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Memo

Date: June 18, 2008

To: Kathy Racher, Ryan Fequet, Wek eezhii Land and Water Board

cc: Nick Lawson, Jacques Whitford AXYS

From: Steve Wilbur, Jacques Whitford AXYS

Subject: Verification of Status of Resolution Regarding Technical Comments on Working Group Section 4 Comments, 2007 Ekati ICRP Report, Chapters 7, 8 and 9 and Appendices F and G

Please find attached a summary of the resolution status of technical comments provided by Jacques Whitford-AXYS on BHPB's May 20, 2008 written responses based on discussions during the May 29 and 30, 2008 Technical Working Group meeting.

In general, for many of the tracking numbers BHPB did not propose to provide any revisions in the next draft. In some cases, however, these followed lengthy technical responses (e.g. 166, 182, and 247). It would seem to make more sense if the next draft included some of the more substantial technical information provided in the response so that the same questions or concerns are not raised again. With this understanding, the following tracking numbers are resolved:

17, 21, 24, 26, 28, 29, 37, 60(124), 61(125), 62(126), 86(131), 95(132), 96(133), 102(134), 103(135), 109(137), 126(139), 127(140), 129(141), 159(142), 160(143), 166(149), 167(150), 168(151), 176(169), 177(170), 178(171), 182(172), 183(173), 224(221), 225(222), 230(224), 246(227), 247(228), 248(229), 252(230), 253(231), 254(232), 261(233), 270(235), 273(236), 278(243), 280(245), 287(247), 288(248), 289(249), 290(250), 293(255), 298(258)

BHPB has stated that they "cannot provide continuous updates to the ICRP that is currently under review each time new information is published," (see response to tracking number 31). While this may be appropriate in some circumstances, it should not be universally applied to the next version, especially considering that the next version will be completed almost 2 years after the January 2007 draft, and that the next round of updates will not come before 2014 (at its earliest). If significant findings have been published (or produced by BHPB's consultants) since January 2007, then they should be reviewed and incorporated into the next version.

Further, it is clear that in many cases the research plans are missing some critical detail, especially where there might be more urgency in the timetable for completing the plan. In general, the research plans provided in Appendix F are not sufficiently detailed or are lacking critical information to assess whether they are adequate. Attachment 1 provides an example of what a research plan should look like.

The following tracking numbers are resolved with comment:

84(129) - In addition to the AEMP references, the revision should also indicate that the results from Diavik (1998) should be updated to reflect actual data and not just predictions.

85(130) - Although it is recognized that BHPB cannot be held responsible for when Diavik pumps from Lac de Gras, it is implicit that there should be an arrangement between BHPB and Diavik to manage the timing if water withdrawals, and that the WLWB may facilitate an agreement.

232(226) - Note that BHPB did not complete the proposed box, but in their response, BHPB indicated the latest water quality modeling results will be provided in the next update of the ICRP.

The following tracking numbers are resolved with a commitment/action and/or recommendation:

18 - It is not entirely clear how, when and to what extent the issues associated with sub permafrost groundwater flow, recharge and talik formation will be studied. Recommend that specific details regarding these issues be described in the Pit Lake Studies research plans.

19 - BHPB has proposed no revision. The text in section 8.43, however, should at least reflect the rationale and information described in their response. Further, any existing reports (e.g. from RESCAN) that describes current modeling efforts should be referenced.

20 – Figure 79 does not provide a clear representation of the interpretations and conclusions regarding salinity stability. Recommend that the figure either be explained in more detail, a different figure be prepared or no figure be used. Further, the details of the technical response should be incorporated into the text in Chapter 8.0.

27 – BHPB has proposed no revision to the text, but some of the details in their response (i.e., "a Monte Carlo approach was used for the climate sensitivity analysis") are important in understanding the limits of the sensitivity analysis. Further a Monte Carlo approach (i.e., random – based) does not seem to be a representative of natural climate variability over a, for example, 20-year period. More justification of this approach is required. Alternatively, a stochastic-like approach would appear to better capture worst-case conditions during dry or wet climate cycles.

30 – Based on meeting discussions, BHPB has agreed to update the text to reflect that more than one generation of wolverines may be affected. The residual effects on wolverines cannot be assessed based solely on the "closure period"; more than one generation of wolverines will be affected by mining-related activities (i.e., exploration through closure). The residual effects, therefore, must be reconsidered.

31 – see general comment above.

82(127) and 83(128) – With respect to water balance modeling results, BHPB has stated that the model produced "reasonable" results. It is not clear what is meant by reasonable. Ultimately, the Board should know the degree of data and model uncertainty to identify risks and make decisions on water license criteria that will govern pumping throughout the entire pumping period. Further, although the model was run assuming a 1-in-10 year dry condition, a more representative conservative approach should run the model over the entire proposed pumping period (i.e., that incorporates the effects on lake water balance from preceding years) for successive dry years.

104(136) – BHPB has proposed no revision, but has indicated in their response that a substantial data set for Ekati has been accumulated in the last 10 years. Similarly, regional data, including that from Water Survey of Canada stations and other nearby mining operations is also available. The ICRP and proposed research should include revisions to hydrologic and meteorologic characterizations based on an updated data base.

110(138) - A lot of detail was provided in BHPB's response, but no revision was proposed. In general, more detail in the research plan is required. See Attachment 1 for an example of what is recommended.

202(220) – BHPB did not provide a response regarding revisions. It is recommended that proposed revisions include the overall strategy for depth and placement of thermistor strings, which includes the expected distribution and density of strings over time as the geometry of the LLCF changes.

226(223) – BHPB has proposed no revisions, but there is not enough information currently provided with respect to the timeframes for specific research. See Attachment 1 regarding schedule in research plans.

231(225) – Detailed elements of the research plan regarding the LLCF water quality at closure are lacking. See Attachment 1 regarding the required details of a research plan.

262(234) – Table 58 provides only a general outline of monitoring period. More detail regarding the timing of specific tasks and the fulfillment of research objectives is required. See Attachment 1 regarding the required details of a research plan.

279(244) – The ICRP should provide a detailed research plan that addresses a stable self-sustaining plant succession (i.e., for example, how successful plant species will perform over time) on dams and dykes.

283(246) – More details regarding the research schedule and what governs the schedule is required. See Attachment 1 regarding the required details of a research plan.

292(254) – The proposed research should be expanded to provide details regarding location, duration and methods used to complete the study.

299(259) – See Attachment 1 regarding the required details of a research plan.

The Following tracking numbers are not resolved:

22 – BHPB will either need to verify that the channel geometries of critical reaches (i.e., those with the highest potential to restrict passage) have been surveyed or that they will update their research plan to conduct these surveys, and then re-run the HEC-RES model. Further, when the model is re-run, more conservative conditions (not annual average) should be assumed (e.g., the 1-in-10 year 7-day low flow condition).

23 – The conclusion that "…pumping rates…will not significantly reduce fish habitat," is not supported by the analysis. First, the order of magnitude level of study does not provide enough resolution, especially considering the high natural variability in the region's watersheds; secondly, the conclusion appears to also be based on a perceived (non-stated) operational practice (i.e., pumping rates will be reduced to minimize effects). The objectives of these studies should be to determine what the pumping limits are based on low-risk multi-year, annual, seasonal and low-flow period scenarios. Since more analysis is required, BHPB's revision could state that "studies to date <u>suggest</u> that the assumed pumping rates would not significantly alter fish habitat".

25 – Given BHPB response to-date, including discussions during the meeting, there is still too much uncertainty in the analysis to conclude that the reductions in October flow will be minor. For example, the use of a uniform runoff coefficient, an average monthly flow distribution, and the short-term (e.g. one-year versus successive dry years) of the analysis, indicates that the relative uncertainty in the analysis is still quite high, which might yield greater risks in defining specific water license criteria for pumping.

Attachment: Example Research Plan

Attachment 1: Example Research Plan
(Note: *where appropriate specific examples of various components of the example research plan from Appendix F, Table 43, Open Pits: Water 1 are shown in italics.*)

Goal:
State any specific goals of the research plan (as it supports the overall reclamation plan goal) that addresses the mitigation of potential negative effects.

Prevent significant negative effects on aquatic habitat in the source lakes and downstream water bodies during pumping from source lakes.

State Research Question:
Identify the question to be answered by the research.

At any given time (or timeframe), what are the volumes and rates of water that can be safely withdrawn from source lakes, without having negative effects on aquatic habitat and organisms.

Further, in the main text of the ICRP, when discussing the closure approach for each mine component (i.e., in this case Pit Lakes), the data and informational uncertainties about closure activities (i.e., in this case water withdrawals from source lakes) should be explicitly identified. These identified uncertainties should guide the development of the research plan and will have the explicit research objective of removing the specified uncertainty.

Objective:
State the purpose and desired output of the research project, linking the research outcome to the information needed, as outlined in the issue identification and statement.

Determine the volumes and rates of water that can be safely withdrawn at any given time from source lakes as part of the input to establishing water license criteria. (This information would be linked to the Drawdown Plans that are required under Water Licenses XXX).

Data and Information Required:
Describe what data and information are necessary to meet the objectives. Include any assumptions. Explain how uncertainties are being addressed, how these will be reduced and what will be the accepted level of uncertainty.

1) *Develop seasonal (e.g., monthly) empirical water balances for each lake-stream system where pumping will occur. Water balance data requirements include rainfall and runoff into the lake, evaporation from the lake, lake water level and streamflow (e.g., at lake outlet). Losses or gains from groundwater storage are considered negligible. The critical periods occur during freshet (when much of the lake is recharged) and during late summer/early fall when lake levels and outlet flows are lowest. Data requirements include a field data collection program supported by reviews and analyses of local (Ekati general area) and regional datasets. Several years of field data collection including continuous recording gages are recommended to minimize data uncertainties in the calibration of rainfall/snowmelt – runoff relationships (especially in the absence of watershed specific precipitation and snowfall data).*
2) *Provide minimum acceptable lake and stream levels that will ensure negative effects on aquatic habitat do not occur. The acceptable lake levels are primarily based on a description and assessment of the vertical and lateral structure of aquatic habitat in the potential zone of impact (i.e., the littoral zone).*
3) *Using the lake-stream system specific water balances and the aquatic habitat assessment, provide maximum acceptable daily pumping volumes and rates from each lake during the entire open water season.*

Existing Data and Information Available:
This includes all relevant research completed to date.

For example, as listed in Table 43, Water 1 for *Research Completed*:

a) Regional baseline data (hydrology, meteorology, water quality and fish habitat) was collected prior to the commencement of mining operations at EKATI (Rescan 1995a, 1995b and 2000). This information was regional only, and did not include specific hydrology for the

above identified source lakes for pit flooding. However this information is useful for water balance studies which assess precipitation and runoff.
b) Stream flow data has been collected at the Ursula Lake outflow over 4 years from 2001 to 2004 to understand pumping of water from this lake for flooding Sable open pit.
c) Measured flow data for Upper Exeter Lake has been difficult to measure and therefore the outflow rate for this lake has been determined through use of a runoff coefficient of 0.5 (EBA, 2006).
d) The estimated lake water use from Lac de Gras for the Diavik Diamond Mine closure was referenced from Diavik reports (Diavik, 1998).
e) A preliminary assessment of aquatic effects was conducted to provide conceptual information on what might occur in source lakes as a result of pumping to flood open pits. Habitat surveys of the upper 1.2 m of the littoral zones of Upper Exeter Lake and Ursula Lake were conducted in August 2006 to assess the potential effects of water extraction on littoral habitat. Predicted effects on source lakes and source lake outflow streams, as well as a discussion on fish habitat in source lakes and outflow streams is provided in Section 8 of the 2007 ICRP Volume 1.

Identified Data and Information Gaps:
This includes a data and information gaps assessment of the results from completed research (i.e., this component would entail the relevant discussion and information described in Table 43, Water 1 for *Results from Completed Research*). Further, this section should also include a discussion of the existing uncertainties (quantified if possible) and how these uncertainties affect the establishment of water license criteria. This section should state whether any of the existing data and/or information are sufficient to address the objective(s), and/or what new (or more) data and/or information are required.

Detailed Scope of Work by Task:
Based on the Data and Information Gaps Assessment:

- Describe anticipated field work (e.g., site-specific details regarding the installing of lake level and/or streamflow gauges) that will be required to fill data and information gaps. Include specifics on timing, duration of activities and the numbers and locations of field sites, and the types of data and/or information that will be collected or generated.
- Describe any anticipated field or office research (including interviews, literature reviews) that will be required to fill data and information gaps.
- Describe any anticipated analyses and/or modeling required.
- Describe how the output from scope of work will meet the research objectives, and how it supports the goal(s) of the closure plan.

Schedule:
- Describe primary and secondary governing factors on the timetable. For example, for each facility work backward from the beginning of BHPB's scheduled closure and reclamation dates to determine when specific research needs to be completed; include time needed for pilot studies, field research, modeling and/or analyses, etc. Also include any time-sensitive links with other research activities.
- Provide the estimated beginning, end and any important milestones for each task/phase.

Monitoring:
- Describe when and how the progress with the research as outlined above will be monitored.
- Describe any links to other research monitoring activities.

Costs:
- As per water license requirements, provide estimated costs by Task of the proposed research activities.

References:

Provide up-to-date (as reasonably possible) references for all completed research as well as those references used in the Data and Information Gaps Assessment