The principal objectives are to measure evaporation and water balance of tailings pond treatment systems in northern climates; and to calibrate an isotope mass balance model to be used as an operational method for characterizing water balance of natural lakes and tailings ponds. This information is expected to provide a valuable tool in the assessment of eventual closure strategies for the Lupin Tailings Impoundment.

From these isotope studies Mr. Jeffrey Whidden achieved both his Bachelor of Applied Science thesis and a Master's thesis. See references.

FISHERIES RELATED STUDIES

Echo Bay Mines Ltd. has continued to carry out or provide support for environmental monitoring programs related to the decant pathway of the tailings impoundment discharge and the receiving water body. These studies are a continuation of the Aquatics Studies Program of 1983 to 1985 and 1988. The most recent programs included:

- **Fisheries Investigations at the Lupin Gold Mine, Contwoyto Lake, NT, 1990**; Fish Tissue Metal Analysis - R.L. & L. Environmental Services, and Seep Creek Investigations - Dept. of Fisheries and Oceans.
- **Application of Selected Monitoring Methods to the Assessment of Impacts on Contwoyto Lake from Lupin Mine Effluent. Phase 2-Longterm Assessment; 1990**. Environmental Protection, Conservation & Protection, Northwest Territories District Office, Yellowknife, NT. **DRAFT ONLY**-March 1991.
- **Metal Concentration in Fish Tissue - Contwoyto Lake, NT; Echo Bay Mines Ltd., 1993**; R.L. & L. Environmental Services Ltd., report currently in the Draft stage.
- **Movements of Lake Trout In The Sun Bay Area And West Arm Of Contwoyto Lake., 1994-1995;** R.L. & L. Environmental Services Ltd., work is currently in progress.

REFERENCES

Darroch, B.A., Woosaree, J. and James, B.T.; Native Grasses For Reclaiming Mine Sites In Alberta. Paper presented at Sudbury '95, Conference on Mining and the Environment. May 28-June 1, 1995.

Cominco, Polaris Operations; Abandonment and Restoration Plan, June 1992.

Echo Bay Mines Ltd., Lupin Operation; Abandonment and Restoration Plan, December 1984, Parts A & B and updates.

Imperial Oil Resources, Norman Wells; Interim Abandonment and Restoration Plan, July 1995.

Northwest Territories Water Board; Guidelines for Abandonment and Restoration Planning in the Northwest Territories. September 1990.

Royal Oak Mines Inc., Colomac Mine; Abandonment and Restoration Plan, July 1995.

Whidden, Jeffrey A.; 1992. Application of Isotope Hydrology To Mine Water Management In The Northwest Territories. Thesis requirements for the degree of Bachelor of Applied Science in Geological Engineering, University of Waterloo.

Whidden, Jeffrey A.; 1994. Developing Waste Water Management Strategies Using Environmental Isotopes For Mines In The Northwest Territories, Canada. Thesis requirements for the degree of Master of Science in Earth Sciences, University of Waterloo.

Winterhalder, Keith; Minimal Soil Amelioration and Native Sod Transplanting as a Means of Restoring Biodiversity on Smelter-Affected Lands. Paper presented at Sudbury '95, Conference on Mining and the Environment. May 28-June 1, 1995.

APPENDIX

Figure 5; Raw Water Supply

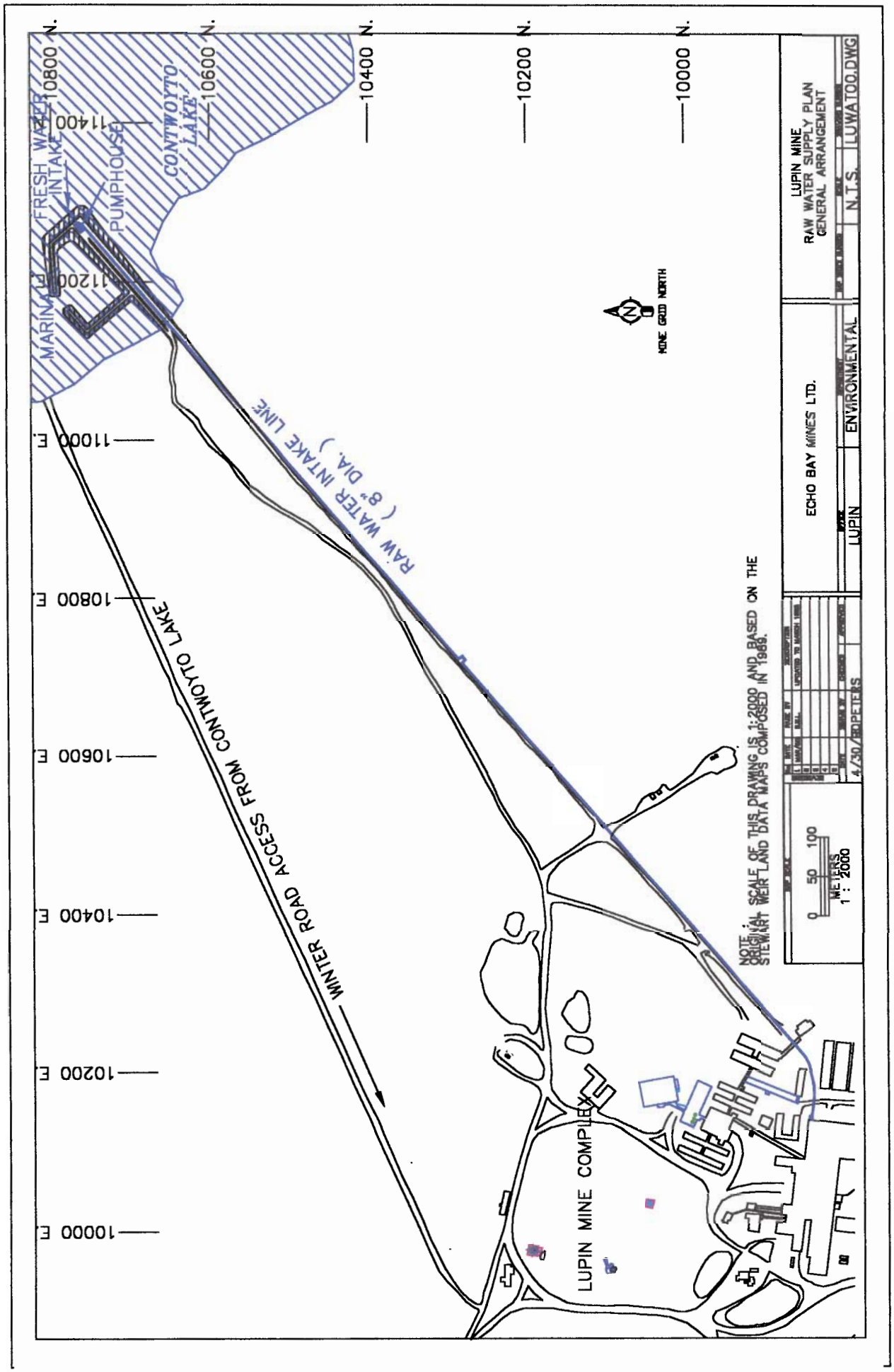


Figure 6; Sewage Treatment Plan

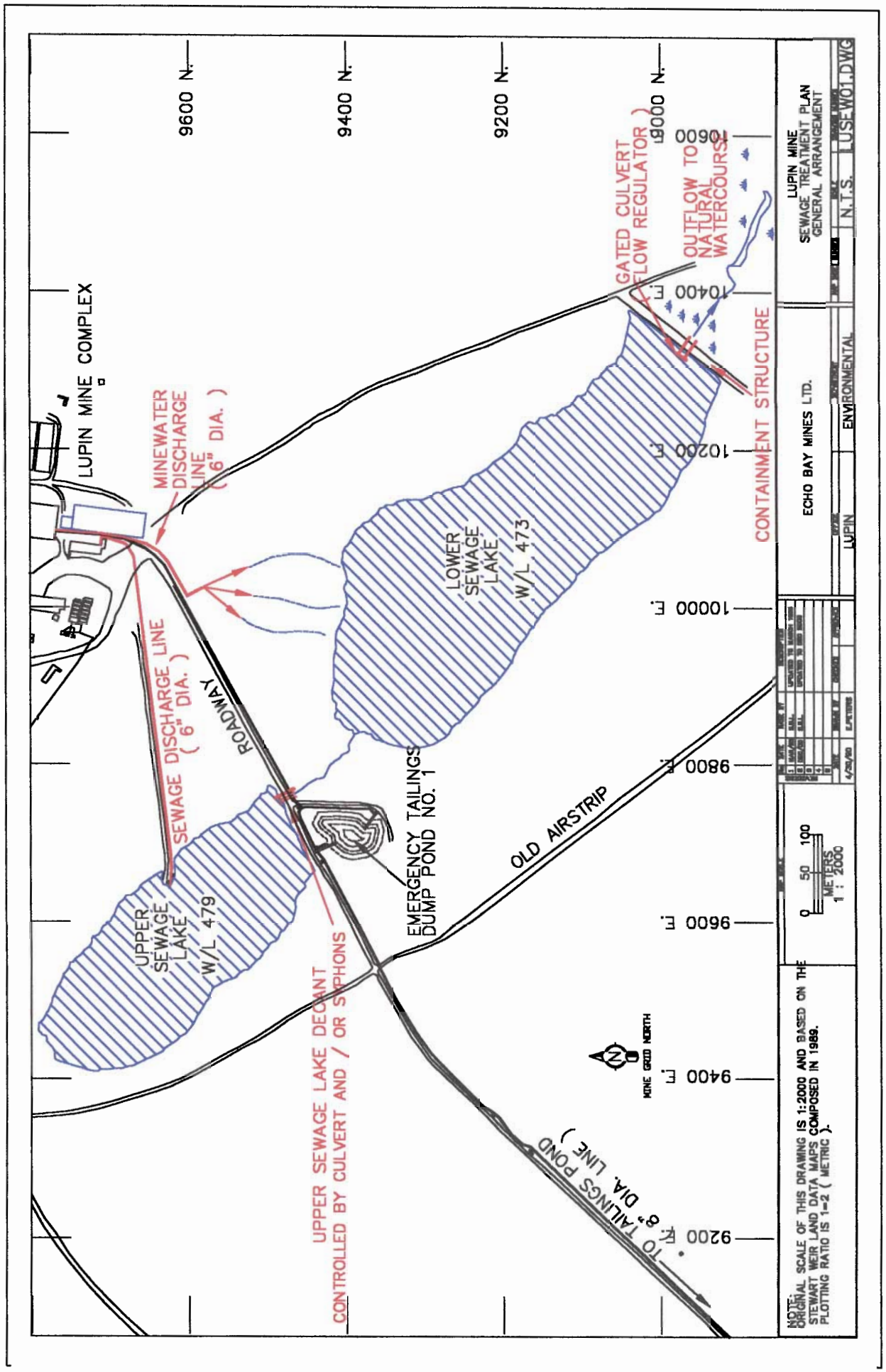


Figure 7; Tailings Line Route - Mill to Pond