Department of Fisheries and Oceans – Fish Habitat Management Report Decommissioning of the dock, marine foreshore, and Garrow Lake Dam at Polaris Mine

Prepared by: Jordan DeGroot, M.Sc.
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Background

Polaris Mine is a lead-zinc producing mine located on Little Cornwallis Island in Nunavut. Teck Cominco Ltd.(TCL) ceased production at the mine in autumn 2002 and is scheduled to commence decommissioning operations in 2003.

In order to decommission Teck Cominco's Polaris Mine, draining of water from the surface layer of Garrow Lake (the mine's tailings facility) and partial removal of Garrow Lake Dam will be required. This will result in the harmful alteration, disruption and/or destruction of fish habitat (HADD) due to lowering of the level of the lake and excavation of benthic fish habitat adjacent to the dam. Partial removal of a sheet-pile dock on Crozier Strait, and excavation to contour the adjacent marine foreshore area will also alter fish habitat. A Section 35(2) *Fisheries Act* Authorization will be required by TCL prior to implementing the proposed project.

The purpose of this screening report is to provide rationale underlying the environmental assessment conducted by the Department of Fisheries and Oceans – Fish Habitat Management on Teck Cominco's proposal to decommission the dock, marine foreshore, and Garrow Lake Dam at Polaris Mine. This screening report compliments the Nunavut Impact Review Board screening on a proposal by Teck Cominco Ltd. entitled "Polaris Fish Habitat Restoration Plan" (dated May 24th, 2002).

Screening Methodology

The applicable legislation guiding the environmental assessments of projects in Nunavut are the Nunavut Land Claims Agreement (NLCA) and the Canadian Environmental Assessment Act (CEAA). The Policy for the Management of Fish Habitat guides DFO involvement in environmental assessments in Nunavut. DFO is triggered to conduct an environmental assessment on the Polaris Mine decommissioning project under both the NLCA and CEAA.

The required section 35(2) *Fisheries Act* authorization is a trigger on the CEAA Law List for DFO – Fish Habitat Management to conduct a CEAA screening on the project. The proposed operations to decommission a sheet pile dock, marine foreshore, and the Garrow Lake Dam will harmfully alter, disrupt and/or destroy fish habitat (HADD) and necessitate issuance of a Fisheries Act Authorization.

The application for a *Fisheries Act* authorization also triggers an environmental assessment under the NLCA. An application for a DFO Fisheries Act authorization for the decommissioning of the dock, marine foreshore, and Garrow Lake Dam triggered a NIRB environmental screening. The NIRB screening decision requires approval from the Minister of Fisheries and Oceans Canada.

The CEAA screening conducted by DFO on the dock, marine foreshore and dam is part of a larger environmental assessment on Teck Cominco's proposal to decommission the

Polaris Mine site by year 2011. Teck Cominco will require a Nunavut Water Licence (renewal) in 2003 to complete the decommissioning operations at the site.

Other applicable legislation triggers other Federal Departments in the environmental assessment of the Polaris Mine Decommissioning Project. There are DIAND issued land leases at the Polaris Mine site that expire in 2011. The *Metal Mining Effluent Regulations* (MMER) are applicable to Teck Cominco's decommissioning plans as Garrow Lake is listed as a tailings impoundment under the MMER. According to DIAND staff, there is presently no CEAA Law List trigger for DIAND to conduct a CEAA screening on the Polaris Mine Site Decommissioning Project.

Other interested parties in the environmental assessment of the Polaris Mine Decommissioning project include the Institutions of Public Government established under the NLCA such as the Nunavut Impact Review Board, Nunavut Planning Commission, and the Nunavut Water Board. Local Hunters and Trappers Organizations at Resolute Bay and Grise Fiord were also consulted during this environmental assessment. Other interested persons or parties were provided with the opportunity to comment on the NIRB environmental screening of the Polaris Mine Project to decommission the dock, marine foreshore, and Garrow Lake Dam in 2002.

Construction and Mining Activities Schedule

The timeline for the work at Polaris spans from 2003 to 2004 (See January 15th Comments submitted by Bruce Donald to DFO):

a) Decommissioning of Garrow Lake Dam
   - Drawing down of Garrow Lake normally starts in mid July depending on weather conditions each summer. Completion of final draw down of Garrow Lake will be by the fall of 2003 (September 15 at the earliest, October 15 at the latest).
   - Inspect the location of the potential wave break structure. If the structure interferes with the natural drainage of the lake, it would be removed after draw down of the lake has been completed as identified above.
   - Inspect the creek channel (after draw down has been completed as stated above) and initiate any minor creek channel repairs that may be identified. As there will be no discharge from the lake at this time of year, the creek channel will be essentially dry. Any minor quantities of residual water in the stream channel will be completely frozen so that sedimentation can not occur.
   - Decommissioning of the dam will be initiated in March of 2004 with removal of the dam completed by June 1, 2004 (before freshet starts).
   - As identified in the Project Plan, work in Garrow Creek is not planned during the summer months when the creek is flowing. However, as a contingency, if upgrading or repairs to the creek channel are required when water is flowing in the summer of 2004, high flow periods will be avoided and sedimentation will be controlled by either diverting the creek flow around work areas or through the creation of settling ponds.
   - All work in the vicinity of the creek will be complete prior to October 15, 2004.

b) Decommissioning of the Dock and Adjacent Shoreline
   - Once glycol in the freezing pipes installed in the dock has been removed, the metals contaminated soils will be excavated in preparation for

underground disposal. Excavation of the surface layer of the dock and/or adjacent shoreline will begin no earlier than April 1, 2003.

- Excavation of the dock fill and adjacent shoreline will be ongoing throughout the summer and as late into the fall/winter of 2003 as possible. Excavation is expected to cease through the coldest portion of winter when it is too cold for work to be efficient. Work will resume as early in the spring of 2004 as possible and proceed until the work on the foreshore is completed, which will be October 15, 2004 at the latest

Environmental Setting

Garrow Lake is meromictic and is vertically stratified into three layers including the surface layer, the halocline, and the monimolimnion. The bottom layer consists of stagnant anoxic, saline water. In 1978 BC Research identified Garrow Lake as an "excellent repository for mine tailings" due to infrequent mixing of the lake and anoxic sulphide rich conditions in the bottom layer that cause metals in mine tailings to precipitate out and form a stable solid layer.

TCL was authorized to deposit tailings in the monolimnion layer of the lake in 1981 provided that the halocline and surface layer of the lake remain unaltered. Although a spill in 1989 resulted in elevated levels of zinc in the surface layer it has been suggested that the zinc concentration did not exceed 0.5 mg/L. The Garrow Lake dam was constructed in 1990-91 to increase the volume of the surface layer and control water quality as a consequence of the spill. The depth of the lake was increased approximately2.6 m and the surface area of the lake increased from 389.7 ha. to 444 ha (Gartner Lee 2001). Since that time Teck Cominco Ltd. siphons water from the surface layer of Garrow Lake into Garrow Creek from July to August on an annual basis. Annual discharge ranges between 2.7 and 4.3 million cubic metres of water.

The surface layer of Garrow Lake has been documented to be habitat for fourhorn sculpin *(Myoxocephalus quadricornus*) and zooplankton including copepods (*Limnocalanus macrurus),* harpacticoid copepods, amphipods (*Gammarus spp*.), and mysid shrimp (*Mysis oculata*).
The fourhorn sculpin was previously designated as a species of concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1989. Although the World Conservation Organization (IUCN) identified the fourhorn sculpin as vulnerable in 1990 and 1994 it was dropped from the Red List in 2000 (see Gartner Lee Ltd. 2001).

Garrow Lake drains into Garrow Bay via a 1400 m long creek. Garrow Bay provides supporting habitat for fish species in Crozier Strait including fourhorn sculpin, and marine mammals such as narwhals. According to a survey conducted by Gartner Lee Ltd. in the communities of Resolute Bay and Grise Fiord there is no indication that Garrow Lake supports a fishery. However, because the surface layer of Garrow Lake supports fish habitat in a larger ecosystem including Garrow Creek and Garrow Bay it has the potential to support a fishery and is consequently considered to be fish habitat.

The marine foreshore area near Polaris is habitat for arctic cod, and marine mammals (e.g., narwhal, ringed seals, walrus). The area above the LLWL has been documented by Teck Cominco Ltd. with photographs and underwater videos have recorded habitat conditions adjacent to the dock and shoreline. The intertidal beach areas are gravel with

grain size of approximately 10 mm. The grade of the existing and post-development shoreline is depicted in photographs in Volume 2, of Teck Cominco (2001) and updated dock and shoreline sections drawn by Westmar Consulting Engineers (2001).

Environmental Effects of the Project

DFO considers the potential environmental effects of the project on fish habitat as negative and significant in the absence of properly implemented mitigation measures.

A. DOCK AND MARINE FORESHORE

Partial removal of the dock and excavation of the marine foreshore area at Polaris will alter 2512 m^2 of fish habitat.

Along the 92 m long face of the dock the vertical surface of the dock will be reduced to a height of 3 m below the lower tide water level. Shoreline will be altered 300 m north and 600 m south of the dock, and contoured to have a slope between of 17.5(H):1(V).

DFO's concerns pertaining to potential effects on fish habitat of this aspect of the project include:

1. Alteration of fish habitat from a shoreline with rip-rap covered face with slope of 2H:1V to a shoreline with slope of 17.5H:1V.
2. Potential release of sediment due to excavation operations adjacent to the dock
3. Potential release of contaminated sediment into fish habitat due to failure to properly remove hydrocarbon and metals contaminated sediment from the surface of the dock and marine foreshore area.
4. Potential release of sediment due to improper stockpiling or storage of excavated materials.
5. Potential release of styrofoam, rubble or other debris into fish bearing waters
6. Potential release of anti-freeze refrigerants into fish bearing waters
7. Effects of blasting including disruption or killing of fish due to pressure changes and/or noise due to blasting.
8. Long-term stability of the shoreline and potential effects of the environment on the project including ice scour, wind, and wave action.
9. Other environmental effects were considered during the environmental assessment of this project.

B. PARTIAL REMOVAL OF GARROW LAKE DAM

Lowering the lake level of Garrow Lake and partial removal of the Garrow Lake Dam will pose potential impacts on fish habitat:

1. Potential for release of mine tailings or metals contaminated sediment into Garrow Bay
2. Destruction of benthic fish habitat adjacent to the Garrow Lake Dam and loss of 30 ha. littoral fish habitat adjacent to the shoreline of Garrow Lake
3. Erosion of shoreline adjacent to Garrow Lake after the level of the lake is lowered.
4. Potential destruction of fish habitat in Garrow Creek due to release of sediment due to construction and partial removal of the dam.
5. The structural integrity of the remaining Garrow Lake Dam structure after construction and potential effect of sedimentation from the abutments on fish habitat.
6. Effect of blasting to excavate fill from the dam and the effect on fish habitat due to the timing of blasting work.
7. Destruction of fish habitat in Garrow Bay due to release of contaminated sediment

from Garrow Lake

8. Effect of zinc and lead loading on fish habitat in Garrow Bay and the influence on marine organisms.
9. Effects of the environment on the proposed works were considered including the effect of ice scour on the dam post-construction, and restriction of flow due to ice blockage between the dam abutments in Garrow Creek.
10. Other environmental effects of the project were considered in the environmental assessment of this project.

Alternative means of conducting the Project:

Three alternatives were considered for decommissioning of the dock including (Gartner Lee 2001):

1. Extracting and cutting off the sheet piles under water and reinstating a beach profile that will minimize erosion.
2. Encasing the dock in rock.
3. Leaving the dock in place.

Option 1 was considered to be the preferable option as confirmed by Teck Cominco (Jan 2003):

> Dock sheet piles will be cut off 3.0 metres below lowest low water level. This is shown on the Westmar drawings included in Appendix 12 of the Project Plan ('Sections – Sheet 3' Drawing Nbr. 00282-01-104 dated May 17, 2002.)
>
> The sheet piles cells form a complex engineered system that was designed to provide containment and structural strength to the loose fill placed into the cells. Complete removal of the sheet piles would remove the containment and compromise the support necessary to ensure the designed stability of the dock fill is maintained. The unsupported fill would be potentially unstable and in the event of rapid failure represents a safety risk to personnel operating equipment on the fill area. If sloughing of the fill were to occur, a substantial area of the fish habitat on the ocean bottom would be buried by the fill.

Alternative Options for Decommissioning of the Dam

In the 2001 EBA Consultants (EBA Engineering Consultants Ltd. 2001)considered two alternative design concepts for decommissioning of the dam including 1. Total removal of the dam, and 2. partial removal of the dam. Partial removal was suggested as the preferred alternative. Very little justification was provided by EBA to describe how selection of this alternative would protect fish habitat and additional information was requested by DFO (see comments by Fallis *et al.* 2001). There were concerns regarding erosion and the structural integrity of the remaining dam structure after blasting techniques were used to remove the fill, and blockage of the Garrow Creek channel with ice. DFO requested that a cost-benefit analysis be conducted to examine different options for decommissioning of the dam. In the absence of such an analysis it was suggested that an irrevocable letter of credit be obtained to cover the expenses of completely removing the dam.

EBA Engineering Consultants Ltd. provided a cost-benefit analysis in Teck Cominco's response to reviewer comments in January 2002. Different options considered included total removal of the dam and partial removal. In the response EBA indicated that there were no differences in predicted erosion or TSS levels in Garrow Creek as a consequence of either option. Furthermore, the risk associated with release of zinc into

the surface layer of of Garrow Lake and release into Garrow Creek would not change. However, leaving a portion of the dam intact would facilitate construction of the dam should water quality in Garrow Lake deteriorate. The EBA response also considered the risk of blockage of Garrow Creek, sedimentation, structural integrity of the remaining dam structure (under global warming conditions) and the timing of the work (during the winter months). Partial removal of the Garrow Lake Dam was identified by EBA as the preferred option (see EBA Engineering Consultants 2002).

Teck Cominco was asked by DFO-FHM to consider potential effects of different decommissioning options for the dam in the "Polaris Fish Habitat Restoration Plan." The following options were considered for decommissioning of the Garrow Lake Dam (Teck Cominco 2002): 1. Leave the dam intact, or 2. Leave the dam intact with a spillway, or 3. Decommission the dam (partial removal). Partial removal of the dam was selected by Teck Cominco Ltd. as the preferred option.

Discharge of Deleterious Substances from Garrow Lake into Garrow Bay
DFO-FHM expressed concern regarding the potential for release of deleterious substances into the surface layer of Garrow Lake (i.e., mixing of the lake) and discharge of deleterious substances into Garrow Creek and the marine environment of Garrow Bay. The influence of zinc and lead contaminant loading on marine organisms in Garrow Bay was also expressed as a concern during the CEAA screening of this project. Gartner Lee Ltd. 2001 indicated that studies by Axys Environmental Ltd. suggest that the halocline in Garrow Lake will remain stable as the water levels in Garrow Lake are lowered and the dam is removed. According to Gartner Lee Ltd. 2001, maintaining a stable halocline is necessary for the elevated metals concentrations in the bottom of the lake to remain trapped ensuring the concentration of zinc in the surface discharge will not exceed the current NWB water license limit for zinc (0.5 mg/L). The report prepared by Axys Environmental in response to DFO indicates there is a low probability of a wind speed great enough to cause the different strata in Garrow Lake to mix.

Cumulative Effects
The decommissioning of the dock and dam is unlikely to have significant adverse cumulative effects on fish and fish habitat in the region (See Environment Canada Jan 2003 letter).

33. Mitigation Measures:
Mitigation measures are necessary to avoid, eliminate, or reduce the extent of negative impacts posed on fish habitat due to implementation of the project. Measures to protect fish habitat are proposed in the "Polaris Fish Habitat Restoration Plan" and other supporting documentation referred to in this report. Teck Cominco Ltd. is responsible for the implementation of all mitigation measures to protect fish habitat.

A. DOCK AND MARINE FORESHORE
Appropriate mitigation measures are required to minimize negative impacts on fish habitat in the marine foreshore area.

1. Removal of the dock to a level of 3 m below the LLWL will eliminate the potential impacts associated with the dock collapsing or impediments to navigation.
2. To minimize erosion and input of fine sediments into fish bearing waters silt fences and a floating silt curtain will be situated along the perimeter of the marine foreshore area if this is deemed necessary. The purpose of the silt curtain will be to prevent a plume of silt from extending into the marine waters of Crozier Strait.

3. Water quality sampling for turbidity will be conducted daily during work and mitigation measures will be implemented to address potential sediment release.
4. Excavation work in the marine foreshore will be conducted "in the dry" period prior to ice break-up between November and May.
5. The refrigerants in the dock will be properly disposed of to prevent release into fish bearing waters.
6. No blasting will be conducted near the dock.
7 Metals contaminated soils near the dock and marine foreshore will be properly disposed of to prevent release of deleterious substances into fish bearing waters. Soil sampling will be conducted following excavation operations to ensure that metals contaminated soils are removed from the vicinity of the dock and marine foreshore area.
8. A soil berm will be left in place between the ocean ice and upslope excavation operations to prevent sedimentation during construction. The outer soil berm will be removed and soil and other deleterious substances will be removed from the surface of the ice prior to break-up.
9. The beach area will have a gradual slope (17.5H:1V) to prevent erosion. The grain size will be approximately 10 mm in the stabilized marine foreshore area.
10. Equipment working near the water will be clean and free of hydrocarbon leaks and appropriate spill containment equipment and materials will be present in case of emergency.
11. Other mitigation measures may be implemented by the proponent as necessary to ensure protection of fish habitat adjacent to the dock and marine foreshore area in the long-term. Additional mitigation measures are listed in the "Polaris Fish Habitat Restoration Plan."

B. PARTIAL REMOVAL OF GARROW LAKE DAM

The plans involve removing the centre portion of the dam to allow the original creek channel to be restored and a "natural flow regime" to be established to Garrow Bay.

1. Excavation of the dam will be conducted prior to spring break-up June 1st 2004 and all silt and loose fines shall be removed from the construction area prior to spring break-up. Removal of the centre portion of the dam will prevent the need for siphoning water from Garrow Lake and will eliminate potential for unintentional breaching of the dam.
2. Upon completion of work adjacent to the creek channel accumulations of sediment will be cleaned up to prevent deposition of sediment in Garrow Creek.
3. The slopes of the dam adjacent to the creek have been designed 4H:1V to minimize erosion.
4. The stability of the remaining dam exposed to seismic events and global warming were considered in evaluating potential impacts on fish habitat related to the post-construction dam structure.
5. Rock rip-rap will be placed on the banks of the stream channel adjacent the dam to prevent erosion and sedimentation.
6. Appropriate mitigation measures will be implemented to control release of total suspended solids in the long-term, including the construction of a dam at the discharge of Garrow Lake if water quality deteriorates due to release of metals contaminated sediment.
7. Blasting on the dam will occur during excavation of the dam in the winter months prior to spring break-up (starting march and ending no later than June 1st) and will comply with the "Guidelines for the use of explosives in or near Canadian fisheries waters." The lake is in excess of 500 m from the blasting site. If monitoring of

peak pressures in Garrow Lake indicate pressures are approaching 100 kPa then blasting patterns and delays will be adjusted to reduce the peak pulse.

Additional mitigation measures and contingency plans to protect fish habitat are indicated in the "Polaris Fish Habitat Restoration Plan."

Fish Habitat Compensation

To rehabilitate and enhance fish habitat in the area of the dock and marine foreshore area, TCL shall conduct the following as indicated in the Polaris Habitat Restoration Plan:

1. Partial removal of the dock pilings to a depth of 3m below the low tide water level will develop natural inter-tidal conditions with slope and substrate adequate to control erosion into Crozier Strait.

2. Excavation of the inter-tidal shoreline adjacent to the dock to develop 12,800 m^2 of marine nearshore habitat with a slope of less than 17.5(H):1(V) to prevent erosion.

3. A Fish Habitat Monitoring Report shall be submitted to DFO, including detailed photographs of the dock adjacent marine foreshore area. Underwater photographs or video footage of the dock will be provided to DFO. The intent of this Monitoring Report shall be to assess the success of fish habitat compensation upon implementation.

To rehabilitate and enhance fish habitat in Garrow Lake, upon completion of water withdrawal and dam removal, TCL shall conduct the following as indicated in the Polaris Habitat Restoration Plan:

1. Restore a natural stream channel to Garrow Bay by removing at least 19,000 cubic metres of dam fill material. The constructed 500 m long by 15 metre wide stream channel through the decommissioned dam will emulate natural stream conditions with a gravel/cobble streambed. Enhancement efforts will result in the banks of the remaining dam having a slope of at least 4:1.

2. The enhanced stream channel draining Garrow Lake will be on average 11 m wide and restore natural drainage patterns in the Garrow Lake area. Clean rock rip-rap will be placed to prevent erosion in the vicinity of the decommissioned dam;

3. A Fish Habitat Monitoring Report shall be submitted to DFO, including detailed photographs of Garrow Lake, stream channel development, prior to completion of the work. The intent of this Monitoring Report shall be to assess the success of fish habitat compensation upon implementation.

Monitoring will be conducted during and after the project to ensure that mitigation measures and compensation have been successfully implemented. There is a contingency plan to address potential significant residual environmental effects associated with decommissioning operations. A Post-Closure Monitoring Plan was presented by Teck Cominco (see Gartner Lee 2002).

The following monitoring provisions are included in Teck Cominco's plans to decommission the dock, marine foreshore, and Garrow Lake Dam:

Sampling of TSS and turbidity will be undertaken by TCL in different strata of Garrow Lake to monitor stability of the halocline and to confirm the absence of tailings in the upper strata of the lake.

A study of the metal concentrations in sediments adjacent to the shore of Garrow Lake, Garrow Creek, and Garrow Bay will be commissioned by TCL. TCL will propose a study design prior to April 2003 for approval by DFO.

TCL will conduct a study of fourhorn sculpins in Garrow Lake and Garrow Bay to examine metal levels in fish muscle tissue. A study design will be proposed by TCL to collect fish tissue samples for analysis by DFO. TCL will propose a sampling protocol for this study prior to April 2003.

Erosion will be monitored on the shore of Garrow Lake and Garrow Creek Stream channel. The study objective will be to quantify erosion rates adjacent to the lake and stream channel. This study will be proposed by TCL for DFO approval prior to April 2003.

TCL will conduct water quality sampling for TSS and turbidity at the Garrow Lake outflow in Garrow Creek. TCL will provide a Water Quality Sampling Report of TSS levels to the DFO Eastern Arctic Office on an annual basis for the duration of this authorization. Water quality sampling for TSS will not cease at the Garrow Lake outflow prior to 2004.

TCL will conduct water quality sampling for TSS and turbidity along the marine foreshore area prior to, during, and immediately following work in the inter-tidal zone. At least seven water quality samples will be routinely collected on a daily basis in the marine foreshore area during work in the inter-tidal zone. Two water quality samples per day will be collected adjacent to the dock.

Conclusions and Recommendations

DFO-FHM concurs with Teck Cominco Ltd. that extracting and cutting off the sheet piles ay least 3 m below the lower, low water level (LLWL) is the preferred option for the site (see DFO comments by Fallis *et. al.* 2001.) The Canadian Coast Guard also concurred that the above option was acceptable as per the *Navigable Waters Protection Act* in 2001. Alternative construction technologies to sheet-pile docks should be considered in future projects to avoid the need for partial removal of structures in marine inter-tidal areas.

DFO-FHM also concurs that Teck Cominco's plan to partially remove the Garrow Lake dam will not pose significant, negative impacts on fish habitat and is preferable to leaving the dam in place and the risk of accidental breaching of the dam. However, Teck Cominco should strive to return the site to its original state if water quality parameters are shown to be stable in the long-term. The NWB and DIAND should consider requiring that Teck Cominco Ltd. return the site as much as possible to its original state as per the Minister of DIAND's Mine Reclamation Policy for Nunavut.

A security deposit should be collected by the Nunavut Water Board for the amount of at least $1, 249,000 to cover the expense of total removal of the dam. An additional

deposit will be required to cover the cost of mobilization of work crews and equipment for monitoring and/or repairs.

Provided that appropriate mitigation measures are implemented, there are no significant effects on fish habitat predicted in Teck Cominco's plans to decommission the dock, marine foreshore, and Garrow Lake Dam at Polaris Mine between 2002-2004.

Selected References

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