MEMORANDUM

To: Karlette Tunaley
Nunavut Impact Review Board

From: Colette Spagnuolo
Environment Canada

cc: Craig Goodings
Cumberland Resources Ltd.

Date: March 7, 2006

RE: Summary of Water Quality Discussions between Environment Canada and Cumberland Resources Ltd.

On March 2, 2006, Environment Canada (EC) held a teleconference with Cumberland Resources Ltd. (CRL) and their consultants to discuss water quality issues that had been identified during the course of EC's review of the FEIS. A summary of the discussions is provided below for the information of the Nunavut Impact Review Board (NIRB).

Environment Canada has incorporated the majority of the results of these discussions into our written submission to the NIRB. However, if further review of the supplemental information provided by CRL results in any additional changes to EC's recommendations to the NIRB, these changes will be highlighted during EC's verbal presentation at the final public hearings.

WATER QUALITY

1. Dewatering of Lakes

Environment Canada's Issue / Recommendations
Based on experience at the Ekati Mine, which dewatered lakes in preparation for open pit mining, drawdown of the lakes during summer resulted in much higher sediment concentrations in the water than when drawdown was done in winter. Even in winter, high suspended solids levels in the lake water limited the volume of water which could be discharged in compliance with license discharge criteria. The FEIS does not have any contingency plans for clarification of water to be discharged, beyond what can be put in the tailings area (which will also have to be drawn down in advance of inputs) and attenuation ponds. Environment Canada recommends that the development of contingency plans for treatment of turbid water during dewatering, or operational contingency plans, would be appropriate.

Cumberland's Response
Please see the Golder attachment, Section 1.1.

2. Lake Sediment Removal

Environment Canada's Issue / Recommendations
Removal of lake bottom sediments will involve handling of saturated materials which are high in several metals (As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn), and having a fine clay/silt particle size. The relatively limited volume to be placed upstream of the tailings dike following excavation of the footing area should not significantly compromise supernatant quality. With respect to the balance of the lake bottom sediments, placement in the footprint of the Portage pit lake may represent a liability when the area is re-watered. Environment Canada recommends that options for disposal of lake-bottom sediments should be refined and disposal methods developed that minimize the potential for effects on surface waters.

Cumberland's Response
Please see the Golder attachment, Section 1.2

3. Water Treatment

Environment Canada's Issue / Recommendations
Water treatment will certainly be required for reclaim pond discharges, and very possibly for pit lakes and attenuation ponds. Very limited information has been presented on the proposed treatment technology which could be used, and no target concentrations have been presented. Details have not been provided for the water treatment processes which would be used for the tailings pond effluent, nor for the settling of solids for dewatering, nor for the sewage treatment plant.

Detailed plans for water treatment should be presented for the tailings (reclaim) pond discharge, and on a contingency basis for the Vault Pit attenuation pond discharge, and for the pits. Estimates of treatment efficiency for each parameter of concern should be provided, and pH adjustment methods should be described. In addition, information on the treatment of camp sewage is needed, including the type of treatment system to be used, and the expected treatment capabilities.

Cumberland's Response
Please see the Golder attachment, Section 1.3.

Information on the sewage treatment and reclaim water is as follows:

- **Sewage Treatment Systems:**
  (from the Standard Practice Manual Draft 3 Ministry of Health May 16, 2005)
  Province of British Columbia

  5.2 Levels of Treatment
  "The Sewerage System Regulation and the Standard Practice Manual are structured around specific levels of treatment prior to discharge into the ground. As defined in the Sewerage System Regulation:

* Type 1 is treatment by septic tank only
* Type 2 is treatment that produces an effluent consistently containing less than 45 mg/l of total suspended solids and having a 5 day biochemical oxygen demand (BOD) of less than 45 mg/l; and
* Type 3 is treatment that produces an effluent consistently containing less than 10 mg/l of total suspended solids and having a 5 day biochemical oxygen demand (BOD) of less than10 mg/l, and a median fecal coliform density of less than 400 Colony Forming Units (cfu) per 100ml."

- **Reclaim Water Treatment:**
  "The treatment system for metals removal after closure would consist of a ferric co-precipitation high density sludge system (HDS) followed by final filtration. The ferric co-precipitation system would be provided by utilizing reagent make-up, agitated tanks, pumps and thickeners available in the mill after shut-down. Polishing filtration would require installation of a separate package that would be installed prior to shut-down The HDS system would utilize ferric sulfate, lime and flocculant in a recycle sludge system. This represents conventional technology for producing effluent that meets low metal discharge limits. Final filtration would ensure that any particulate metal carry-over from the HDS system is consistently removed to meet to low environmental limits."

4. Water Quality Predictions

Environment Canada's Issue / Recommendations
The information presented does not adequately identify the potential ecological effects associated with alteration of water quality in Third Portage Lake and Wally Lake. To assess the magnitude of impacts it would be useful to have an estimate of the extent of chronic toxicity expected to occur in the receiving environment. This should include identification of which species are likely to be affected, and how so. Also, no information has been provided regarding treatment in order for reviewers to evaluate the extent to which adverse effects could actually be eliminated.

In order to understand and properly assess effects to the aquatic receiving environment a comprehensive discussion of potential effects associated with the effluent discharge is needed. Specifically, what changes and effects are predicted for the immediate area of effluent discharges? What ecological effects will be expected when pit lakes are connected to the watershed and become a source of contaminants, major ions, and nutrients? What is the magnitude on a local scale?

Aquatic effects are discussed in the context of discharging at MMER levels for the relevant parameters, but actual discharge criteria are likely to be much lower, and treatment options should be discussed in the context of how best available technology will be employed to ensure protection of the environment.

Cumberland's Response
Effluent will be discharged to Third Portage Lake from the Second Portage attenuation

pond only during Years one to four or five of operation. Beyond Year 5 effluent will be directed to Goose Pit. Based on conservative predictions of water chemistry within the attenuation pond, all metals concentrations in effluent will be considerably lower for all metals prescribed in the Metal Mining Effluent Regulations. It is not anticipated that treatment will be required prior to discharge. Note that no water that comes into contact with mine tailings will be discharged to the receiving environment.

Cumberland Resources is committed to fulfilling all requirements of MMER, including environmental effects monitoring, specifically no acute toxicity to fish, investigations of sub-lethal toxicity of effluent, fish metals investigations and benthic invertebrate community surveys according to prescribed schedules.

Environment Canada expressed concern that while whole basin predictions of water quality have been made, there has been no evaluation of water quality of the lake area surrounding the discharge point. Given the relatively low metal loading predicted for the effluent and the large dilution capacity of the discharge point, we anticipate that impacts to the near-field mixing zone will be negligible. No exceedences of metals for which there are CCME guidelines will be exceeded in Third Portage Lake north basin, except for cadmium which for reasons explained earlier, is an artifact of the hardness derived guideline.

5. Effluent Discharge Configuration

Environment Canada's Issue / Recommendations
Environment Canada supports the use of a diffuser to facilitate mixing, but has concerns that the proximity to lake-bottom may result in disturbance of the sediments and/or bottom scour. It would be helpful to have bathymetry information for Wally Lake.

Effluent will have higher salinity than the receiving waters. Has consideration been given to the potential for density gradients to develop in low areas of the lake? It does not appear that lakes in the area tend to stratify, so this may be of minimal concern, but should be examined.
Environment Canada recommends that further details be developed for the effluent outfall configuration, and predictions for the likely behavior of the plume.

Cumberland's Response
Under MMER there is a requirement to conduct a plume delineation study to determine the actual zone of impact and to determine the spatial extent of the plume. Modeling to delineate the spatial extent of the plume will be conducted as part of detailed engineering design, once the location and design of the diffuser system has been determined.
To minimize impacts to the receiving environment, the following design features will be incorporated into the effluent discharge system:

- The effluent pipe will be seated along the bottom of Third Portage Lake north basin and extend directly offshore of the north end of Second Portage Lake opposite the attenuation pond.
- Effluent will only be discharged during the open water period and not under ice.

- The pipe will run along the bottom of the lake to a depth of at least 16 m. The shoreline along Third Portage at the discharge pipe location has a very steep drop off to water of about 20 m depth at about 80 – 100 m offshore.
- Effluent will be discharged far enough away from shore and productive fish habitat so as to have no direct impacts.
- The effluent pipe will be fitted with a diffuser to facilitate mixing.
- The diffuser head will be situated several meters above the lake bottom to ensure that sediment is not disturbed or entrained in the outflow.
- The location of effluent discharge pipe will be far enough offshore to take advantage of the prevailing north – south wind direction that will facilitate longitudinal and vertical mixing.

Environment Canada will be kept appraised of developments with respect to siting and design of the effluent discharge system.

6. Airstrip Extension

Environment Canada's Issue / Recommendations
The report describes the potential expansion of the airstrip into Third Portage Lake by 380 m, using till material. However, there does not appear to be further information available regarding the likelihood of airstrip expansion, nor associated effects. If the airstrip is likely to be extended into the lake, EC would have concerns with introduction of sediments and contaminants into the lake. The potential for spills and dust being introduced into the lake would be increased. Further information and assessment of the airstrip extension is needed.

Cumberland's Response
The airstrip has been reoriented and now will not extend into the lake.

7. Other Questions

a) Will sufficient geotechnical investigations be completed along the dike alignments so that reviewers can be confident that there will be no concerns with the silt/clay sediments not being excavated?

Cumberland's Response: please see Golder attachment, Section 1.4.1

b) Have end-of-pipe effluent quality predictions been developed?

Cumberland's Response: please see Golder attachment, Section 1.5

c) In the Water Quality Predictions report, pages 3-2 and 3-3, inputs for ammonia are shown as 0 from the tailings. Is ammonia already accounted for elsewhere? Why aren't CN degradation amounts included?

Cumberland's Response: please see Golder attachment, Section 1.6

d) Will the Goose Pit be likely to develop a chemocline?

Cumberland's Response: Golder will respond under separate cover.