Gartner Lee Limited

memorandum

to: Dave Hohnstein, Nunavut Water Board
from: Leslie Gomm, Gartner Lee Limited
Cc: Dave Stevenson, Wolfden Resources Inc. and Glenda Fratton, Gartner Lee Limited
date: May 2, 2006
ref: 51013
re: **Ulu Interim Water Management Plan – Predicted Ulu Lake Concentrations**

Dave:

As per your request I have carried out two additional scenarios with respect to the impact of runoff from the excavated ice on Ulu Lake. Both of these scenarios are based on the assumption that the loading to Ulu Lake does not mix with the entire lake volume but only the volume associated with the southern portion of the lake, estimated to be approximately 15% of the total lake volume. Scenario 1 assumes that the ice melts, flows to East Lake where it is fully mixed. The resulted contaminant load subsequently flows to Ulu Lake where it is mixed with only 15% of the total available volume. Additional dilution of the load to East Lake from June runoff and snow melt is not included in this scenario. Scenario 2 assumes the same conditions as Scenario 1 with the additional dilution from runoff and spring melt from the East Lake catchment. For both scenarios it is assumed that the excavation ice melts over a period of 3 weeks in June. The assumptions for each of the scenarios are presented in Table 1.

Table 1 Summary of Assumptions

East Lake Drainage Area	581,717 m^2
East Lake Total Volume	29,925 m^3
Runoff Coefficient	0.60
Total Mean Annual Precipitation	280 mm
June Component of Mean Annual Precipitation	49 %
East Lake Drainage Water Quality	Same as East Lake except for nutrients which are set to detection limits
Total Ulu Lake Volume	1,138,494 m^3
Southern Portion of Ulu Lake Volume (15% of Total)	170,774 m^3

The results of the two additional scenarios are presented in Table 2 and Table 3.

Table 2. Scenario 1 - Predicted Water Quality for South Portion of Ulu Lake (assumes no dilution due to runoff)

	CCME Guideline for Protection of Aquatic Life	Existing Ulu Lake Water Quality[a] (mg/L)	Total Load from East Lake (kg)	Predicted Ulu Lake Water Quality – S. Portion (mg/L)
Routine Parameters				
Nitrate + Nitrate (as N)		0.006	120.6	0.557
Ammonia (as N)		0.0199	45.9	0.226
Total Suspended Solids		<4	1121.5	8.25
Metals (Total)				
Total Aluminum	0.005 – *0.1*	0.0184	42.6	***0.21***
Total Arsenic	0.005	<0.0001	0.166	0.0008
Total Cadmium	0.000017	<0.00005	0.0032	***0.000054***
Total Chromium	0.001	<0.0005	0.115	0.0009
Total Copper	*0.002* – 0.004	0.00209	0.380	***0.0034***
Total Lead	*0.001* – 0.007	<0.00005	0.071	0.00036
Total Nickel	*0.025* – 0.15	0.00217	0.159	0.0024
Total Zinc	0.03	0.0056	0.711	0.0076

Notes: *a) Median concentration from 2004 – 2005 Baseline Program*

Italics – appropriate guideline value based on site specific conditions (ph, DOC and / or hardness)

Italics *– Exceeds CCME Guideline*

Table 3. Scenario 2 - Predicted Water Quality for South Portion of Ulu Lake (with dilution due to runoff)

	CCME Guideline for Protection of Aquatic Life	Existing Ulu Lake Water Quality[a] (mg/L)	Total Load from East Lake (kg)	Predicted Ulu Lake Water Quality – S. Portion (mg/L)
Routine Parameters				
Nitrate + Nitrate (as N)		0.006	58.9	0.274
Ammonia (as N)		0.0199	22.9	0.12
Total Suspended Solids		<4	646.9	6.08
Metals (Total)				
Total Aluminum	0.005 – *0.1*	0.0184	21.0	***0.11***
Total Arsenic	0.005	<0.0001	0.090	0.0004
Total Cadmium	0.000017	<0.00005	0.0028	***0.000052***
Total Chromium	0.001	<0.0005	0.069	0.0007
Total Copper	*0.002* – 0.004	0.00209	0.231	***0.0027***
Total Lead	*0.001* – 0.007	<0.00005	0.0358	0.0002
Total Nickel	*0.025* – 0.15	0.00217	0.115	0.0022
Total Zinc	0.03	0.0056	0.444	0.0064

Notes: a) Median concentration from 2004 – 2005 Baseline Program

Italics – appropriate guideline value based on site specific conditions (ph, DOC and / or hardness)

***Italics** – Exceeds CCME Guideline*

Table 4 provides a comparison of these predicted water quality for Ulu Lake to the original predictions for presented in the Interim Water Management Plan.

Table 4. Comparison of Predicted Water Quality for Ulu Lake

	CCME Guideline for Protection of Aquatic Life	Predicted Ulu Lake Water Quality (full mixing) (mg/L)	Predicted Ulu Lake Water Quality – S. Portion (no runoff) (mg/L)	Predicted Ulu Lake Water Quality – S. Portion (mg/L)
Routine Parameters				
Nitrate + Nitrate (as N)		0.076	0.557	0.274
Ammonia (as N)		0.055	0.226	0.12
Total Suspended Solids		4.73	8.25	6.08
Metals (Total)				
Total Aluminum	0.005 – *0.1*	0.052	***0.21***	***0.11***
Total Arsenic	0.005	0.0002	0.0008	0.0004
Total Cadmium	0.000017	***0.000051***	***0.000054***	***0.000052***
Total Chromium	0.001	0.00057	0.0009	0.0007
Total Copper	*0.002* – 0.004	***0.0023***	***0.0034***	***0.0027***
Total Lead	*0.001* – 0.007	0.0001	0.00036	0.0002
Total Nickel	*0.025* – 0.15	0.0022	0.0024	0.0022
Total Zinc	0.03	0.0059	0.0076	0.0064

Notes: a) Median concentration from 2004 – 2005 Baseline Program

Italics – appropriate guideline value based on site specific conditions (ph, DOC and / or hardness)

***Italics** – Exceeds CCME Guideline*

As outlined in Table 4 the predicted concentrations of the various parameters are, as expected, higher when the loading from East Lake mixes with only the southern portion of Ulu Lake. For Scenario 1 (no runoff) aluminum, cadmium and copper exceed the CCME Guidelines for the Protection of Aquatic Life. Scenario 2 provides a more realistic prediction of the water quality in the southern portion of Ulu Lake as it includes the water that is added to the East Lake system during spring melt. Aluminum, cadmium and copper are predicted to exceed the CCME guidelines although present at much lower concentrations than Scenario 1. The elevated aluminum concentrations are most likely associated with the elevated total suspended solids in the excavated ice meltwater (66 mg/L). The predicted concentrations for cadmium in each scenario is dominated by the assumed concentration of cadmium naturally occurring in East Lake and Ulu Lake, present at levels below the detection. All prediction calculations used the

detection limit value of 0.00005 mg/L for the natural cadmium concentrations which is above the corresponding CCME guideline.

Scenario 1 and 2 provide estimates of the concentration in the southern portion of Ulu Lake and do not include any contribution of freshwater from spring runoff from the Ulu Lake catchment, other than the East Lake catchment. In reality, a significant amount of additional dilution water will be available in this portion of Ulu Lake during the time that the ice meltwater is discharged to the receiving environment, further reducing the resultant concentrations in Ulu Lake.

I hope that these two additional scenarios for the predicted concentrations in Ulu Lake resulting from the discharge of meltwater from the proposed ice excavation provide you with the information that you required. Please feel free to contact me at (867) 668-2858 if you have any questions or require any further clarifications.

Regards,

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