Wek'èezhìi Land and Water Board

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(BHPB & Diavik)

September 18th, 2008 Files: MV2003L2-0013

Ms. Laura Tyler
BHP Billiton Diamonds Inc.
#1102, 4920-52nd Street
Yellowknife, NT X1A 3T1

Dear Ms. Tyler,

Re: 2007-2009 Re-evaluation of AEMP Design – Review of Conditions for Approval from April 19, 2007

The Wek'èezhìi Land and Water Board met on September 15, 2008 to consider whether the conditions for approval, as set out in a Board directive of April 19, 2007, have now been fulfilled for BHP Billiton's 2007-2009 Re-evaluation of AEMP Design (required as per Part I, Item 1 of MV2003L2-0013).

The Board would like to thank BHP Billiton for the submission of a number of reports and other information on April 30 and August 27, 2008, in fulfillment of the conditional approval noted above. The Board also appreciates BHP Billiton's cooperative work with Board Staff over these past months in providing the additional information needed to finalize the approval.

One of BHP Billiton's submissions on April 30, 2008, was the Long Lake Containment Facility Water Quality Prediction Model (Version 1 and 2). Several parties submitted high-quality reviews containing very useful comments and suggestions for improvement of the model and the Board would like to encourage BHP Billiton to make use of this information whenever the model is next updated.

In fulfillment of Condition # 6a of the April 19, 2007, directive, the Board accepts BHP Billiton's proposal, as written below, with the expectation of the necessary follow up work to determine effect sizes in consultation with stakeholders:

"...BHP Billiton proposes to firstly circulate to the WLWB and reviewers a scoping document that will better define "the issue of effect size" specific to and appropriate for EKATI. In this document, BHP Billiton can describe its understanding and intention as regards linkages between the adaptive management plan, AEMP, effect thresholds, and critical effects size as regards sampling design. Based on responses from the WLWB (and reviewers) this might be the basis of an initial workshop. BHPB Billiton feels that this approach will establish a necessary common understanding of the scope, direction and objectives for an evaluation of effects sizes for EKATI. This will reduce the risk of misunderstanding and disagreement at a later date after substantial resources have been applied by all parties to a scope that has not been defined." (excerpt from BHPB's response to comments on the 2007 AEMP Report, June 26, 2008)

The Board requests the above proposed scoping document be submitted by November 15, 2008.

The Board believes that all of the conditions set out in the April 19, 2007, directive have now been adequately fulfilled and final approval is granted for the 2007-2009 AEMP Re-evaluation.

If you have any questions, please feel free to contact Kathleen Racher at racherk@wlwb.ca or by phone at 867-669-9591.

Sincerely,

Violet Camsell-Blondin
Chair, WLWB

Copied: BHPB Distribution List

STAFF REPORT

Company: BHP Billiton (BHPB)	
Location: Lac de Gras	**License:** MV2003L2-0013
Date Prepared: September 3, 2008	**Meeting Date:** September 15, 2008
Subject: 2007-2009 Re-Evaluation of AEMP Design – Review of Conditions for Approval from April 19, 2007	

Purpose

The purpose of this report is to review the conditions of approval, given by the Board on April 19, 2007 in relation to the 2007-2009 Re-Evaluation of the AEMP Design, to check if these conditions have been fulfilled by BHPB's most recent submissions.

Background

During the renewal of BHPB's main licence, MV2003L2-0013, the Board imposed a condition requiring BHPB to update their plan for the AEMP every three years starting in 2006 (the program is for 2007-2009, with the next revision due by December 31, 2009). This interval was chosen to balance the need for maintaining the most effective AEMP possible with the need for consistency and continuity between years.

BHPB revised the plan for the AEMP after soliciting input from parties through a workshop and through the opportunity to submit written comments. This community engagement phase was followed by the submission of the revised AEMP to the Board on January 3, 2007, which initiated the Board driven review and approval phase. The AEMP Design for the Ekati mine site was approved, with 11 conditions, by the WLWB on April 19, 2007 and applies to the monitoring years of 2007 to 2009.

Many conditions of approval of the re-evaluated AEMP Design either required substantial work on the part of BHP Billiton and/or were changes to be made in their 2007 AEMP Annual Report; therefore, BHPB was not able to fulfill the conditions prior to this year.

On April 30, 2008, BHP Billiton submitted several of the requirements of their conditional approval including a Variability Study, the Long Lake Containment Facility Water Quality Prediction Model (Versions 1 and 2), and a letter that explained how the other conditions were fulfilled. All of these items were distributed to all parties for their information and review on May 8, 2008 with comments requested by June 20, 2008. Reviewers were reminded, at that time, that these items were not being submitted in response to any licence terms or conditions; rather the submissions were to be checked against the

Board directive of April 19, 2007 conditional approval of the 2007-2009 AEMP Re-evaluated Design. AEMP Board Staff also hired Dr. Don Hart, of Ecometrix Incorporated, to advise us as to whether BHPB's submissions fulfilled the conditional approval. Comments were sent to BHP Billiton on July 2, 2008 and responses received back from the company on July 23, 2008. Board Staff met with BHPB in August 2008 to solicit more information on some of the conditions and BHPB submitted this additional information on August 27, 2008.

Discussion

The conditions for approval given by the Board on April 19, 2007 were extensive and called for several different reports to be generated by BHPB. Board Staff have worked with reviewers and BHBP to ensure that all of these conditions have been fulfilled. The details of each condition can be found in the attached Comment Table entitled "Response to April 19, 2007 Directive on the Conditional Approval of the 2007-2009 AEMP Re-evaluation".

As part of the fulfillment of the conditions of approval, information has been submitted that needs to be appended to the 2007 AEMP or discussed again as part of the next AEMP re-evaluation scheduled for 2009 – these are detailed below for the record:

1. Conditions that have resulted in additional information being appended to the 2007 AEMP:

    - Condition # 1b: Graphs of the "Frequency of Occurrence" of major prey taxa for the three reference lakes and the six potentially affected lakes for lake trout and round whitefish (submitted August 27, 2008).

    - Condition # 1h: The QA/QC procedures for benthic organisms used in the 2007 AEMP were submitted August 27, 2008. BHPB has also committed to submitting a short report in December 2008 detailing the results of their benthic sub-sampling and re-sorting precision analysis for 2008; this report will be appended to their 2008 AEMP Annual Report.

2. Conditions that will were fulfilled but that may be discussed again in the context of the next re-evaluation of the AEMP Design in 2009:

    - Condition # 1d: The use of slimy sculpin as a surrogate for whitefish or trout in the measurement of metal levels in tissue was investigated enough to satisfy the condition; however, BHPB is doing more studies that may reinitiate this discussion in 2009.

    - Condition # 1e: BHPB is continuing to develop methods for nematode taxonomy as part of their benthic metrics in the AEMP and propose reviewing their results in 2009.

    - Condition # 1j: This condition called for the so-called Type 1 error rate to be re-examined to ensure that it was sensitive enough to allow the AEMP to detect all possible effects of the mine to fish. In consultation with BHPB and the Board's reviewer, Dr. Hart, it was determined that the statistical analysis presented in the 2007 AEMP was sufficiently sensitive so far; however, Board Staff suggest that this issue be looked at again in 2009.

    - Condition # 2: This condition stipulated the information needed by the Board in order to accept BHPB's recommendation to reduce the open-water sampling frequency in its AEMP; BHBP decided not to pursue that at this time, but it may come up again in 2009.

- Condition # 6b-1: There is still some debate as to the method for taking sediment samples within the AEMP – this condition required BHPB to try a new method last year. BHPB's consultant, Rescan, reported that they did try but could not make it work. DFO and EC think that BHPB should try again. Board Staff consider this condition to be fulfilled even though BHPB was not successful; however, we suggest that this topic be revisited in 2009.

- Condition # 11: This condition calls for information on how the AEMP is linked to the Adaptive Management Plan (AdMP) and this information has been provided in the AdMP submitted by BHPB. Once the AdMP is approved, there may be changes necessary to the AEMP and these changes, if necessary, can be discussed in 2009.

Finally, Conditions # 6a and 8 need some follow up even though Board Staff believe they have been fulfilled. These are detailed below:

- Condition # 8 called for the submission of a Long Lake Containment Facility (LLCF) Water Quality Prediction Model. This model was developed to help understand what factors and/or processes affect the water quality within the LLCF over time. BHPB has submitted both the original version of this model as developed in 2006 as well as an updated version from 2007. Although the Board's consultant and Board Staff believe that these submissions fulfill Condition #8 satisfactorily, many reviewers recommended further improvements that could be made to the model. BHBP acknowledges these very helpful comments/suggestions and says it will use that information when the model is updated again in the near future. Board Staff recommend that the Board encourage BHPB to use the information submitted by reviewers during subsequent updates of this model.

- Condition # 6a stipulated the evaluation of "effects sizes" for the AEMP but did not clarify exactly what the Board meant by that term. BHPB attempted to fulfill the condition but reviewers and Board Staff agree that BHPB's idea of "effect sizes" is not correct. In response to this confusion, BHPB has proposed to prepare a scoping document intended to properly define effect sizes and a work-plan to determine these values with all stakeholders. Board Staff have agreed with this proposal and recommend a due date of November 15, 2008.

Conclusions and Recommendations

Overall, BHPB has worked hard to fulfill the conditions of approval for the 2007-2009 Re-Evaluation of the AEMP as directed by the Board on April 19, 2007. Board Staff believe that all of the conditions have been adequately fulfilled at this time and recommend final approval be granted.

Board Staff also recommend that the final approval letter from the Board to BHPB include:

1. A statement encouraging BHPB to make use of the very useful comments and suggestions submitted by reviewers on the LLCF Water Quality Prediction Model whenever the model is next updated; and

2. A statement accepting BHPB's proposal, as written below, with the expectation of the necessary follow up work to determine effect sizes in consultation with stakeholders:

"…BHP Billiton proposes to firstly circulate to the WLWB and reviewers a scoping document that will better define "the issue of effect size" specific to and appropriate for EKATI. In this document, BHP Billiton can describe its understanding and intention as regards linkages between the adaptive management plan, AEMP, effect thresholds, and critical effects size as regards sampling design. Based on responses from the WLWB (and reviewers) this might be the basis of an initial workshop. BHP Billiton feels that this approach will establish a necessary common understanding of the scope, direction and objectives for an evaluation of effect sizes for EKATI. This will reduce the risk of misunderstanding and disagreement at a later date after substantial resources have been applied by all parties to a scope that has not been defined."

BHPB should be required to submit their proposed scoping document by November 15, 2008.

Respectfully submitted,

Kathy Racher, PhD.
Regulatory Director

Ryan Fequet, B.Sc.
Regulatory Specialist

Attachments:

- Comment Table: "WLWB Response and Recommendations – 2007-2009 AEMP Re-evaluation – Conditional Approval Items from April 19, 2007 – Sept 3 08"
- Board Directive – Conditional Approval of 2007-2009 AEMP – Apr19 07
- BHPB cover letter for 2007 AEMP Report and the 2007 Variability Study, submitted April 20, 2008 entitled "BHPB Submission – 2007 AEMP, Variability Report and Conditions Tracking – Apr30 08"
- BHPB's submission "Analysis of Variability Report" – April 2008 ***– on enclosed cd***
- BHPB's submissions "Long Lake Containment Facility Water Quality Prediction Model" Versions 1.0 and 2.0, dated March 2008 ***– on enclosed cd***
- Dr. Don Hart (consultant for the Board) comments entitled "Ecometrix Comments – Variability Study – Jun30 08" submitted June 30, 2008 ***– on enclosed cd***
- Dr. Don Hart (consultant for the Board) comments entitled "Ecometrix Comments – Conditions 1, 9, 10 of 23007-2009 AEMP – Jul2 08" submitted July 2, 2008 ***– on enclosed cd***

- BHPB 2007 AEMP Report (Summary Report plus Appendices A, B, and C), submitted April 20, 2008 ***– on enclosed cd***

- INAC comments on the LLCF Water Quality Prediction Models including a review by LORAX Environmental, submitted June 20, 2008 ***– on enclosed cd***

- IEMA comments on the LLCF Water Quality Prediction Models, submitted June 18, 2008 ***– on enclosed cd***

- Lutsel K'e Dene First Nation comments on the LLCF Water Quality Prediction Models, submitted June 17, 2008 ***– on enclosed cd***

- Letter from BHPB to the Board, dated July 23, 2008 and titled "EKATI Diamond Mine – Long Lake Containment Facility Water Quality Model"

- Dr. Don Hart (consultant for the Board) additional information "Ecometrix review - Additional Information on Condition 1j from April 19, 2007 Directive - Aug05 08" submitted August 5, 2008 ***– on enclosed cd***

- Letter from BHPB to the Board, dated August 27, 2008 and titled "2007-2009 AEMP Re-evaluation – Follow-up on WLWB Conditional Approval"

COMMENT TABLE – (BHPB's Response to April 19, 2007 Directive on the Conditional Approval of the 2007-2009 AEMP Re-evaluation) – Submitted (April 30, 2008)

Tracking Number	Condition # (from letter of April 19, 2007)	Tracking Number from Comment Table on 2006-2009 AEMP (April 19, 2007)	Condition or Commitment	BHP Response to Condition of Approval (from letter of April 30, 2008)	Hart Review from July 2, 2008	WLWB Staff Recommendations
1	1a	7	*"There is a concern as to the limited sampling of responsive biota exposed to epilimnetic waters under the proposed plan. Although impacts to deep waters are most likely (making determinations of profundal benthos community structure important), it is also possible that epilimnetic waters might be affected with lesser effects on the deep waters and sediments. If there are any likely impacts that are limited to epilimnetic waters during stratification, the protocol is not adequate to detect this change. DFO recognizes that BHP is proposing to initiate a spatial variability study in order to address this concern as a component of the revised AEMP."*	Sections 4.3.3 and 4.3.4 of the Variability Study Report discuss the substrate variability and its impact on the analysis of sediment quality and benthic counts.	The DFO concern was about dropping the sampling of shallow water epilimnetic communities. BHPB responded that there was considerable substrate variability in this zone, as well as benthic community variability related to the substrate variability. It was hoped that the Variability Study would shed light on this issue. The BHPB letter of 30 April, 2007 points to Sections 4.3.3 and 4.3.4 of the Variability Study as addressing this issue. What these sections indicate is that many planned sediment samples were not obtained, due to rocky substrate, and that the reduced amount of data limited the ability of the study to draw conclusions. Examination of the data that were obtained for soft sediments in shallow, mid-depth and deep zones, does not indicate that shallow water data were particularly variable. The	**Although BHPB tried to sample a large number of shallow water sites for benthics, they were successful only about half the time because the substrate was not suitable. Thus, although the discussion in the Variability Report does not provide a sufficient rationale for dropping the shallow water benthic sampling (see Hart review), we can infer, from the results of the study itself, that obtaining these samples is very hard to do. This inference along with the fact that reviewers already agreed to BHPB dropping the shallow sampling for benthics in 2007, means that no further sampling or revisions to the report are necessary.** **This condition has been fulfilled.**

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					fundamental problem seems to be that there are areas of rocky substrate, particularly near shore, where soft sediments cannot be obtained. The question of whether we should sample benthic invertebrates on hard substrates (using different methods), or drop shallow water benthic sampling altogether, or just sample soft substrates here, and why, has not really been addressed in the report.	
2	1b	10	*"The taxonomy of stomach content may not be the most relevant parameter. Some measure of stomach content frequency of occurrence, numbers, and volume by taxon should be included. Over time this might provide some insight as to shifts in food base as a result of environmental change."*	AEMP Appendix A Sections 3.7.3.11 (Koala Watershed) and 4.7.3.11 (King-Cujo Watershed).	The DFO comment suggested that some measure of "frequency of occurrence, numbers and value by taxon" should be obtained as fish diet descriptors. BHPB responded by indicating the dietary metrics already in use. The BHPB letter of 30 April, 2007 points to AEMP Appendix A, Sections 3.7.3.11 and 4.7.3.11. In these sections, we see the following metrics: • Average % of prey numbers by taxon • Average % of prey weight by taxon • Average number of total prey organisms ,	**In their responses to comments last year, BHPB agreed to report "frequency of occurrence" but it seems that they have not.** **Since this metric offers a different way of looking at the data and BHPB had already agreed to it, Board Staff recommend that the "frequency of occurrence" of stomach contents be calculated from the fish data and the before-after mine effect, if any, be**

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					and • Average weight of total prey organisms Weight is used instead of volume. We see no reason to prefer volume. However, frequency of occurrence seems to be missing. Frequency of occurrence is usually the % of stomachs containing a particular taxon. This metric takes no account of weight, volume or numbers of prey organisms; thus, items consistently present may be seen as important, even if their weight and numbers are low. There are different views on whether this is potentially important or misleading information.	**determined for this metric as well. This can be provided as a separate addendum to the AEMP.** ***Update as of August 27, 2008:*** ***BHPB has provided, in their letter of August 27, 2008, the requested data and analysis for the 2007 AEMP. This data will be distributed for the information of reviewers and attached to the 2007 AEMP in the public registry. As well, BHPB has committed to including this information in subsequent AEMP reports where applicable.*** ***This condition has been fulfilled.***
3	1c	11	*"Gross anatomy of organs and any observed deformities should also be included. Thus since liver and gonad weights are to be taken, then a photograph of their gross anatomy in parallel to the DELT analysis would be useful. There is*	AEMP Appendix A Sections 3.7.3.11 (Koala Watershed) and 4.7.3.11 (King-Cujo Watershed) for evaluation. AEMP Appendix B Section 14 for all data and photos (Tables 14-95-105 and Figure 14-25).	Photographs of organs were requested by DFO, and agreed to by BHPB. Interior and exterior photographs of each fish examined were included in AEMP Appendix B Section 14. This fully meets the commitment.	**This condition has been fulfilled.**

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			some literature on such effects for fishes in heavily industrially impacted northern Siberian lakes. Colour of the organs should also be assessed (i.e., include a standard colour photocard in the photographs)."			
4	1d	14	*"DFO appreciates the fact that BHP will be adding slimy sculpin as an indicator species on a trial basis in 2007, and if cross comparisons of results among species are favourable they should be the only species used for destructive sampling in the future."*	The results of slimy sculpin whole body metal concentrations show only a few significant correlations to metal concentrations in tissues from round whitefish or lake trout, thus it is not suggested that they be a surrogate for either of these species (AEMP Appendix A Section 3.7.3.12)	The DFO suggestion that slimy sculpin be evaluated as an indicator of metal bioaccumulation, to possibly replace lake trout and round whitefish destructive sampling, was adopted by BHPB. A commitment was made to engage DFO in the decision about species used for destructive sampling and metals analysis. The evaluation of results is included in AEMP Appendix A, Section 3.7.3.12. It was found that metal concentrations in sculpin tissues correlated poorly with those in lake trout and round whitefish (they were significant only for cadmium, molybdenum and nickel – whole-body sculpin vs. round whitefish muscle). Thus, it was suggested that sculpins not be	**BHBP seems to have fulfilled their commitment to do this comparison, and found that whole-body slimy sculpin metal concentrations cannot be compared to measured metal concentrations in whitefish/trout muscle tissue. BHPB (in a separate conversation) said that they couldn't do the analysis on just slimy sculpin muscle tissue because each fish doesn't give enough tissue for analysis.** **In their "Cell E Fish Survey – Work Plan 2008" (submitted to the Board on July 30, 2008), BHBP describes some follow-up work that they plan on doing this summer that will provide more useful**

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					used as a surrogate for either species. We are not aware of consultations with DFO on choice of species for metals analysis in future. Possibly correlations between species would be better for a common tissue type.	**information on this topic.** **This condition has been fulfilled.**
5	1e	17	*This is new science and was a DFO suggestion to explore whether something could be done with nematodes. Nematode identification is not easy, QA/QC issues and availability of qualified taxonomists may be important. BHPB notes that, even if detailed taxonomy proves useful, there will be no baseline data of this type. We would also add that interpretation of changes and their ecological significance is not straightforward. We would suggest that it is premature to commit to nematode taxonomy without a review of DFO's rationale and any case studies. Our recommendation is*	In 2007 nematode identification was improved, and different morphotypes were identified, which are believed to represent different genera. Benthic taxonomic data is presented in AEMP Appendix A Sections 12 and 13. BHP Billiton continues to believe that collection of this data is feasible and that identification of nematodes will improve to the point where the morphotypes are known to genus or species level. BHP Billiton will continue with nematode identification for 2008 and 2009 with the intent of reviewing the issue again during the next	The DFO suggestion to attempt detailed nematode taxonomy was accepted by BHPB, and results were obtained as described in AEMP Appendix B, Sections 12 and 13. Various morphotypes were identified which are believed to represent different genera. The results were not used in the statistical evaluation of benthic community metrics. However, spatial patterns of nematode morphotype diversity were explored in Appendix B. BHPB proposes to review the method at the next three year review.	**This condition has been fulfilled.** **We will look in the 2009 re-evaluation for more info as suggested by BHPB.**

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			that nematodes not be incorporated into the AEMP at this time. We suggest that DFO, as the originator of the request, provide additional information regarding methodology, analytical techniques and any examples or case studies to demonstrate how the results of such analysis will be meaningful and beneficial to this program."	scheduled 3-year review		
6	1f	18	*"All parties agree with this. The AEMP suggests that it might be possible to judiciously select sensitive biota as indicator species, Although adding an element on indicators is useful, it is important to continue looking at the community as a whole and this should be maintained as the focus. Our recommendation is that the analysis of the complete community composition should be continued."*	BHP Billiton continued to evaluate the complete community composition	While there was some discussion in the December 2006 AEMP Plan for 2007-2009 of focusing on sensitive planktonic or benthic species as community indicators, BHPB agreed that more holistic analysis of community composition was useful and should be continued. Except for calculation of benthic community metrics, such as density and diversity, with and without nematodes, the community metrics remain unchanged from earlier studies, with a focus on whole community	**This condition has been fulfilled.**

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					metrics. This is appropriate.	
7	1g	32	*EC supports the selection of two lakes for the lake variability study and would appreciate the opportunity to review the sampling design when available.*	The sampling design is explained in Section 2 of the Variability Study Report. The ideas discussed by stakeholders at the AEMP re-evaluation session considered and implemented in the study. Time constraints precluded a review of the sampling design with Environment Canada prior to implementation. BHP Billiton is available to meet with Environment Canada to discuss the study.	While there was a commitment to review the design of the Variability Study with Environment Canada prior to implementation, BHPB indicates that this did not occur due to time constraints.	**From the Hart review, it seems that the Variability Study was well-designed despite the fact that EC was not consulted. Also, Environment Canada did not submit comments on the Variability Study or on not being consulted. Board Staff believe that the intent of the condition was to ensure that the study was properly designed and, therefore, this condition has been fulfilled.**
8	1h	33	*t is suggested that BHPB use guidance from the Metal Mining Effluent Regulations for EEM for benthic sample QA/QC.*	The methods used for benthic sample QA/QC are described in Section 2 of the AEMP Report Appendix B. A review of the QA/QC programs for the AEMP was made in 2003 in the AEMP Re-evaluation and refinement report. This review included comparison to established monitoring programs.	It was suggested by Environment Canada that BHPB should follow the Metal Mining Effluent Regulation EEM Guidance for QA/QC for benthic invertebrate samples. BHPB committed to review this guidance. The 30 April, 2008 letter from BHPB to the WLWB indicates that the benthic sample	**In Section 2 of Appendix B, the only reference to QA/QC was with respect to Water Quality Analysis, and there is no mention of QA/QC in the benthos sections.** **As mentioned by Don Hart in his review, section 2.3 of the 2007-2009 AEMP Plan**

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				Recommendations were made and adopted at that time. The 2007-2009 AEMP program adopted some changes to the QA/QC program and these are listed in Section 2.3 of the AEMP Program Plan for 2007-2009	QA/QC for the 2007 AEMP is described in Appendix B, Section 2. We do not find any discussion of benthic QA/QC in this section, or any reference to the EEM Guidance on this subject, which is focused on characterization of sorting efficiency and sub-sampling error. The 30 April, 2008 letter also refers to Section 2.3 of the AEMP Plan for 2007-2009. This section identifies the following change to the QA/QC program: "Investigate potential sub-sampling quality control issues related to laboratory analyses of benthic samples." It goes on to say that sub-sampling issues (particularly for benthos) should be verified for each laboratory that works on Ekati samples to document uncertainties associated with sub-sampling. The meaning of Section 2.3 is not entirely clear. However, we do not find in the 2007 AEMP report any discussion of sub-sampling performed, or any documentation of sorting	**also did not adequately address this condition.** **Board Staff recommend that BHBP produce an addendum to the 2007 AEMP Report which describes what QA/QC procedures were followed with respect to benthos sampling (i.e., sorting efficiency, sub-sampling procedures etc).** ***Update as of Sept. 2, 2008:*** ***BHPB has provided, in their letter of August 27, 2008, the requested information on their QA/QC procedure for benthic organisms in the form of a comparison to the EEM guidance. BHPB has identified two changes in their procedures with respect to the precision of sub-sampling and re-sorting of the benthos, both of which they commit to implementing for their 2008 data. They also commit to provide a short report in***

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					checks or sub-sampling error, or any indication that MMER EEM QA/QC procedures were followed, or that EEM quality criteria were met.	***December 2008 with the analysis of the 2007 and 2008 sub-sampling precision as well as the 2008 re-sorting precision.*** ***This condition has been fulfilled.***
9	1i	50	*Stack losses in the form of chlorinated organic compounds and polycyclic aromatic hydrocarbons will ultimately reside in the fatty tissues of top level predators. Some of the cumulative forms of these analytes should be added to the list of analytes conducted in lake trout livers and edible tissue.*	AEMP Appendix A Sections 3.7.3.13 and 3.7.3.14	It was suggested by INAC that polycyclic aromatic hydrocarbons and chlorinated organics should be added to the parameter list for fish tissue analysis. BHPB committed to analyze hydrocarbons and chlorinated phenols in fish tissues, because these substances have been associated with flavor impairment. The results of these analyses were evaluated in the 2007 AEMP Appendix A, Section 3.7.3.13 and 3.7.3.14. They indicated elevated levels of two hydrocarbons phenanthrene and benzo[a]pyrene in fish bile, in Leslie and Moose Lakes as compared to Nanuq Lake. Of 19 chlorophenols analyzed in fish tissues, none were detected in fish tissues of either	**Commitment seems to have been fulfilled. Plus, BHPB is planning a follow-up study this summer of fish from Cell E. Further studies, if necessary, await the results of the August 2008 study.**

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					exposed or reference lakes.	
10	1j	51	*The type I error used in the BACI analyses must be examined. A value of 1% sets the bar for declaring a change higher than any other environmental program. The value should be changed to at least 5% and possibly 10%. All other things being equal the degree of environmental protection afforded by an AEMP decreases as the type I error rate decreases.*	AEMP Appendix A Section 2.2.3.9	It was suggested by INAC that a Type I error rate of 0.01 was used in BACI analyses, and that a higher value of 0.05 or 0.1 would be more appropriate. BHPB responded that an experiment-wise Type I error rate of 0.1 was used, with a lower per-comparison error rate, according to Sidak's formula, and depending on the number of pair-wise exposure vs. reference lake comparisons performed for each parameter. In the 2007 AEMP, BACI analyses was used only for the fish parameters. If the pair-wise tests are seen as all testing the same hypothesis of difference between exposure and reference lakes, then Sidak's formula seems appropriate. It gives a per-comparison error rate of approximately 0.01.	**The way in which Rescan, on behalf of BHPB, did the analysis is not wrong in that the overall experimental error is set at 0.1 even if the pairwise comparisons are set at 0.01. Still, by setting the error of the pairwise comparisons to 0.1, we might have a more sensitive measure of potential effects to the environment. It is impossible to say, without actually doing the analysis what difference it would make to the final conclusions.** **Don Hart performed a quick re-analysis of the data to see what difference it would make to use a more sensitive error rate. His analysis showed that an additional three LakexPeriod interactions would be significant if the pairwise comparisons were set at an**

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						error rate of 0.1. This information was provided to BHPB for a response. ***<u>Update as of Sept. 1, 2008:</u>*** ***BHPB has provided, in their letter of August 27, 2008, a summary analysis of the three additional interactions found by Don Hart when the error rate was set to 0.1. Their discussion reveals that the additional interactions detected did not change the evaluation of mine effects on fish populations from that reported in the 2007 AEMP report. BHBP recommends, and Board Staff agree, that the best time to discuss the most appropriate error rate for BACI analyses will be during the next 3-year AEMP review, scheduled for 2009.*** ***This condition has been fulfilled.***

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11	1k	57	*Flaws in logic*	AEMP Appendix A Figure 2.2-1	Comments by INAC questioned the logic of the data interpretation framework. In response, BHPB committed to present a figure illustrating that framework. The figure is present in the AEMP Appendix A, Figure 2.2-1. It is rather general and does not present the details of "Statistical Analysis" in terms of hypotheses tested or methods used. We are not sure if the figure answers all the INAC questions, but it does generally explain BHPB's decision process, and meets the commitment that was made.	**This condition has been fulfilled.**
12	1l	58	*It is not clear that the spatial information among stations (i.e. hydraulic gradients) will be used in the temporal-spatial analyses.*	Throughout the 2007 AEMP graphs and tables are presented with a gradient (u/s-d/s). Attempts were made to include two measures of gradients in the model: a cumulative point-to-point distance between the	Comments by INAC questioned whether information about hydraulic gradient would be used in the statistical analysis. BHPB committed to consider incorporating gradient information explicitly into the statistical analyses.	**This condition has been fulfilled.**

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				containment facility and the sampling location in each lake; and a simple ordinal predictor numbering the lakes in order from the containment facility. However, the models treating each lake separately provided far better fit to the data.	The 30 April, 2008 letter from BHPB to the WLBW indicates that attempts were made to explicitly incorporate two approximate measures of hydraulic gradient into the analysis – a distance measure, and a lake order index. It notes that neither attempt was successful, and that models treating each lake separately provided much better fit to the data. This is described in the AEMP, Appendix A, Section 2.2.3 Section 2.2.2 of Appendix A notes that lake order information was considered qualitatively in interpreting a statistically significant change. In particular, if a change did not show a clear spatial gradient, strong in lakes near the mine, and weaker further away, it was not interpreted as a mine effect.	
13	1m	59	*Use for temporal and gradient relationships for zooplankton, phytoplankton, benthic macroinvertebrates, sediment chemistry and aquatic chemistry.*	This will be completed for the next 3-year review of the AEMP (2009).	The original comment by INAC questioned the inclusion of multiple watersheds, years and seasons in the principle components analysis (PCA). However, based on the evident success of the PCA in discerning effects, the commitment was to continue use of the	**This condition has been fulfilled. We will look in 2009 re-evaluation for more info.**

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					method every three years. Since 2007 is not one of those years, we do not see the analysis in the 2007 AEMP. BHPB indicates that the analysis will be repeated again in 2009.	
14	1n	62	*Integrate Analyses*	Time trends were completed this year and are presented throughout Appendix A. The multivariate stats will be completed for the next 3-year review of the AEMP (2009).	The original comment by INAC was about integrating univariate and multivariate analyses. The BHPB commitment was to complete a univariate analysis of time trends annually and a multivariate analysis every three years. The time trend analysis is presented in detail in Appendix A of the 2007 AEMP. The multivariate analysis will be repeated again in 2009.	**This condition has been fulfilled. We will look in 2009 re-evaluation for more info.**
15	2	6,16,45	Open Water Sampling Schedule: The current schedule of sampling in June, July and August shall be maintained. If BHPB wants to proceed with August only sampling, BHPB needs to submit information demonstrating that August only	This was conducted for the 2007 season and will be conducted in 2008 and 2009, at which time BHP Billiton may propose changes as part of the 2009 3-year review.		**This condition has been fulfilled. We will look in 2009 re-evaluation for more info.**

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			sampling is superior or at least an equally effective indicator of long term trends (Tracking Numbers 6, 16 and 45).			
16	3		Three year review requirements a) Multivariate analyses every 3 years, time trend analyses every year b) Assessment of using step-wise elimination of biotic data c) Reconsider the use of fish plugs	a) Time trends are presented in Appendix A, multivariate analyses will be completed in 2009 plan review. b) 2009 plan review. c) 2009 plan review.		**This condition has been fulfilled. We will look in 2009 re-evaluation for more info.**
17	4		DELT analysis: The Board notes that under point 13 on page 2-2 of the plan that Lutsel K'e and the Inuit are the groups that have expressed interest in participating in the DELT analysis. The Board expects BHPB to extend the invitation again to the other affected communities well in advance of the start of the scheduled field season for the DELT analysis.	Extended invitation to participate in DELT analyses to all affected communities and 4 communities participated in the survey. Results are presented in Appendix B Section 14 and assessed in Appendix A Section 3.7.3.15 (Koala Watershed) and 4.7.3.13 (King-Cujo Watershed).		**This condition has been fulfilled.**

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18	5		Shallow water benthic sampling: The Board approves the termination of shallow water benthic sampling.	Shallow benthic sampling was removed from the program in 2007.		**This condition has been fulfilled.**
19	6a		Effects Sizes the evaluation of effects sizes must include an evaluation of power analysis (Tracking Number 4)	Effects sizes were evaluated using power analysis and Minimum Detectable Differences. Discussion is provided in Appendix A of the AEMP Report.		**In its responses to comments on the 2007 AEMP Annual Report, BHPB commits to draft a "scoping document that will better define "the issue of effect size" specific to and appropriate for EKATI. In this document, BHP Billiton can describe its understanding and intention as regards linkages between the adaptive management plan, AEMP, effect thresholds, and critical effects size as regards sampling design. Based on responses from the WLWB (and reviewers) this might be the basis of an initial workshop."** **Board Staff recommend endorsing this proposal and to setting the due date for this document at no later than November 15, 2008.**

COMMENT TABLE – (BHPB's Response to April 19, 2007 Directive on the Conditional Approval of the 2007-2009 AEMP Re-evaluation) – Submitted (April 30, 2008)

Tracking Number	Condition # (from letter of April 19, 2007)	Tracking Number from Comment Table on 2006-2009 AEMP (April 19, 2007)	Condition or Commitment	BHP Response to Condition of Approval (from letter of April 30, 2008)	Hart Review from July 2, 2008	WLWB Staff Recommendations
20	6b		Variability Study 1. As committed to by BHPB, the variability study shall include a component on core sampling and whether or not there is any systemic bias related to this sampling method. The variability study is to address sediment deposition rate and, if necessary, consider 1 cm sampling depths (Tracking Numbers 9 and 31). 2. The variability study is to include shallow water benthic sites and is to consider standardizing sampling on specific substrates and proportional representation of all substrate types for stratified sampling (Tracking Number 19). 3. The variability study is to indicate what constitutes a valid replicate for the purpose of representing within-lake variability (Tracking Number 55).	In the Variability Study Report: o Core sampling is assessed in Section 3.1.4. o Shallow water benthic sites were included where sampling was possible (Section 3.1.5). o Analyzing water, sediment and aquatic biology measurements as independent observations may underestimate the true variability, making statistical tests overly and incorrectly sensitive. The simplest method of dealing with pseudoreplication was to average all measurements from each lake to provide a single observation. Because comparisons were made across lakes and across years, averaging the data within one lake has no effect on the tests of interest and eliminates the issue of pseudoreplication in the AEMP	The Variability Study has adequately addressed the question of sample independence, which was part of Condition 6b. It has not resolved the question of core sampling vs. Ekman sampling of sediments, since cores could not be obtained. Data relevant to variability in shallow water benthic sites were obtained, but not discussed in the context of sediment and benthos sampling design. The report could be improved by further discussion of several issues, as noted above, and particularly by description of the "2007 AEMP error" against which the sampling error within lake sections is said to be small. Further, it would be helpful to clarify whether the larger spatial patterns of within lake variability, eg., between sections, may contribute appreciably to the "2007 AEMP error", and how sampling should be conducted relative to these larger patterns.	**1. Trying to take sediment cores and being unable to do so would satisfy the first part of this condition. However, in the Variability Report there has not been sufficient discussion or reasons given for why the sediment corer did not work – there is only one line that mentions that the lakebed was "loose and sandy". The Board reviewer, Don Hart, believes that continuing with the Eckman sampling should be sufficient, and Board Staff will contact Environment Canada and DFO to see if this is still a problem for them. Board Staff have contacted DFO and EC as of July 30, 2008. At a minimum, BHPB should ask Rescan for more details on why the corer did not work at all. Board Staff note that DDMI has recently investigated taking 1-cm cores in Lac de Gras and found a successful protocol, so it is not clear why this would not work at the Ekati site as**

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						well. ***<u>Update as of Sept. 1, 2008:</u>*** ***BHPB has provided, in their letter of August 27, 2008, the requested detail of why the corer did not work. Board Staff have sent this information to EC and DFO to see if it satisfies their original comments or not. Regardless of their response, Board Staff recommend this issue be revisited during the next three year re-evaluation scheduled to begin in 2009 so that all parties have time to comment. Since the sediment sampling happens only every 3 years – the next time will be 2011 – the re-evaluation review time will work fine.*** **2. This part of the condition has been fulfilled (see also response under Tracking #1).** **3. One problem with the fulfillment of this part of the condition is that the**

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						Board reviewer, Don Hart, could not figure out how the "2007 AEMP Error" as listed in Table 4.3-2 was calculated. There is a footnote to the table to say that the value came from the AEMP report, but Hart could not find it. The comparison of this error rate with the sampling error is an important conclusion and Board Staff would like BHPB's consultant, Rescan, to describe exactly how the "2007 AEMP Error" was calculated. ***Update as of Sept. 1, 2008:*** ***BHPB has provided, in their letter of August 27, 2008, a more thorough explanation of what "2007 AEMP Error" actually means. Rescan, BHBP's consultant, states that the "2007 AEMP Error" represents the total error, quantifying "how much the observations in one lake in one year will vay abou the fitted mean as a result of all sources of***

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						variation". They then go on to explain what those sources of error actually are. In this context, BHPB's conclusion that the sampling error is small in comparison to the 2007 AEMP error makes sense. We can consider this condition as being fulfilled.
21	7		Flushing times (annual, peak and no discharge periods) are to be provided in the February 2008 Report for Leslie, Moose, Nema and Slipper Lakes (Tracking Number 2).	Residence time of surface runoff for lakes downstream of the LLCF are presented by Month in Section 2 of Appendix B.		**This condition has been fulfilled.**
22	8		LLCF Water Quality Modeling: The Board appreciates BHPB's efforts to improve the LLCF water quality modeling. Although this isn't a requirement of BHPB's water licenses, the Board has given a number of approvals, most notably for the use of chloride in the process plant and the Wastewater and Processed Kimberlite	Two reports describing the LLCF water quality model (Versions 1.0 and 2.0) were provided to the WLWB in April 2008. No changes to the AEMP are proposed based on the model results	The modeled chloride concentrations are technically acceptable based on the data currently available, and adequately fulfill Condition 8 in the April 19, 2007 approval letter.	**Several excellent reviews of the LLCF Water Quality Prediction Models Version 1 and 2 were submitted to the Board. In general, reviewers saw a great improvement of the model from Version 1 to Version 2. Reviewers also asked a number of questions of BHPB and made recommendations for revisions to the existing model versions as well as refinements to consider for future**

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			Management Plan, on the understanding that the results of this modeling would be provided to the Board in the near future. BHPB must complete this modeling and update the plan for the AEMP if necessary to address any trends of concern identified in the modeling results. The changes, if any, are to be proposed in the February 2008 Report so that they can be reviewed by the Board (Tracking Number 1). The Board itself may require changes to be made to the plan based on the modeling results			**versions.** **In a letter to the Board, dated July 23, 2008, BHPB points out that these reports are not a condition of the licence, but rather a condition of approval of the 2007-2009 AEMP Re-evaluation. Therefore, they do not believe that they should be required to respond to all the comments nor make revisions to the existing versions.** **Board Staff largely agree with BHPB. According to the Board reviewer, Don Hart, and from Board Staff's own review, the submitted models do fulfill the condition of approval (#8) from the April 19, 2008 directive. Board Staff also note that reviewers were given the following instructions with respect to the review of these models: "Document is not for approval. Reviewers may submit comments which will be forwarded to BHPB and placed on the public registry. If reviewers wish to have their comments considered by the Board in our deliberation of whether these**

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						submissions fulfill the condition of the Board directive of April 19, 2007, comments need to be submitted by June 20, 2008. " Therefore, reviewers should have understood that their comments, while very useful for BHPB, may or may not be used by the Board in considering the fulfillment of this condition. **In their letter of July 23, 2008, BHPB does state that they will be using the information submitted by reviewers during subsequent updates to the model. Board Staff recommend that the Board strongly encourage BHPB to do this as it will benefit all parties, including BHPB, as this model may be used for several aspects of environmental management.**
23	9		Cumulative Effects: Part I, item 3(h) of Water Licence MV2003L2-0013 requires that BHPB include in	The AEMP sampling program includes the waters, sediment and aquatic organisms in	Condition 9 recognizes that BHPB can only contribute information about Ekati related effects or stressors reaching Lac de Gras. This	**Board Staff believe that BHPB is providing an adequate description of how the project is affecting the**

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			the plan for the AEMP "a description of how the project-related cumulative effects on the aquatic environment in the Lac de Gras region will be evaluated, including the effects of contaminant loadings." Although BHPB is not responsible for carrying out a regional cumulative effects assessment on Lac de Gras, BHPB must collect the Ekati-related data that would inform such an assessment. To satisfy the licence condition quoted above, BHPB shall identify all stressors reaching Lac de Gras through the Slipper Lake and Lac du Sauvage drainages and all other pathways sourced at Ekati (e.g. dust deposition) and describe the monitoring needed to document the magnitude of these stressors (Tracking Numbers 3 and 28). This information is to be provided in the February 2008 Report.	the Slipper Lake and Lac du Sauvage drainages. These samples are within the receiving environment upstream of Lac de Gras and are representative of the mine-related effects of water and dust.	information could be part of a larger study of cumulative effects on Lac de Gras from all sources. The December 2006 AEMP Plan for 2007-2009 indicates that BHPB will continue to collect information pertinent to Ekati effects on Lac de Gras, which could contribute to a cumulative effects assessment managed by the regulatory authorities. The Plan identifies sampling locations in Slipper Lake and in Lac de Gras near the outflow from Slipper Lake and further away from the outflow. It also identifies sampling locations in Lac du Sauvage near the outflow from Christine Lake and further away from the outflow. The Plan includes sampling of water and sediment quality, phytoplankton, zooplankton and benthic invertebrates as well as physical limnology measurements, at both Lac du Gras and Lac du Sauvage stations (and at upstream stations). Interpretations of effect at these stations in the 2007 AEMP report, in terms of	**environment with respect to discharges from the LLCF. Although BHPB states that the effects of dust are being captured by AEMP sampling of downstream lakes, Board Staff are not aware of any evidence to this conclusion. No dust monitoring is conducted on site as part of the AEMP, so it is unclear how much dust in generated and where it is landing. Given that the prevailing wind is sin the direction of south and east, there is reason to wonder if dust is making it to Lac de Gras.** **Board Staff would like to discuss this further with BHPB.** ***Update as of Sept. 2, 2008:*** ***In a conversation with BHPB, Board Staff were reminded that dust monitoring is part of their Air Quality Monitoring Program that is required under the Environmental Agreement .***

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					these measured parameters, can contribute to cumulative effects assessment. We find no mention in the Plan of dust deposition as a potential effect in the aquatic environment. It is unlikely to be a large effect in Lac de Gras, but if it contributes to water and sediment quality effects, its effect will be captured in the water and sediment quality measurements, as noted in the 30 April, 2007 letter from BHPB to the WLWB.	***This condition has been fulfilled.***
24	10a		Clarify: It's responses to Environment Canada's comments regarding the purpose of doing triplicate samples for all lake water samples and the archiving of invertebrate samples for at least 5 years (i.e. why will samples only be archived for 3 years?) (Tracking Numbers 30 and 34).	BHP Billiton has "parked" its proposal for triplicate sampling in August as representative of the open-water season, to be revisited during the next 3-year review (2009). BHP Billiton will commit to archiving samples for 5 years.	As regards the archiving issue, BHPB has committed to archive invertebrate samples for 5 years as suggested by Environment Canada. As regards triplicate water sampling in August, BHPB has "parked" this proposal, to be further considered in the next three year review (2009).	**This condition has been fulfilled.**

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25	10b		Clarify: How multiple reference lakes will be treated in the analysis of time trends compared between lakes (i.e. lake x time interaction) (Tracking Number 53)	Measurements sampled from each lake in each year are averaged to create a single grouped observation without any loss of information. Variations in these values are broken into two components: yearly effects that impact the measurements in all lakes; and effects that impact each of the monitored and reference lakes individually. These sources of variation are included in the model as random effects, and the form of the resulting mixed effect model is presented in Section 2.2.3.2 of Appendix A of the AEMP Report.	In the 2007 AEMP, 3 replicate water samples were collected in August in each of the lakes. It is unclear exactly where in each lake they were collected, and therefore what type of variability they represent. Based on the findings of the Variability Study about substantial differences between basins (or sections) within a lake, we wonder if the replicates are spread across basins to collectively represent the whole lake. We understand that replicates are averaged to produce a single open-water value for each lake in each year. It is important to know what spatial entity the average represents, and this should be consistent from year to year. As regards the use of multiple reference lakes, BHPB has tried to explain, and has pointed to Appendix A of the AEMP report for details. From Section 2.2.3.2 of Appendix A, we understand that time trend in an exposed lake is compared to the pooled trend for reference	**This condition has been fulfilled.**

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					lakes, when the reference lakes do not differ. If the reference lakes show different trends, then we simply ask if a trend exists in the exposed lake.	
26	10c		Clarify: The reason why DOC will not be sampled (supporting analysis/justification required) (Tracking Number 49).	BHP Billiton has identified, though other studies, that DOC levels are very low in the local waters and, therefore, not useful in chemical analyses.	As regards DOC, BHPB indicates that DOC is very low in local waters, and therefore not important as a modifier of metal availability. We have not seen the supporting data, but the explanation is reasonable.	**This condition has been fulfilled.**
27	11		Link between the AEMP and Adaptive Management Plan: Part I, item 2(h) of WL MV2003L2-0013 requires that BHPB describe *"…how the results of the [AEMP] will be incorporated in the overall adaptive management strategies employed by [BHPB]."* The Board understands that much of this information will be included in the	The Watershed Adaptive Management Plan (WAMP) (Feb'08) describes specific linkages between the AEMP and the WAMP. A review of the WAMP by the WLWB is pending and will provide opportunity to review these linkages		**The links to the Adaptive Management Plan will be established during the process of review, revision and approval of that plan. If changes to the AEMP are also necessary, these can be explored during the next re-evaluation of the AEMP to begin in 2009.** **This condition is considered to have been fulfilled.**

COMMENT TABLE – (BHPB's Response to April 19, 2007 Directive on the Conditional Approval of the 2007-2009 AEMP Re-evaluation) – Submitted (April 30, 2008)

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			Adaptive Management Plan and that it relates to the results of BHPB's evaluation of effects sizes. The Board will review the Adaptive Management Plan and the report on effects sizes and, if necessary, provide BHPB with further direction on how to address the licence requirements quoted above			