Executive Summary

Polaris Mine is a joint venture owned by Cominco Ltd. (77.5%) and Teck Corporation (22.5%). Both companies are Canadian with head offices in Vancouver B.C. Cominco is the sole operator of the mine.

Polaris Mine is located on Little Cornwallis Island (LCI) in the Canadian High Arctic, in the Territory of Nunavut. Situated at about latitude 75°N and longitude 97°W, it is approximately 100 km northwest of Resolute. Polaris Mine is an underground zinc-lead mining operation and the world's most northerly metal mine. The Polaris Mine occupies a total of about 962 hectares of land under surface leases from the Government of Canada.

The Polaris orebody was discovered in the early 1970's. Following socio-economic, engineering and environmental studies, construction of the mine and facilities began in 1980. The first concentrate was produced in late 1981. The mine is due to close in 2002 when mining of the orebody will be complete. On closure approximately 21 million tonnes of ore will have been processed to produce 4.4 million dry tonnes of zinc concentrate and 0.9 million dry tonnes of lead concentrate.

The Polaris facility is a substantial installation with excellent ancillary features. Cominco Ltd. had hoped to extend the life of the operation by development of other expected ore sources in the area. After extensive exploration work over the last 12 years, no economic deposits have been discovered. No alternate uses for the site have been found to date. Cominco Ltd. intends to implement closure plans immediately following cessation of mine production.

This Decommissioning and Reclamation Plan (the Plan) has been prepared on the assumption that all facilities and installations that comprise the Polaris Operations will ultimately be decommissioned, removed or reclaimed under the terms of the land leases. The intent of the land leases to "remove all improvements" is served by the proposed decommissioning and landfilling in the Little Red Dog Quarry of the barge, accommodations complex and other large scrap equipment and buildings (after removal of any hazardous materials/substances).

Use of an on site landfill for disposal of the site improvements has the following benefits:

- Eliminates potential safety hazards by removing improvements from the land;
- Improves visual aesthetics by removal of the improvements;
- Provides an environmentally secure disposal location (non-hazardous material encapsulated in permafrost);
- Reduces the number of ships that must travel through the arctic to transport building debris to the south (and, thereby, reduces the associated environmental and ecological risks);
- In the case of the barge, reduces environmental and ecological risks, complex regulatory approvals and concerns from communities along potential towage routes;
- Eliminates landfilling debris in the South that was created for and used in the North;

- Eliminates landfilling of debris in the South where the materials would potentially be exposed to groundwater;
- The additional volume of fill placed in LRD Quarry aids in contouring the quarry for closure.

Regulatory Framework

The Polaris Mine occupies land leased from the Government of Canada under the Territorial Lands Act and the Territorial Lands Regulations. There are five surface leases at the Polaris site, all of which expire on April 30, 2011. Cominco holds three mining leases under the Territorial Lands Act through the Canada Mining Regulations. The surface leases contain various requirements for "Restoration", but the general theme is "to restore the land as near as possible to its original state, including removal of all improvements".

Water use, tailing disposal and effluent discharge at Polaris are governed by a Water License under the jurisdiction of the Nunavut Water Board. The License expires December 31, 2002. The Water License also sets out conditions applying to abandonment and restoration.

Cominco submitted a "Restoration Plan" for the surface leases to the Department of Indian and Northern Affairs (DIAND) in 1984 and received approval by DIAND in 1985. Cominco also submitted a revised "Closure and Reclamation Plan" to the Northwest Territories Water Board in May 1996 in compliance with the requirements of the Water License.

This Plan supersedes the previous submissions and meets the Abandonment and Restoration requirements for the Polaris Mine Water License and the surface leases. It addresses the comments and concerns raised by the regulators in their reviews of previous closure plans and the May 2000 draft of this plan. It also provides updated information on the status of Cominco Ltd.'s Polaris Mine and provides a plan of the work to be completed in the various stages of mine closure.

An environmental monitoring program ("EMP") for the post-reclamation timeframe will be implemented to demonstrate the success of the reclamation work with respect to achieving environmental objectives.

Objectives

The general objectives for the Plan have been prepared in accordance with Cominco Ltd.'s Environmental Policy, the regulatory requirements specified on the Land Leases administered by Department of Indian Affairs and Northern Development (DIAND), and the Water License requirements now administered by the Nunavut Water Board (NWB). They are:

- To ensure that the site returns to a condition such that public health and safety, and the environment are protected;
- To provide a working document that addresses the concerns and requirements of all stakeholders during the consultation and implementation stages;
- To eliminate or minimize the requirements for long term care and maintenance;

- To identify those activities required to return the site to an aesthetically acceptable condition.

The Plan will serve as the basis for managing and scheduling the work required for facilities decommissioning and for reclamation activities. Input from regulatory agencies and the local communities was solicited and has been incorporated into the Plan.

Physical Environment

The climate is typical of the high arctic with cold winters, short cool summers and very little precipitation. Snow-melt typically begins in June, with break-up of the sea ice occurring from mid July into early August, and freeze-up beginning in September.

The terrain of Little Cornwallis Island consists of very gently rolling low-relief hills and plains rising out of the ocean. The Polaris Mine site area is characterized by a steep west-facing hillside leading from the accommodation complex down to the site of the process barge below.

In the vicinity of the mine site and elsewhere in the surrounding area, overburden forms a thin mantle over the calcareous bedrock. Barren, gravel type surface material predominates at the Polaris Mine site. The Polaris mine site is located within the zone of continuous permafrost. The vegetation of Little Cornwallis Island is classified as "Arctic Tundra". Due to the harsh climate, high winds and shallow soils, vegetation forms are typically dwarfed, low-lying and grow in clusters or as a dense mat. Environmental baseline studies were conducted prior to development of the mine. Environmental sensitivity mapping was used to assess the suitability of various areas within the proposed mine site for development. Vegetation, soils and animal use were considered in the assessment of environmental sensitivity. The active mine site area was developed within the area classified as Bare (coarse textured), characterized as having relatively low biological sensitivity and low susceptibility to mechanical disturbance.

Historical Land Use

An archaeological survey in 1977 identified 36 significant sites on LCI. These sites, however, were to the north and east of the mine site. None of the sites are in the areas covered by Cominco's surface leases at the Polaris Mine site.

Population studies over the last 20 years show few Caribou or musk ox resident on LCI. Caribou and musk ox numbers throughout the Arctic islands have been reduced considerably in the last few years due to severe weather conditions. Polar bears are culturally and economically significant to the Inuit and are common in the LCI area.

The Inuit hunters interviewed in a 1997 study indicated that hunting on LCI did continue after the mine was established. However, the widespread declining caribou numbers have resulted in less trips to LCI for hunting. The most recent siting of caribou on LCI was in 1992.

Community interviews that were conducted in 2000 indicated the following with respect to historical land use:

1. LCI has largely been a stop over for residents from Resolute while in transit to Bathurst Island for hunting;
2. Hunting on LCI has occurred in the past on an opportunistic basis with brief stop-overs;
3. The northeastern portion of LCI is viewed as a more favourable area for camping;
4. The Polaris Mine area has previously been a "view area" for polar bears.

Overview of the Polaris Mine Operations

The Polaris orebody is situated completely in permafrost, which extends to more than 300 m below surface. Ore minerals are sphalerite (zinc sulphide) and galena (lead sulphide). The waste rock (host rock) is predominantly dolomite with calcite. Hanging wall rocks are shales. The orebody is located as close as 60 m to surface and extends to 300 m below surface. Except for a very small open pit on the north, the ore has been mined by underground methods.

There are two types of rock quarries at the mine site, the Little Red Dog (LRD) Quarry from which limestone aggregate material is extracted and the two shale quarries. Underground mine openings were filled with shales from the surface quarries (backfilling) until 1996. Since 1996, backfilling has employed a mixture of quarried limestone and cement. Backfilling has been an integral part of the mining method to maintain stability of the underground openings. Waste rock mined from underground development is also used as backfill underground eliminating the need for disposal on surface. There is no water underground and therefore pumping water from the mine to surface is not required.

The mined ore is crushed underground and moved by underground conveyor to the mill. The resulting concentrates are stored in a covered storage building through the winter and are shipped to market in the short shipping season. The mill tailing is pumped via a 4 km tailing line to a tailing thickener located above Garrow Lake. Process water is recycled from the thickener back to the mill via a duplicate pipeline. The thickened tailing is deposited in the bottom of Garrow Lake. A frozen-core dam was constructed near the outlet of Garrow Lake in 1990 and 1991 that allows the lake water level to be controlled during mine operations. Fresh water is obtained for the plant and domestic purposes by pipeline from Frustration Lake about 5 km from the mine.

The Polaris mine is an extremely compact mining operation. The process barge contains the mill and most of the service facilities including: power house, maintenance shops, warehouse and offices. The other two main buildings on site are the concentrate storage building and the accommodation building. Diesel fuel oil for power generation and mobile equipment is stored in a tank farm and in tanks located in the barge. There are two landfill sites located approximately 1 km south of the accommodation building and one landfill located approximately 1 km northeast of the accommodation building that have been or are active during mine operations. The Little Red Dog Quarry is proposed to ultimately be used as a landfill during mine reclamation.

The mine has a ship docking facility capable of handling ships up to 44,000 tonnes. Bulk supplies and equipment are transported to the site by ship. The arctic shipping season is restricted to the ice free season between July and October of each year. The mine is also serviced by aircraft from Resolute using the 1200m airstrip located adjacent to the accommodation building.

Decommissioning, Reclamation and Restoration

In preparation for closure, Cominco Ltd. commissioned several studies to characterize geotechnical and environmental conditions at the mine site and the receiving environment and to provide direction for remedial measures to be undertaken during decommissioning of the mine. Studies have been undertaken by Gartner Lee Limited regarding a two phase (1999 and 2000) environmental site assessment, design of engineered covers for closure of the landfills and a comparative review of two alternatives for decommissioning of the process barge. A risk-based development of site specific soil quality remediation objectives was undertaken by Cantox Environmental Inc. Studies have also been completed for Plan scheduling and costing (Cascade Management Inc.), demolition volumes and methods; dock reclamation and shoreline stability (Westmar Consultants Inc.), modeling of the chemical stability of Garrow Lake (AXYS Environmental Consulting Ltd.), and decommissioning of the Garrow Lake dam (EBA Engineering Consultants Inc.).

Cominco's approach to closure planning follows that outlined in the document "Mine Reclamation in Northwest Territories and Yukon", Northern Water Resources Studies, Indian and Northern Affairs Canada, April 1992. An overview of the decommissioning and reclamation approach for each of the major mine components is presented below.

Mine Workings

Once mining has been completed, all underground equipment and machinery will be considered for reuse at another site, offered for sale or left in place in the mine. Any equipment that is not removed from the mine for reuse or salvage will be cleaned of any potentially hazardous waste materials such as fuel, lubricants and batteries. These materials will be handled in accordance with the NWT Hazardous Waste Management Guidelines and disposed properly off-site. Waste oils and lubricants may be burned on-site or may be shipped off-site with other hazardous materials.

Sealing all portals and raises by means of secure plugs and caps will preclude post-reclamation access to the underground mine workings. These installations will be backfilled and graded to conform to the contours of the surrounding area.

Surface subsidence that has occurred over certain older underground openings in the area now referred to as the Reclamation Landfill will be remediated by placement of a simple soil/rock cover that will promote surface runoff and eliminate safety hazards. Future surface subsidence in this area or in other areas is expected to be minimal because of the beneficial effects of backfilling.

Known areas of ore stockpiling will be investigated by mine site geologists and cleaned up. Recommendations will be made to either process the material through the mill or seal the material in the underground mine, depending on the results of inspections and testing.

Garrow Lake Tailing Facility

At mine closure, approximately 15 million dry tonnes of process tailing will have been deposited in Garrow Lake located approximately 5 km southeast of the process barge. Garrow Lake is a meromictic lake that is both thermally and chemically stratified with no vertical circulation. The mill tailing is deposited into the bottom layer of Garrow Lake, where the density difference between the bottom layer and the surface layer is the most important factor that prevents the upward movement of the tailing into the surface layer. The anoxic (oxygen-poor), sulphide-rich conditions in the bottom layer also act to contain metals in the tailing in a stable solid phase. The current Water License requires Polaris Operations to monitor the stratification of Garrow Lake and apply the results to a model that will predict the short and long-term stability of the Lake. The model has been updated and the results show that the lake will remain chemically stable after closure. A report on this topic as prepared by AXYS Environmental Consulting Ltd. is included in Volume 2, Supporting Documents. Monitoring will be continued through post-closure to verify the chemical and physical stability of the tailing deposition area.

Once tailing deposition is complete (after production ceases and the mill has been cleaned), the physical structures such as pipelines will be flushed, removed, and disposed in the LRD Quarry. The pipeline right-of-way will be re-contoured as required, in order to restore natural drainage patterns and prevent ponding of surface run-off.

A frozen core dam was constructed during 1990 and 1991 to contain water within Garrow Lake such that water could be discharged from the lake in a controlled manner. Decommissioning will require that the lake water level be lowered to its original elevation and that the centre portion of the dam be removed. This approach will restore the lake and the outflow creek to their pre-mining condition. A report on the reclamation plan for the Garrow Lake dam, as prepared by EBA Engineering Consultants Inc., is included in Volume 2, Supporting Documents.

Buildings

Previous Closure Plans have only considered the option of removing the barge from the site by re-floating and towing to a southern location for disposal or re-fitting for another project. The feasibility of re-floating the barge had not been examined in any detail until recently, when it became clear that the concept of re-floating and towing south would present substantial risks from environmental, operational and cost perspectives. An alternate reclamation approach for the barge was developed and compared to the re-floating approach in order to ensure that the environmental and other risks were minimized. The comparative review, as prepared by Gartner Lee Limited, is included in Volume 2, Supporting Documents.

The alternate approach was subsequently selected and forms the basis of this Closure Plan. The selected approach involves demolition and disposal of the process barge on site, dismantling/demolition of the barge superstructure and recovery of saleable equipment, followed by demolition of the barge hull. All demolition materials would be buried on site in the LRD Quarry after removal of chemicals and other hazardous materials. An environmental site assessment identified that the industrial activities conducted in the vicinity of the barge have resulted in metal and hydrocarbon contamination of the active layer surrounding the barge. This material will be removed following mine closure.

Other buildings to be demolished will include: the concentrate storage building, the Bent-Horn fuel conditioning building, the cemented rock-fill plant (CRF), the accommodation complex, and the tailing thickener building. Construction waste from the demolition of the buildings will be disposed in the LRD Quarry, including concrete footings and stub walls. The footprint formerly occupied by the buildings will be backfilled and graded to a stable slope.

Equipment, furniture and other usable materials within the buildings will be considered for re-use by Cominco Ltd., recycling off-site by nearby communities or disposal on-site. Chemicals and hazardous materials, including fuels, will be handled in accordance with the NWT Hazardous Material Guidelines and will be prepared appropriately for shipping off-site for recycling or disposal.

Fuel Storage and Handling Areas and Distribution Lines

Fuel remaining in the diesel tanks at mine closure will be transferred to one of the main tanks in the tank farm, from where it will be available for use in reclamation work and, ultimately, removed from the site by oil tanker. Any sludge remaining in the tanks will be removed and burned. The tanks themselves will be purged of vapours prior to dismantling and cleaning, and disposed in the LRD Quarry. The impermeable lining in the tank farm compound will be disposed in the underground workings. The berms surrounding the tank farm area will be graded to prevent diversion or ponding of surface run-off.

The pipelines associated with the fuel tanks will be drained, purged of vapours, cleaned and sectioned for disposal into the LRD Quarry. The pipeline right of ways and culverts under roadways will be graded and re-sloped to prevent ponding of surface run-off.

Concentrate Load-out Conveyors

Concentrate load-out support structures, conveyors and ancillary equipment will be removed and dismantled. Steel or equipment not required elsewhere will be cut into sections and disposed into the LRD Quarry.

Miscellaneous Outbuildings

Any buildings or equipment not specifically discussed above will be dismantled, removed from the site or disposed into the LRD Quarry. Examples include the firehall, equipment storage sheds and satellite receiving dishes.

Dock Site

Several alternatives were considered for decommissioning of the dock and restoration of the shoreline.

The dock structure will be decommissioned by removal of the shiploading tower, conveyorways, surface pipes and electrical utilities followed by cutting off the sheet piles underwater below the low water level, excavating the material from the inside of the cells and removing the sheet piles with a crane.

This method will have minimum impact on the seabed, will remove all above water improvements and will restore the beach to a smooth profile. The reclamation plan for the dock site, as prepared by Westmar Consultants Inc., is included in Volume 2, Supporting Documents.

Airstrip

The airstrip will be left largely intact. The related equipment including the radio beacon, runway lights and signs will be removed.

Freshwater Line and Pumphouse

The pumphouse at Frustration Lake will be dismantled and the equipment removed. The jetty extending into the lake will be left in place to avoid the impact removal would cause on the aquatic environment. The water storage tank will be dismantled and removed, together with the associated electrical equipment. Its base will be graded to a stable slope. The associated water lines will be dismantled and disposed in the LRD Quarry. Pipeline routes will be re-contoured where required to prevent ponding of surface water and restore natural drainage routes.

Access Roads and Ramps

Approximately 40 kilometres of road exist at the site. The major roads are those from the plant site to Frustration Lake and to the tailing thickener and Garrow Lake. There are no stream crossings, except a small culvert crossing over the stream exiting Loon Lake. All culverts will be removed to re-establish natural drainage patterns. Re-contouring will be carried out where graded slopes would otherwise be expected to become unstable in the long-term.

Sewage System

The sewage pumps, storage tanks and pipelines will be flushed, removed and disposed into the LRD Quarry.

Heating (Glycol) Distribution Lines

The glycol will be drained, collected in drums and either incinerated on-site or shipped for appropriate disposal off-site. The pipes and tanks associated with the heating systems will be cleaned and disposed in the LRD Quarry.

Electrical and Communications Cables

All electrical and communications cables throughout the site will be removed. Cables that are worth recovering for recycling or for re-sale will be shipped off-site. Otherwise, cables will be cut into manageable lengths and disposed in the LRD Quarry.

Solid Waste Management Operations

Two landfills are located approximately one kilometre south of the accommodation building and comprise two separate sections referred to as the Construction Landfill and the Operational Landfill. The Construction Landfill contains non-hazardous solid waste produced during the initial construction of the mine site, is covered with local soils and is not currently in use. Relocation of the Construction Landfill to consolidate it with the Operational Landfill commenced in 2000 as part of Cominco's progressive reclamation work. The relocation is part of the engineered closure plan for the consolidated landfill area. An engineered cover for closure of the consolidated landfill area has been designed to ensure that the waste materials remain frozen within the permafrost layer and that surface contours facilitate drainage. The landfill closure plan (including the recommendation for relocation of the Construction Landfill and the engineered cover for closure of the consolidated landfill area), as prepared by Gartner Lee Limited, is included in Volume 2, Supporting Documents.

The Reclamation Landfill is located approximately one kilometre northeast of the accommodation building. This landfill makes use of an area where surface subsidence above older mine workings has created a surface depression. Decommissioned heavy equipment and other non-hazardous materials are placed into the Reclamation Landfill. Cominco maintains a documented record of all materials that are placed into the Reclamation Landfill including a chain of custody that identifies the operators, supervisors and managers involved. The Reclamation Landfill will be closed by placement of a simple soil/rock cover that will promote surface runoff and eliminate safety hazards.

The LRD Quarry will be used as the disposal location for demolished surface buildings, concrete foundations, decommissioned pipelines, electrical cable and other materials from demolition. No hazardous materials will be placed in the quarry. An engineered cover will be constructed for closure of the LRD Quarry that follows the design for the consolidated Operational Landfill area as described above and as reported in detail by Gartner Lee Limited in Volume 2, Supporting Documents. The closure cover will promote surface runoff and prevent ponding of water.

Chemicals

The inventory of chemicals, reagents, fuels and lubricants will be carefully controlled during the final year of operation to ensure that a minimum volume remains to be managed after mine closure. Remaining inventory will be stored in original containers. Following mine closure, all inventory of chemicals and reagents will be transported off-site and will be:

- Returned to the chemical supplier;
- Sold to another user of the product;

- Used at another Cominco Ltd. facility;
- Shipped to a licensed disposal facility.

Hazardous Materials

Environmentally acceptable management procedures will be followed for the handling of each category of hazardous waste. Cominco Ltd. is registered with the Government of Nunavut as a generator of hazardous waste and will be responsible for the classification and labeling of hazardous wastes. Cominco Ltd. will complete waste manifests and ensure that the waste is transported by a registered hazardous waste carrier and received by a registered receiver. Cominco Ltd. will ensure that trained workers are used for the management of hazardous waste and ensure that occupational health and safety and emergency spill response measures are in place.

Contaminated Soils

An environmental site assessment (ESA) conducted in 1999 and 2000 by Gartner Lee Limited delineated areas of the mine site containing metal and petroleum hydrocarbon contaminated soils. Options for treatment and disposal were studied. The proposed remediation method for contaminated soils involves excavation and placement in the zone of continuous permafrost within the underground mine. Excavated areas would be re-graded and contoured. The remediation plan for metal contaminated soils recognizes that there are areas where metal concentrations were naturally elevated prior to mining activities due to surface outcropping of mineralized rocks.

A human health and ecological risk assessment was undertaken by Cantox Environmental Inc. that resulted in recommended soil quality remediation objectives of 10,000 ppm for zinc and 2,000 ppm for lead to be used in areas that have been mapped as barren-ground within the active mining area. The risk assessment utilized community historic land use activities on LCI and identified Inuit children as the most sensitive receptor. The development of the site specific SQRO's for lead and zinc was undertaken according to the permitted Federal framework (CCME, 1996).

The generic Federal soil remediation guidelines for parkland standards are applied to areas outside of the immediate active mining area. The Yukon Territory Contaminated Sites Regulation for hydrocarbon contaminated soils of 1,000 µg/g LEPH or HEPH (light or heavy extractable petroleum hydrocarbons) was adopted for the Polaris closure plan.

Complete reports, as prepared by Gartner Lee Limited, that describe each of the 1999 and 2000 Environmental Site Assessments are provided in Volumes 3 and 4, respectively, of the Supporting Documents. The human health and ecological risk assessment conducted by Cantox Environmental Inc. for the development of site-specific soil quality remediation objectives is included in Volume 2, Supporting Documents.

Northern Community Benefits

Throughout the Decommissioning and Reclamation process, Cominco will continue to identify and discuss potential forms of benefit to northern communities including: disposal of assets; decommissioning contracts and employment. Cominco began community involvement with the environmental site assessment and monitoring phase at Polaris. Community meetings have been held to discuss the Plan.

Post Closure Site Management and Monitoring

Cominco will provide a project management team to oversee all activities and to maintain responsibility for the site. Following the completion of the decommissioning and reclamation work, all personnel will leave the island.

Post closure monitoring of the site will be conducted to confirm that the remediation measures provide for a site that is both physically and chemically stable. A post-closure monitoring and visual inspection program has been developed as described in Section 7. It is anticipated that the monitoring program will be conducted for a period of 7 years following completion of reclamation work (to 2011), or until the physical and chemical stability of the site can be demonstrated.