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MEMORANDUM

TO: Tony Pearse, T.D. Pearse Resource Consulting

CC: Don MacDonald, MacDonald Environmental Sciences Ltd.
Colin Macdonald, Northern Environmental Consulting

FROM: Peri Mehling

DATE: April 24, 2005

PROJECT: Snap Lake Project – Science Panel

RE: Review Comments on DeBeer's Submitted Water Licence Reports

Overview

At the request of SLEMA Core Group and as directed by Tony Pearse of T.D. Pearse Resource Consulting, Mehling Environmental Management Inc. (MEMI) reviewed 6 reports submitted by De Beers Canada Mining Inc. (De Beers) as part of their Water Licence requirements. Review focussed on the mine site aspects of water quality and geochemistry issues. Background information included review of:

- Mackenzie Valley Environmental Impact Review Board (MVEIRB). July 24, 2003. Report of Environmental Assessment and Reasons for Decision on the De Beers Canada Mining Inc. Snap Lake Diamond Project
- DIAND, Water Resources Division. Feb 14, 2003. An Evaluation of the Environmental Assessment of the Proposed Snap Lake Diamond Project. Submission to MVEIRB. (MEMI assisted in developing this submission, focusing on mine site geochemistry and water quality issues.)

The six reports submitted by DeBeers included:

- Sampling Plan for Total Dissolved Solids, Calcium and Chloride – July 2004
- Groundwater Quantity and Quality Monitoring Program – August 2004
- Water Management Plan – August 2004
- Adaptive Management Plan – August 2004

- Aquatics Effect Monitoring Plan – July 2004
- Quality Assurance and Quality Control (QA/QC) Plan Revision 2004

Generally the reports describe reasonable site monitoring programs. There is a lot of overlap between the studies, and the reports are often not stand-alone. Some necessary details are missing and, in many cases, it appears that the effort required to provide those details is being delayed, perhaps in order to meet Licence deadline requirements or to await startup of the project. This raises some concern that the details will be provided too late to allow review and input before they are put into practice.

The key triggers for action for most of the plans appear to be exceedances above effluent or impact levels predicted in De Beers Environmental Assessment Report (EAR), but the actions to be undertaken are typically more study and review of the monitoring programs and previous predictions. Few effective mitigation actions are identified or described. This is partially understandable for impacts related to elevated Total Dissolved Solids (TDS) levels, as there are few mitigation measures available other than reducing inflows to the underground workings by grouting (may be difficult to achieve effective reduction) and costly treatment technologies such as reverse osmosis. So response to elevated TDS levels tends to focus on more study to determine if an impact is really occurring and is significant, rather than trying to lower loads and concentrations in an effective manner.

The package of reports is excellent in its emphasis on comparing measured flows, effluent quality and impacts with predicted values and lake impact contours from the EAR. Review of the actual data will need to be carefully checked to assess whether measured mass loadings from and around the site differ from predicted EAR values because of changes in flows predictions or in water quality predictions. Early years are likely to note greater variation from predicted values for flow estimates, rather than water quality estimates. The actual values to which the monitoring results are to be compared will have to be extracted from the EAR, and, ideally, should have been included in each of the reviewed reports or, at minimum, have had specific page references to the EAR and its many appendices.

The Adaptive Management Plan (AMP) tends to focus on checking data and reassessing risk, rather than identifying specific mitigation measures that can be applied if necessary. This tends to reinvent the work already conducted by the MVEIRB and the Water Board.

Of interest are reports still to be submitted, including the ARD Characterization Study and the Ore Storage, Waste Rock and Processed Kimberlite Management Plan. Management of waste rock used for construction (road maintenance and North Pile structures) will be of immediate interest. As yet, there does not appear to be any monitoring of pore water quality in the active zone of the North Pile, such that long-term predictions can be confirmed - only a single site (SNP 02-02) at some unspecified location along the North Pile drainage collection ditch.

Specific comments on each of the reviewed reports are provided below.

Sampling Plan for Total Dissolved Solids, Calcium and Chloride – July 2004

Generally, this document provides an appropriate approach, but it is not a stand-alone document. Required details, such as inflow stream monitoring for water flows and concentrations, targets and response actions, are not included, but are referred to as being in other documents.

Note that the following comments are from an engineering standpoint. Those with greater experience in lake sampling and the required statistics may have other views.

Specific comments:

- The key products are identified as:
 - 3-dimensional maps of TDS, chloride, and calcium (Ca) concentrations in Snap Lake at 4 times through each year;
 - estimates of whole lake average TDS, chloride and Ca concentrations at 4 times through each year;
 - a mass balance model to validate the loads in Snap Lake as estimated from the analytical data
 - a summary and discussion of historical and forecasted loadings for whole lake values, and concentrations throughout the lake.
- Section 2.1: The inclusion of electrical conductivity as a parameter (although not required by the licence) is applauded, and is consistent with MVEIRB recommendation (R1) to develop correlations that might allow conductivity to act as a surrogate for TDS (MVEIRB, page 60 and 80).
- Section 2.2: Stations numbers are confusing as a single Surveillance Network Program (SNP) number consists of multiple stations. Also each De Beers' station numbers may

contain several sample locations. It would help if a standard numbering system for top, middle and bottom depth samples were provided, as well as a standard numbering system that would identify 'depth-averaged' values.

- Section 2.2: The 15 identified stations are not comprehensive for completing the proposed mass load model. Additional sites required to complete the proposed model include SNP02-17 (Final Combined WTP & Sewage Treatment Plant Effluent), and SNP02-01 (Final Mine Water Collection Sump), as well as inflow streams to Snap Lake (number and locations not specified, referred to Draft Hydrology Monitoring Program, 2003). These need to be identified in this document.
- Section 2.3.1: The basis for the determining the appropriateness of selected depth intervals, or the means to define presence of a 'vertical gradient' that determines whether the 3 discrete depth samples will be combined or not should be clarified. It may be important to understand TDS, Ca, and chloride concentrations near the lake bottom above the mine workings, as this will factor into the proposed mass load model. It is not clear whether a difference of 25% would be significant in the mass load model or not. Higher TDS effluent concentrations and lower flows are anticipated at the start of the mine, with TDS concentrations decreasing as the input from the lake to the mine workings increases over the mine life. So it may be appropriate to obtain discrete near lake bottom concentrations in the early years of operation as a check on the quality of inflowing water to the workings.
- Section 2.4: De Beers proposes to enhance extrapolations between measured sites by using results from the Snap Lake Water Quality Model. It is not clear how this helps if there are no measurements to calibrate boundary conditions or check projected interpolations. The concern is that this may just reinforce preconceived ideas of how concentrations would vary in the lake. The MVEIRB report indicates that there was uncertainty in the mixing model as baseline current information was lacking and vertical mixing was assumed (MVEIRB, page 72 and 80).
- The independent validation using a mass balance TDS model for Snap Lake is considered useful as a crude check, and will provide some insight into how the lake hydrology functions. But there appear to be too many unmeasured variables to provide a lot of confidence in this method for validation. For example, the model will apparently account for groundwater discharges from Snap Lake, but there are only estimates of groundwater losses from the lake as a whole and groundwater quality associated with these losses. Measured values in the underground mine workings (SNP02-01) will include both groundwater losses from a portion of the lake and from adjacent ground (i.e. deeper connate water), and De Beer's

estimates of the percentages coming from each was a key point of disagreement at the MVEIRB Hearings.

- Section 2.5: This section basically refers to the Adaptive Management Plan. Forecasting is emphasized, which is good. But the values that may initiate actions are limited (350 mg/L whole lake average) and no mitigation measures are identified.
- There is no mention of targets associated with the predicted percentage of Snap Lake that might be impacted, and no specific effects threshold values identified for TDS, Ca and chloride (more on this later).
- Section 2.6.2.1 notes that all samples will be collected in accordance with Golder Associates Ltd. Technical procedures. These should be referenced and a copy should be provided and posted on the Water Board site since they form a key part of De Beer's monitoring program.
- Section 2.6.2.1 notes that samples will be submitted to a laboratory that is accredited, but detection limits are not specified. The QA/QC Report (Appendix 3) indicates that the detection limits for the two identified labs are substantially different, and it is not clear which lab or which detection limits apply to which monitoring program.
- Reporting seems appropriate, but it is not clear that 3-dimensional maps of TDS, Ca and chloride concentrations will be included. The detailed description of data analyses and modelling methods proposed for the first annual report will be critical, as details are not clear in this Plan. Summaries will apparently be provided, but the level of detail in those summaries will be critical. For example, the last bullet should explicitly include a discussion of the percentage of Snap Lake that may exceed effects thresholds in comparison to EA predictions. Annual reporting seems appropriate, given the lower predicted impacts in the early years, and the emphasis on forecasting future impacts.
- Adaptive Management Plan – Section 3.1 applies specifically to TDS, Ca and chloride, although the title implies a focus on uncertainty in lake mixing and density stratification, rather than being directly tied to the monitoring plan.
 - Section 3.1.3 Action Levels: this section finally identifies proposed effects thresholds for TDS and calcium, and includes a general reference to the spatial area to which those effects are to be limited, i.e. not to extend “beyond the mixing zone“. For context, MEMI notes that MVEIRB assumed the immediate mixing zone of the mine water discharge to be equal to approx. 1.1% of Snap Lake (page 95). MVEIRB concluded that the effects of TDS will be confined to chronic toxicity of sensitive aquatic life within that portion of the lake.
 - The AMP does not specify the mixing zone size. The Licence SNP specifies site

SNP 02-20 to be on the edge of the mixing zone and to include 3 stations located in a radius of 120 degree at 200 m from the diffuser. MVEIRB (page 72) references a mixing zone within 250 m of the effluent discharge that DFO considered unacceptable as it resulted in impacts to 1 to 10% of Snap Lake.

- There is some discrepancy between De Beers' proposed effects thresholds and those discussed in the MVEIRB decision report (see table below). INAC recommended effects thresholds are lower for TDS. MVEIRB did not identify specific threshold values, and De Beers appears to have reverted to their earlier value for TDS .
- The BC Guildelines for chloride are identified as a monitoring target but the actual value of 150 mg/L is not mentioned.

Effects Thresholds (mg/L)	INAC	DeBeers
TDS	500	600
Ca	116	110
Chloride	372	
BC Guidelines for chloride		150

- Four action levels are identified on page 14 of the AMP. The first refers to predicted concentrations in De Beers EAR. A more detailed reference is needed. Preferably, these predicted values would be included in this document.
- The last 2 action levels need to be clarified by specifying the actual effects threshold value for TDS and Ca, the distance of the diffuser mixing zone, and the actual value for the BC water quality guideline.
- Section 3.1.4 and 3.1.5 are inadequate. Potential actions are left dependent on 'specific circumstances'. Proposed actions include review of site water management and treatment measures, confirmation of forecasts, studies of actual effect thresholds (implying that the proposed thresholds are not well substantiated?), and a (re)assessment of risks to aquatic life. These are all directed at reviewing items that were already addressed in the EA and reviewed by MVEIRB. Determining acceptable risks to aquatic life was precisely MVEIRB's mandate. While review may be of value, mitigation should be implemented if the predicted impacts and values accepted by MVEIRB are exceeded. However, no mitigation measures are identified in the AMP.

- The lack of mitigation measures is contrary to the MVEIRB decision report. The MVEIRB report references, and appears to place reliance on, mitigation measures identified by De Beers (page 61), specifically grouting of underground workings to reduce mine water inflows. Grouting is now downplayed as an effective mitigation measure by De Beers (page 9, AMP), and it is implied that grouting may need to be reduced (at least carefully managed) in order to keep TDS effluent values below regulatory requirements. How grouting will be managed is not clarified in this AMP. Monitoring data from the SNP and the AEMP will apparently be used to evaluate the use of grouting, but how the data will be assessed and specifically used as a management tool is not discussed. (This should link to the groundwater monitoring plan and the monitoring of an unspecified number of mine sumps.) The AMP now notes that changing the mine plan may be required (page 9, AMP) if De Beers encounters substantially more groundwater flow into the mine than anticipated. How the mine plan might be changed to reduce flows is not clarified.

Groundwater Quantity and Quality Monitoring Program – August 2004

This report overlaps with the previous monitoring plan since both cover groundwater in the underground mine. There is a minor inconsistency between the two reports:

- Section 2.3 suggests that mass loading from the underground will be “evaluated to determine whether there is an increasing trend that required examination and potential corrective action”. The TDS report suggests that increasing trends are anticipated, so that it action will be base on comparisons to original EAR predictions.

While triggers are identified for investigative and evaluation actions, neither report identifies specific mitigation measures that might be applicable. This report does not provide “...a means for management groundwater quantities within the range of the EAR predictions...”, as required by Water Licence Part F, Section 5.

Specific comments:

- The Groundwater report indicates there will be additional stations beyond the final mine water collection sump SNP 02-01, including sumps and boreholes, that will be monitored if triggered by significant trends in the quality of water. The number of additional sites and frequency of sampling are not specified. While these are expected to change with changing mine working profiles, the level of effort being proposed, and the means of identifying the

'significant trends' that would initiate the additional work are not clear.

- The triggers to initiate water quality monitoring at these additional sites were to be described in section 2.3.1.1, but this section is missing. In Section 2.4.1, it indicates that sampling of sumps and boreholes in the mine to identify sources of high TDS water would be initiated "If the revised predictions begin to approach the whole lake average requirements of 350 mg/L". Since minewater comprises >90% of the effluent discharge load, it would appear that any measured values above predicted values in the mine water discharge would lead to an increase in the current predicted whole lake maximum of 350mg/L. Therefore, if measured values are above EAR predicted values at SNP 02-01, an examination of high TDS sources should be triggered.
- Sampling of these additional stations is to be similar to weekly requirements for SNP 02-01 (pH, turbidity, TDS, TSS, Total ammonia, chloride and calcium) with more detailed analyses to follow depending on the results of the first round. MEMI suggests that conductivity be added to this list, as well as an estimate of flow.
- Section 2.2.4.1: Indicates that data from the piezometers that will be installed as part of the Ore Storage, Waste Rock and Process Kimberlite Management Plan will be used by the Groundwater Monitoring Program to indicate the contribution of seepage from the North Pile to the chemical mass load. No sites are specified, nor are the number of sites, the frequency of sampling, or whether water quality data will be collected from these sites.
- Section 2.3: This section indicates the GoldSim mass loading model will be updated on an annual basis, incorporating the monitoring data. However, it will also be critical to compare measured results to predicted loads at specific points. The points of comparison should be specified in the Plan, and should include, at minimum:
 - Final mine water discharge from underground
 - North Pile collection ditch water, and additional upstream points to provide assurance that physical losses from the collection ditch have not contributed to an apparent decrease in loads from this source
 - Final effluent discharge to Snap Lake
 - Seepage losses from WMP
- Section 2.4.1: Mine Water. This section indicates that the trigger for action will be the updated GoldSim model indicating that the 350 mg/L whole lake TDS value might be exceeded in the future. Action to be taken would be additional sample collection and analysis to identify the sources of high TDS in the underground workings. This would be followed by review that all reasonable measures were in place to control inflows. At that

point, management options would be considered. No specific management options or mitigation measures are mentioned.

- Section 2.4.2: Seepage Water from WMP. This section indicates that exceedance of predicted seepage flows and/or loading rates above EAR predictions would result in increased frequency of monitoring and a general investigation. Corrective action would follow if an environmental risk is identified on review of the overall GoldSim Model and mass loadings. No actual risk levels are identified that would trigger corrective actions, nor are any specific correction actions identified.
- Management of North Pile seepage is not discussed.
- Section QA/QC procedures – Sample labelling for seep surveys will be varied in each year. Therefore it will be critical for the samplers to link each year's data sites and sample numbers with previous years sites and sample numbers so that seep trends can be discerned where possible. The Water Licence indicates that additional sampling, more than twice per year, should be conducted as soon as practical after major storm events. Therefore sampling frequency should be twice annually AND as soon as practicable following major storms events, not "OR" as indicated.
- Section 4 Reporting: Data summaries should also include comparisons of measured flows and mass loadings to the original EAR predicted values. Updates are to include an outline of anticipated mitigation measures that are required. But at this point, no mitigation measures have been identified for the underground mine, North Pile seepage or WMP seepage. This report only presents triggers for investigative and evaluation actions. No actual mitigation measures have been identified.

Water Management Plan – August 2004

For the Phase 1 Pre-Production Period

- The Phase 1 Pre-Production Period commences in 2004 and continues through construction in 2006. There appears to be a potential typo, in that this phase is expected to finish by May 2005, where it appears it should read May 2006.
- Future water management plans are to be "stand-alone". This one is not. It appears that the only reason it is not is to minimize effort at this point in time.
- There is very limited information in this document. The Water Licence (Part F, section 4) requires an updated Water Management Plan. "This Plan shall include a description of the process and facilities intended for the purposes of obtaining fresh water from Snap Lake for use at the Snap Lake Diamond Project, the process and facilities for the collection and

management of surface runoff generated on site and the process and facilities for the treatment and discharge of treated effluent from the Snap Lake diamond project to Snap Lake. The Water Management Plan shall include details of the final hydraulic design of all water management structures and water balance calculations on a monthly basis for each year of the proposed License. The WMP shall include a detailed monitoring plan for each key element of the water management system.” This document does not comply with Licence requirements in that there are no details of final hydraulic design of all water management structures, no water balance calculations, and no detailed monitoring plans for each key element.

- Details of the intakes (existing and future) are referenced as De Beers files, but are not included. No details are included of the treatment plant or diffusers.
- Section 4.2 indicates performance of the water treatment plant will be optimized by comparison of the quality of water before and after treatment. However, the inflow is not an SNP site. It is not clear what the proposed frequency of sampling is, what parameters are to be analysed (only flow, pH, temperature conductivity and turbidity are mentioned), or whether the data will be submitted as part of the annual report. It is likely important to measure total metals in the inflow for comparison to the effluent discharge, rather than relying on calculations from flow and concentrations measured from SNP 02-1 (Final mine water collection sump) and 02-02 (North Pile drainage collection ditch), as the inflow to the treatment plant can be affected by inputs from other sources, such as the Water Management Pond.
- Sections 4.2.1(mine water quantity) 4.2.2 (mine water quality), 4.2.3 (site runoff), 4.2.4 (North Pile starter cell) do not provide details on monitoring, or on sites that will be monitored. General systems are described that are not linked to SNP sites.
- Section 4.2.1 indicates that there will be two main sumps underground. It is not clear where SNP 02-01 is located, or whether one or both of these sumps will be monitored.
- Section 4.2.3 does not link SNP sites to sedimentation traps in outlying areas such as the airstrip, ammonium nitrate storage and explosives manufacturing plant.
- Section 4.2.4.1 is not clear whether the ditches around the starter cell will include downstream frozen berms, as discussed at the MVEIRB hearings, and ditch bases below the surface elevation of Snap Lake. These were proposed as part of the MVEIRB review to limit seepage towards Snap Lake. Seepage collection is estimated at 90% rather than “all seepage collected” as previously indicated. It is not clear that 90% of seepage will be collected given the brief descriptions of design and partial lining. The ditch depths and

widths are not linked to actual North Pile foundation conditions. Felsenmeer may extend below the proposed 2 m ditch depth in some areas. No grades along the ditches are specified. It is not clear where SNP 02-02 (North pile drainage collection ditch) is relative to the starter cell ditches. It is not clear whether SNP 02-02 will need to be moved as the North Pile grows.

- There does not appear to be any proposal to study pore water quality development in the active layer of the paste material. Although perhaps this may be included in the forthcoming ARD/Geochemistry Characterization Plan, or Materials (ore, waste rock, kimberlite) Management Plan.
- Details of the existing water treatment plant are sketchy. Reagents include ferric sulphate, sodium hydroxide, flocculent (which one not specified) and sulphuric acid. Capacity is rated at 5000 m³/day.
- Section 4.3.3 indicates that water quality in the water treatment plant will be monitored before and after treatment as required by the Water Licence, however the Water Licence does not require monitoring of treatment plant influent. Thus this site appears to be voluntary. No specific parameters or frequencies are specified. Monitoring of the WMP (stilling well near the pumphouse – SNP 02-14) is required by the Water Licence and is likely to reflect inflows to the treatment plant for the stated Phase 1 Pre-Production period as it appears that all water is directed to the WMP prior to treatment. This is not the case once the final treatment plant is built.
- No details are provided of the temporary diffuser to be used over the Phase 1 period. No details are provided for the permanent diffuser to be installed in 2005.

Adaptive Management Plan – August 2004

The Adaptive Management Plan (AMP) is limited to 4 specific aspects of the project. These are aspects that arise from specific mention in the Water Licence (Part B, section 12), but do not appear to cover all of the aspects mentioned in four bullets in part B, section 12 of the Water Licence. Details of specifically mentioned mitigation measures (grouting, phosphorus abatement program, enhanced sewage treatment and/or artificial aeration) are missing, and other aspects of the project would benefit from an AMP approach. The MVEIRB recommendations and suggestions imply a broader application for an AMP. The Water Licence (Part B, section 12) also indicated that the AMP should not be limited to the four specified items, and the four Licence items. Thus this AMP needs to be expanded.

Much of the AMP talks about what will be, rather than what is in place. For example (page 9) “De Beers will have EMS programs and procedures for the Project that are directly related to the AMP.” This is somewhat understandable as the project has not geared up for construction. But submissions should be proactive, not submitted after they are needed and potentially in use.

Action levels generally are not explicitly stated, but refer to general conditions. Mitigation measures tend to be listed for consideration, but are not linked to actual action levels. In general, the AMP provides for investigation and analysis if monitoring indicates disturbing trends, and does not provide a decision tree or system to direct actions towards specific mitigation efforts.

Updates are to be submitted “as necessary” or as requested by the Board or Inspector. An update should be requested in the near future.

Specific comments:

- Page 6: The report states that the AMP begins when the monitoring data show a change that results in levels that exceed the Action Level or a trend that will result in levels that exceed the Action Level. MEMI does not agree. The AMP should anticipate what action should be undertaken if the Action Level(s) are exceeded or are predicted to be exceeded.
- Page 6: It is not considered reasonable to review the Action Level once it is predicted to be exceeded. This should be done prior to exceedances, i.e. the Action Levels should be set at appropriate and researched levels now.
- Page 7: The solution may be broader than mitigation measures, but should include mitigation measures thought out beforehand.
- Comments on section 3.1 are provided in comments on the TDS Monitoring Report above.
- Section 3.2: Geotechnical Performance. The North Pile Monitoring Program is referred to on page 16, but no reference or details are provided. The details of the Starter Cell Monitoring Program are not provided, and should include details of locations of monitoring instrumentation, types of instrumentation, and frequency of monitoring.
 - Page 17 – The AMP contains no details of proposed thermistor installations: number, location, or frequency of sampling. More extensive thermal and seepage monitoring during the initial development period of the North Pile is identified as being required, but how this will be accomplished is not described.
 - Page 18 – The AMP contains no details of North Pile seepage monitoring:

number, location or frequency of sampling of piezometers. Details are also lacking in the Groundwater Monitoring Program Report.

- Action levels (Section 3.2.3) are vague, especially for stability and temperature.
- Action levels trigger re-evaluations and, potentially, corrective actions. All corrective actions are vague.
- Section 3.2.4.3 indicates that spatial and temporal trends in pH of seepage water will be evaluated. It is not clear how this will be done, as a monitoring program has not been described to this point that would accomplish this. Reference is made to the ARD Monitoring Program, which has not yet been submitted.
- Section 3.2.5 Mitigation Measures list possibilities, or examples. Few specifics are provided. Corrective actions for seepage are proposed if unanticipated impacts to Snap Lake are identified, as well as persistent change in seepage pH, an assessed risk to surface water or plants, or the presence of bioavailable metals at concentrations that exceed background. The monitoring program that would identify these impacts has not been provided. The detection of most impacts results in further investigations. Some potential corrective actions are identified, including covering the acid generating materials, and/or freezing the acid generating materials using mechanically active or passive freezing systems. No details are provided.
- Section 3.3: Nutrient Enrichment
 - Similar to other sections: No details of vertical water quality profile intervals are provided. Should one assume at 1 m intervals to within 0.5 m of bottom as per other profiles? No details of field parameters are provided. Should one assume that they include dissolved oxygen, pH, temperature, conductivity as per AEMP water quality sampling page 47? What about turbidity? There is no indication of how long the data record must be kept to allow trend analysis. Should one assume 4 years as per the AEMP water quality discussion on page 49? Action Levels in section 3.3.3 are not explicit:
 - What rates of increases have been predicted in the EAR and why are rate increases of interest?;
 - What are the specific water quality guidelines for the protection of aquatic life being proposed?;
 - What specific thresholds would impact aquatic populations in Snap Lake?; and,

- Have these been studied and targets determined?
- Mitigation measures are discussed in a speculative manner, indicating that these are likely options and not defined action items.
- Section 3.4: Total Suspended Solids
 - Section 3.4.4.3 – This section indicates action will be taken if sampling indicates levels of TSS are above Water License criteria – this is too late. The report introduction suggests that action items will be taken if levels above Water Licence criteria are *predicted* to be exceeded. This is more appropriate.
 - Section 3.4.5 – Specific mitigation measures are not linked to action levels. A list of potential mitigation measures is presented that apparently will be considered if monitoring indicates trends of concern.
 - Page 30: At what low level will the Water Management Pond be maintained? How will that level be maintained? Are facilities for the addition of coagulant or flocculants to the WMMP and/or the underground sumps available on site for immediate application if needed?

Aquatics Effect Monitoring Plan – July 2004

Review of this report by MEMI was limited, and focused on the special Plume Characterization Study (page 33 – 36), and Project Monitoring for Water and Sediment Quality (page 37 – 52).

Plume Characterization – Special Study

This study seems reasonable in extent, but key details are missing.

- An additional objective should be to confirm that the 200 m distance is the effective edge of the mixing zone. This may not be achievable with the proposed radial transects at 100, 200, 300, 400 and 500 m. Some additional sites closer to the diffusers and the suspected mixing zone edge may be appropriate.
- The Plan indicates the plume will essentially be defined using electrical conductivity. The basis for assuming that concentrations of other parameters will mimic electrical conductivity concentrations is not clear.
- The report notes: “Vertical electrical conductivity profiles will be recorded at regularly spaced monitoring sites along each radial transect. The horizontal spacing of monitoring sites, and the vertical spacing of the electrical conductivity measurements at each site will be determined in the field based on the estimated dimensions of the plume.” Details are lacking on the number of sites along each radial transect, as well as the number of vertical sites at each station.

- Water samples are to be collected along the centreline (line of highest concentration of electrical conductivity) of the plume at distances of 100, 200, 300, 400 and 500 m from the outfall. However, it is not clear how the line of highest concentration will be determined. MEMI notes that the 'centreline' may vary with depth, such that a vertical profile at a single station may not capture the highest concentrations at all depths. Also that the plume may not be limited to a single finger of high conductivity material. Details on the number of discrete samples that will be taken at each station are not specified, and should be indicated. Details on the parameters that will be analysed in each water sample are not specified – Will these cover the complete suite of parameters of interest at this site?

Water and Sediment Quality – Project Monitoring

- It is difficult to comment on the selected stations, since the predicted impact area is not presented (it is apparently somewhere in the EAR).
- Page 45: It is not clear whether flow will be measured near the inlet to Mackay Lake. The inclusion of flow measurements would allow some crude comparison to chemical mass
- Page 49: The Plan indicates that statistical trend analyses will be undertaken once 4 years of data have been collected. Earlier, non-statistical examination of trends should also be conducted. Comparative plots of data will be a critical component of the reporting.

Misc. comment

- The special study on fish health baseline indicates (page 12) that supporting environmental variables will be collected daily as part of the fish health study: dissolved oxygen, water temperature, pH, conductivity, turbidity, air temperature, and weather. It is not clear where these parameters will be collected, both locations relative to the net sites, and/or depth. Additional details are likely to be required.

Quality Assurance and Quality Control (QA/QC) Plan Revision 2004

- Section 2.3.2, bullet 3: If all field meter probes are to be rinsed with "site water", a specific uncontaminated source should be specified, and a sample collected for analysis for each sampling event. Site water should be uncontaminated (i.e. not an effluent), but even Snap Lake water quality will be variable spatially and temporally due to the effluent discharges.
- There is no reference to additional sampling stations (i.e. beyond SNP) that have been mentioned in other monitoring plans, such as the underground sumps and boreholes mentioned in the Groundwater Monitoring Plan.

- Table 1 appears to refer to Daily Sampling, whereas the Water Licence refers to continuous in-line monitoring
- Section 3.2: There needs to be provision for numbering multi-station SNP sites such as 02-04 through 02-10. Since 02-03 through 02-09 refer to uncontrolled surface runoff, it is not clear whether sites can be linked to the proposed sedimentation pond supernatant, or whether site locations will be repeatable.
- Section 4.2: Detection limits for the two labs differ significantly. It is not clear what detection limits for what parameters will be used for which samples. Section 4.4 indicates that “appropriate detection limits” will be used for each SNP station. Specific detection limits should be identified for each program and/or site.
- Section 4.4 references Table 2, but this is not included. It appears this should refer to Table 1.

I trust these comments meet your needs at this time.

Yours truly,

MEHLING ENVIRONMENTAL MANAGEMENT INC.

per:

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