| Issue No. | Commenter & Agency | Date | Issue Theme | Section in TOR | EAC Chapter or Supporting Document | EAC Volume | Additional information or clarification required in Application | Proponent Response | Status of Issue as of 01-24-2011 | Additional Proponent Response | Additional Working Group Comments | Additional Proponent Response | Final PBM Response | Key Project Component Number | Status of Issues as of May 2012 |
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| DFO-001 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 1-Sep-10 | Fish habitat | | | | Section 1.4.2 of the FHCP references the plan in the EAC Application (Appendix AB) which describes the reduction in flow volume in Stream 7 (53400). The FHCP proposes to redesign the diversion channels as described in the EAC Application to enable Tailing Storage Facility (TSF) diversion channel water to flow into Stream 7 (53400) immediately below the TSF seepage dam. The FHCP reports that this redesign of the TSF diversion channel drainage will avoid the dewatering of the upper fish bearing reaches of Stream 7 (53400) and thus eliminate the predicted harmful alteration, destruction or disruption (HADD) to fish habitat at that location. DFO strongly supports project redesign to avoid or minimize predicted harmful effects to fish habitat. To ensure the feasibility and likelihood of success of this proposed redesign of the diversion channels, however, PBM must satisfactorily demonstrate that sufficient flow will be available to the upper portion of Stream 7 (53400). The reliance on mechanical means (i.e.: a pumping system) to achieve sufficient flow rates should also be avoided. | PBM commits to minimize the volume of water retained in the TSF by managing the diversions. This will also mitigate and minimize the reduction of flow in Stream 7. It is not anticipated that there will be any residual effects to Stream 7. However if during detailed design, any residual effects are identified they will be considered as a HADD for which FHCP will be developed. | Unresolved; further discussion required. Information regarding Stream 7 is contradictory regarding diversions, dewatering and the need for a HADD. DFO is unclear whether the proponent is indicating that a HADD is likely or unlikely to occur. DFO would also like to stress that, should an unanticipated HADD occur in the future, a new EA would be required. | The water management plan for the TSF maintains a base flow of 50% (varies from 47% to 70% during operations and initial closure) will be provided in Stream 7, as described in Section 10.2.1 in the RRR Rev.2 and Section 3.2.4.2 in the FHCP March 21, 2011. On closure, 100% of the flow in Stream 7 will be restored will be restored. | Based on the information provided in the Review Response Report - Rev. 2, the July 12, 2011 Memo from Klohn Crippen Berger, and the March 21, 2011 version of the fish habitat compensation plan; the flows in stream 7 will be reduced between 47% and 70% at different stages of construction and operation of the tailings storage facility. The proponent estimates that a 50% reduction in flows in stream 7 will translate into a 540 m2 reduction of spawning and juvenile rearing habitat used by rainbow trout and coho salmon. The area of affected aquatic habitat may be underestimated at stages of the project when there are larger flow reductions (i.e. 70%). | Note that the FHCP Table 3.9 is titled " Summary of Catchment Area Reductions for Stream 53400 due to TSF" however the last line of the table is % of baseline flow that is maintained from the contributing areas. Thus the % reduction in water flow for Stream 53400 is actually the reverse of the values indicated by DFO, e.g. the contributing flows vary from 47% to 70% of baseline (e.g. the percent reductions vary from 30% to 53%). Therefore PBM believes 50% reduction in stream flow is a reasonable basis for determining the effects.<br><br>The effects on fish habitat include the fresh water intake and diffuser. The roads, transmission line and tailings pipelines have been considered and do not add additional effects on fish habitat. | PBM will minimize the volume of water retained in the TSF by managing the diversions. | | |
| DFO-002 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 1-Sep-10 | Fish habitat | | | | In section 2.L2.2 of the draft FHCP, the reduction in the flow of Stream 10 is proposed to be partially mitigated by the addition of tailings water seepage to the stream. As tailings water is restricted from direct discharge to fish habitat at other areas of the TSF, the effects of discharging to Stream 10 should be carefully evaluated. DFO will defer to Environment Canada for the suitability of discharging tailings water directly to fish habitat. | The referenced addition of tailings water is seepage that will not be captured in the seepage collection ponds. This seepage will report to Streams 7, 8 and 10 as well as to Morrison Lake. As documented in the RRR the effects of this seepage are not significant. However proposed water quality objectives will be submitted for permitting prior to construction. | Information / clarification: The proponent should be aware that section 36(3) of the Fisheries Act prohibits the deposit of a deleterious substance of any type into waters frequented by fish or that may enter such waters. | | No further comment | | Noted | | |
| DFO-003 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 1-Sep-10 | Fish habitat | | | | Section 4.2.3 of the FHCP describes the option of placing rock reefs in Morrison Lake as a means of habitat compensation. The rock reefs are described as providing opportunities for cover for juvenile fish species to avoid predation. The DFO Policy for the Management of Fish Habitat (1986) identifies a hierarchy of preferences for achieving no net loss policy of fish habitat. Following avoidance of harmful effects to the productive capacity of fish habitat, the next choice in the hierarchy of preferences is to compensate for lost fish habitat productive capacity with like-for-like habitat. The use of rock reefs would not be considered like-for-like compensation and its use would be considered less preferred in the hierarchy of preferences for maintaining a no net loss of productive capacity of fish habitat. As such, the fuither development of this option is discouraged. | Acknowledged. PBM is not including the rock reefs in the proposed FHCP (Dec 2010). | Resolved. | | | | | | |
| DFO-004 | DFO, Jack Smith | 1-Sep-10 | Fish habitat | | | | The Habitat Compensation Budget described in Section 6 of the FHCP no longer reflects the current understanding of the site conditions or preferred compensation options. DFO will require an updated Compensation Budget table reflecting recent information and understandings of site conditions. The revised table should provide greater detail on the habitat compensation area realised from the expanded "off-lake channel" compensation option originally referenced in the FHCP and further defined in subsequent telephone conversations. | Acknowledged. An updated FHCP (Dec 2010) has been provided. | Unresolved; further discussion required. DFO does not consider this resolved. For example, the new budget does not contain riparian impacts nor does it account for flow related impacts in streams 4-10. A consolidated FHCP tables should be provided which includes riparian areas. | See the FHCP submitted March 21, 2011. Habitat Losses are shown in Table 3.13, 3.14. The habitat balance is provided in Table 4.1. | No further comment | | Noted | | |
| DFO-005 | DFO, Jack Smith | 11-Jun-10 | Project Description | 3 | | | DFO requires the EAC Application include a complete description of all project components that could result in a harmful altercation, disruption or distruction (HADD) of fish habitat. Water management structures, including the effluent diffuser and freshwater intake, were identified as project components that were inadequately described in the information contained within the addendum package, however, the level of detail to determine the phyical areas of potential impacts to fish habitat is not present for these components. These items are also excluded from the fish habitat compensation balance calculations. | Additional descriptions including determination of the physical areas of potential impacts is provided in the FHCP (December 2010). | Resolved. | | No further comment | | | | |
| DFO-006 | DFO, Jack Smith | 11-Jun-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | | | In order to understand existing conditions of Aquatic Resources that could be affected by the project, an understanding of baseline conditions is required. In the screening of the September 2009 Application, baseline characterization of Nakinilerak Lake, Stream 10 (6070) and the area of Morrison Lake adjacent to the proposed low-grade stockpile (LGS) was identified as deficient. The Addendum contains baseline data for Stream 10 (6070) which flows into Nakinilerak Lake but is not provided beyond inferred assumptions from Stream 10 data and some limited sport-fishing data. Sampling along the LGS is limited to a single sediment sampling site (site A) located to the South of the LGS as discribed in the September 2009 application. | PBM commits to collecting Nakinilerak Lake Baseline data prior to construction. In the Fall of 2010, PBM initiated a field work program to commence collection of data. PBM collected additional data from Morrison Lake in 2009 and 2010 and commits to continuing to collect baseline data prior to construction. PBM commits to preparing a consolidated Surface Water Quality database incorporating available data. Proper sampling, QA/QC and analytical procedures will be used. | Unresolved; further discussion required. In order to evaluate the potential environmental impacts of the project and their significance, this information should be included in the EA. | Nakinilerak and additional Morrison baseline data collected to date, including 2011, is included in the RRR Rev.2 Appendix I. Nakinilerak Lake will potentiallly be affected after Year 5 of the project and then only from TSF seepage to Stream 10, whose effects are predicted to be negligible to minor as described in | Relates to water quality. DFO to defer to WQ experts. | Baseline data has been collected for Stream 10 and Nakinilerak Lake. | Noted | | |
| | | | | | | | | | | TSF seepage will report to Streams 7,8 and 10 with negligible seepage reaching Stream 6. Waste rock and Low Grade Ore seepage will be managed using a low permeability glacial til base while runoff will be captured in runoff ditches and pumped to the TSF. (During operations the waste will be stored in a natural catchment area draining into the open pit. Further during operations the area in the vicinity of the open pit will be dewatered to ensure pit wall | Relates to water quality. DFO to defer to WQ experts. | | Condition #14 | | |
| DFO-007 | DFO, Jack Smith | 11-Jun-10 | Aquatic Biology and Fisheries | 5.8 | | | In the Morrison Lake Effects Assessment Report (May 2010) by Klohn Crippen Berger (Appendix AB), additional field studies are recommended to supplement the existing baseline information. These field studies include a shoreline survey, along the east side of the lake to confirm sockeye spawning and confirmation of fish absence from the ponds within the proposed location of the TSF. | Within the Aug 09, 2010 "Fish Habitat Compensation Options" presented to DFO, KCB confirmed again that fish are absent from the ponds within the proposed TSF. | Resolved. | | | | | | |
| DFO-007a | DFO, Jack Smith | 11-Jun-10 | Aquatic Biology and Fisheries | | | | For the shoreline sockeye spawning survey, DFO recommends that the shoreline across from the mine site is also included in the survey. In regards to the confirmation of Fish Absence in the ponds of the proposed TSF area, please be aware that the presence of fish in these ponds may have significant implications to the regulatory requirements for this project. | PBM has contributed funds to LBN for a fish spawning study in the fall of 2010 and awaits LBN submission of the report, which should address shoreline spawning in Morrison Lake. | Resolved. | | | | | | |

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| DFO-008 | DFO, Jack Smith | 11-Jun-10 | Aquatic Biology and Fisheries | 6.8 | | | To maintain a "no net loss" of fish habitat, the potential effects on fish habitat resulting from the project must be adequately described in the Application. Effects on fish habitat from certain mine components and from stream flow reductions are not fully included in the addendum materials or application. The physical efects on fish habitat of the freshwater intake and effluent diffuser is not described in the September 2009 Application or the addendum. Although originally described as an "infiltration gallery" the freshwater intake is now described as a constructed pipeline into Morrison Lake. The effluent diffuser is described as a 200 metre pipeline along the bottom of Morrison Lake. The physical impacts on fish habitat from both of these structures must be considered. Although the potential chemical effects of tailing water discharge is considered for stream 6070, the potenial impacts of flow reduction to this stream do not appear adequately described. | Additional description including determination of the physical areas of potential impacts due to the installation of the fresh water intake and the diffuser are provided in the FHCP (December 2010). Additionally, the effects of tailings water seepage discharged to Stream 10 (6070) are described and considered. | Resolved. | | | | | | |
| DFO-009 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | Habitat Mitigation and Compensation Plan | 9.2 | | | The September 2009 Application did not provide a Fish Habitat Compensation Plan (FHCP) of sufficient detail to ensure that project related environmental effects on fish habitat will be adquately mitigated. The FHCP included in the Addendum did not include the effluent diffuser or the freshwater intake. The HADD table calculations also appear to have removed the riparian areas requiring compensation which were originally included in the September 2009 EAC Application. | Potential impacts to the environment are identiifed and mitigation in the form of a fish habitat compensation plan is proposed in the FHCP (December 2010). Although the discharge pipeline and effluent diffuser are not expected to be installed until Year 45 of the project the effluent diffuser and freshwater intake are considered as immediate potential impacts to the environment. | Unresolved; further discussion required. The proponent's response does not consider the riparian impacts. Consolidated habitat | Consolidated habitat balance table including riparian areas is provided Table 4.1 of the FHCP March 21, 2011. | No further comment | | Noted | | | |
| DFO-010 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | Aquatic Biololgy of Fisheries | 5.8 (b) | | | There is no mention of potential effects to fish from the effluent diffuser installation and discharge into Morrison Lake (as briefly mentioned in section 4.12.4.13 Tailings Dam Construction, page 4-121) and the release of excess water to Morrison lake from the pit (as described in Table 13.3-1, page 13.9). A description of the fish habitat at these locations must be included. | | Resolved. | | | | | | |
| DFO-010a | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | Aquatic Biololgy of Fisheries | | | | Appendix AB Lake Effects Assessment: App. AB recommends additional field studies to supplement the baseline information: Shoreline survey along the east side of the lake near the proposed mine to confirm sockeye spawning (DFO also recommends that the shoreline across from the mine site is also assessed for beach spawning). DFO is extremely concerned that there are still outstanding plans to "definitely confirm the absence of fish in the TSF ponds"(App.AB S13.5,P148). If fish are in the ponds, MMER TIA listing process will be required. The application is incomplete without this confirmation. | Within Aug 09, 2010 "Fish Habitat Compensation Options" presented to DFO, KCB confirmed again that fish are absent from the ponds within the proposed TSF.<br><br>PBM has contributed funds to LBN for a fish spawning study in the fall of 2010 and awaits LBN submission of the report that should address shoreline spawning in Morrison Lake. | Resolved. | | | | | | |
| DFO-011 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | Aquatic Biololgy of Fisheries | 6.8 | | | Section 8.9 states that because there are no fish in the 'affected aquatic environments' no compensation is required. Please note that the Federal Fisheries Act defines Fish Habitat as, "...spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly ".If draining these waterbodies alters the potential to provide these life processes to downstream fish values, than these areas are defined as, "fish habitat" and impacts will require a Fisheries Act Authorization and compensation. Section 8.10.4.3 states that "juvenile fish and egg mortality is possible from reduced water flow ...resulting in dewatering and pool isolation during summer flows and overwinter freezing to the bottom during winter low flows." The application does not adequately detail the amount of habitat that may be lost or may be rendered harmful from the diversions. Fisheries Act Authorization does not permit the destruction of fish. If fish will be killed by other means than fishing, a Sec. 32 Authorization to kill fish will be required. As per CEAA, all phases of the project must be considered, It is predicted that the pit will reach the optimal water level at year 24. After this time, excess water in the pit will need to be released. DFO will need details on how this water | | Resolved. | | | | | | |
| DFO-011 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | d) Flow changes from water management and diversion: and | | | | More information is required on the seepage dams (North and South), polishing ponds and outlet diffuser into the bottom of Morrison Lake. (page 4-121). The diffuser installation will most likely require a Fisheries Act Authorization and compensation. Section 8.10 DFO would like to see more details on the proposed stream diversions including where the flow re-enters the stream, the design of the structures, details of potential downstream impacts from reduced flow on features such as rearing pools, etc | | Resolved. | | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | | | |
| DFO-011a | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | Aquatic Biololgy of Fisheries | | | | App. AB (Lake Effects Assessment) and AC have conceptual designs of the diffuser and water freshwater intake; however, no discussion of installation methods, mitigation and compensation for the physical footprints of the structures is provided. | Additional details are provided in the Aug 09, 2010 "Fish Habitat Compensation Options" and the FHCP (Dec. 2010) as presented to DFO. | Resolved. | | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | | | |
| DFO-011a | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | d) Flow changes from water management and diversion: and | | | | The discharges of the diversions ditches into natural streams are not described. (e.g.: Example the west diversion around the proposed waste rock dump). The descriptions of any potential impacts of the construction of diversion structures (i.e. bank stabilization or disturbance) where clean water will divert to streams are not provided. The construction phase drawing D-3101 shows that initially diversion around the east of the proposed TSF will be directed into stream 53400 (fish bearing). How will this flow then be redirected to over this stream to the main seepage dam during operation? The rationale for excluding a seepage collection dam for the west dam of the TSF is not provided. Appendix AC states, "a seepage collection pond will be constructed downstream of each dam". | Additional details regarding diversion ditches are provided in the Aug 09, 2010 "Fish Habitat Compensation Options" Section 5.2 as presented to DFO. | Unresolved; further discussion required. Seepage dams are not well described. No drawings or other information other than a general description is provided regarding the new diversion ditch plans in section 5.2; | Seepage collection dams will be constructed downstream of the Main Dam, North Dam and West Dam. These dams will be designed and constructed as water retaining dams. The main east diversion alignment is shown on Figure 2.2 of the RRR Rev.2. Design criteria for diversion ditches is provided in the EAC Addendum - Appendix AC. | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | Noted | | | |
| DFO-012 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | e) Impacts from compensation activities. | | | | Incomplete: Section 13.6.8 deals with Monitoring, not with the potential impacts which may result from compensation activities. Please clarify. | | Resolved. | | No further comment. | | | | |
| DFO-012a | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | e) Impacts from compensation activities. | | | | Same comment as initial comment DFO-012 above, | Additional details are included in the FHCP (December 2010). Potential impacts that may result from construction activity include archeological disturbance, erosion, sedimentation, disturbance of vegetation, disturbance of fish and fish habitat and spils. The fish habitat compensation plan includes mitigation measures to address these impacts during construction and as well includes post construction reclamation that includes site restoration, soil salvage and re-vegetation. | Resolved. | | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | | | |
| DFO-013 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | (h) all creeks and rivers that may experience changes to fisheries resources including, but not limited to the Morrison valley, and streams associated with the road access, any linear corridors for pipelines or conveyors, transmission line | | | | There will be a dam/diversion on Stream 6070 which drains into Nakinilerak Lake. This system was described as good quality habitat with beaver dams and a log jam. There is no data to suggest that these barriers are not temporary with a potential for future fish migration/use. Potential impacts to this system from altered flow and potential for spills/accidents should also be considered. | | Resolved. | | No further comment. | | | | |
| DFO-013a | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | (h) all creeks and rivers that may experience changes to fisheries resources including, but not limited to the Morrison valley, and streams associated with the road access, any linear corridors for pipelines or conveyors, transmission line | | | | Appendix AB (Lake Effects) address only the potential for tailings discharge water quality, not flow changes. Flow reduction for Stream 6070 was also not included in Appendix AB Sec 9 - Residual Impacts | Additional details are provided in the FHCP, Appendix III, Fish habitat Compensation Options as presented to DFO. Flow changes are considered therein. | Resolved. | | No further comment. | | | | |

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| DFO-014 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | I) Habitat loss or alteration, including aquatic vegetataion and sensitive areas such as spawning grounds (including shoreline spawning assessment of Morrison Lake), nursery areas, winter refuges and mitration corridors, and riparian (streamside) vegetation | | | | Section 8.10.4.3 states that "juvenile fish and egg mortality is possible from reduced water flow ... resulting in dewatering and pool isolation during summer flows and overwinter freezing to the bottom during winter low flows." The application does not adequately detail the amount of habitat that may be lost or may be rendered harmful from the diversions. Fisheries Act Authorization does not permit the destruction of fish. If fish will be killed, by other means than fishing, a Sec. 32 Authorization to kill fish will be required. DFO requests more details on the calculations of "partial loss of fish habitat Table 13.6-2) as a result of altered flow. It was not explained how the predicted loss of flow was equated to a loss of stream width nor was it explained what impacts to rearing areas, migration areas and overwintering pools will occur as a result of the altered flow. An instream flow analysis to assess the potential impacts of flow reduction, Rescan 2009, was mentioned on page 13-43. The results of the study should be available for the review of the application. This information is required to determine the potential for a HADD resulting from reduced flow. This will also assist in the determination if the compensation plan is feasible to offset the HADD. More information is required on the seepage dams (North and South), polishing ponds and outlet diffuser into the bottom of Morrison Lake. (page 4-121). The diffuser installation will most likely require a Fisheries Act Authorization. | | Unresolved - Details regarding stream flow alterations is not clearly described for Stream 7 | Details regarding Stream 53400 (Stream 7) are provided in Section 3.2.4 of the FHCP March 21, 2011. | No further comment. | | Noted | | |
| DFO-014a | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | I) Habitat loss or alteration | | | | Addendum Appendix AB, Section 9 Residual effects is a re-statement of Table 13.6-2. There is no further explanation for the calculation of lost stream width (and no reference to the Rescan flow analysis). In addition the new version of the table omits the riparian removal calculation in the Fish Habitat Losses. The two documents are contradictory and DFO cannot conclude on the extend of the HADDs and if the compensation is feasible to offset the HADDs (thus concluding on the significance of effects). | Additional details are provided in the FHCP, Appendix III, Fish habitat Compensation Options as presented to DFO. Flow changes are considered therein. Additional information pertaining to the effluent diffuser and freshwater intake are provided therein. | Unresolved; further discussion required. A single consolidated habitat balance table, including riparian areas is required. | Consolidated habitat balance table including riparian areas is provided Table 4.1 of the FHCP March 21, 2011. | No further comment. | | Noted | | |
| DFO-014b | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | I) Habitat loss or alteration | | | | There is no mention of potential effects to fish from the effluent diffuser installation and discharge into Morrison Lake (as briefly mentioned in section 4.12.4.13 Tailings Dam Construction, page 4-121) and the release of excess water to Morrison lake from the pit (as described in Table 13.3-1, page 13.9 ). The installation of diffuser may require a Fisheries Act Authorization. | | Resolved. | | No further comment. | | | | |
| DFO-014c | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 10-Jan-11 | I) Habitat loss or alteration | | | | DFO cannot issue Sec 35.2 Authorizations for the HADD of fish habitat from the deposit of a deleterious substance. Note: page 132 of Appendix AB states, "seepage and effluent discharge may also be considered as HADD of fish habitat and therefore compensation would be required. The Fisheries Act does not Authorize the HADD of fish habitat resulting from the deposit of a deleterious substance. The deposit of a deleterious substance into waters frequented by fish constitutes a violation of Sec 36 of the Fisheries Act. | Potential effects from effluent diffuser to fish are found in Addendum Appendix AB (Lake Effects Assessment) as well as in FHCP, Appendix III, Fish habitat Compensation Options. Acknowledged regarding deposition of a deleterious substance. | Physical effects of diffuser resolved but DFO defers to EC for Section 36.3 advice. | | No further comment. | | | | |
| DFO-014d | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | I) Habitat loss or alteration | | | | It is unclear if the streams crossed by the tailings pipeline (buried) and/or water pipeline (above ground) will impact fish or fish habitat (including riparian habitat). The potential for habitat alteration or loss has been described when upgrading stream crossings (culverts bridge pilings). However the section then continues that DFO operational statements will be used to minimize these impacts. Please note that if the DFO OS are used properly there can be neither installation of culverts in fish streams nor any encroachment into the natural channel. It is unclear if a Fisheries Act Authorization will be required for any of the stream crossings. | Acknowledged. | Information: Any areas with potential HADDs should be identified. | | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | | | |
| DFO-014e | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | I) Habitat loss or alteration | | | | It is unclear what structure will be required when the diversion channel around the TSF converges with the mainstem of 53400. Will this convergence adversely impact rainbow trout habitat? DFO has asked the proponent to conduct detailed field assessments to confirm that the stream reaches within the proposed Tailings Management Area are non- fish bearing. Neither Fig 7.10-1 indicates that any recent assessments have occurred. No further assessment results are included in the Appendices nor mentioned in the body of the application. It is imperative that this work is conducted to ensure that the TIA is not located in fish-bearing waters. If the TIA is within fish-bearing waters, this would require a listing of the watercourse on Schedule 2 of the MMER. | | Resolved. | | No further comment. | | | | |
| DFO-014e | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | I) Habitat loss or alteration | | | | The Addendum Appendix AB includes a new table: 9.2 page 129 with Fish Habitat Losses. Reference to riparian vegetation removal (which was included in the initial application, Volume 3,13-35, Table 13.6.2) has been removed. Impacts from riparian removal must also be included in the final calculation of predicted HADDs and requirements for compensation. | Additional details are provided in the Aug 09, 2010 "Fish Habitat Compensation Options" as presented to DFO. Riparian removal is considered and included in the compensation plan. | Unresolved; further discussion required. Riparian information is not included in the December 7 plan. | Consolidated habitat balance table including riparian areas is provided Table 4.1 of the FHCP March 21, 2011. | No further comment. | | Noted | | |
| DFO-015 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | HADD rationale and proposed compensation plan | | | | Section 13.6.5.1 (page 13-38) proposes a plan to divert flow to just below the south seepage dam rather than the originally planned south trib of stream 53400. The report talks of the benefit of maintaining this section of fish habitat (977 m) but with significantly section of fish habitat (977 m) but with significantly alterations to baseline flow. The report continues that no conpensation would therefore be required. | | Information: Water diversions are unclear based on updated information. | | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | Noted | | |
| DFO-015a | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | HADD rationale and proposed compensation plan | | | | Addendum AB, 10.3.3 lists potential compensation options but maps to show the proposed locations are not provided. Proposed areas for compensation are listed but the treatments to enhance the productive capacity are not provided. For example, what are Pacific Booker's plans for Olympic Lake? What are the plans to enhance the productive capacity to gain 22.5 ha in habitat? | Additional details are provided in the Aug 09, 2010 "Fish Habitat Compensation Options" as presented to DFO. Further details are also provided in the FHCP (December 2010). | Response satisfactory. | | No further comment. | | | | |
| DFO-016 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | HADD rationale and proposed compensation plan | | | | DFO agrees that relocation and re-design to first minimize impacts is encouraged, DFO would require additional information and rationale as to why continued reductions to flow would not alter fish habitat, before we could agree that no HADD or compensation would be required. | | Unresolved - Stream flow impacts to to Stream 7 must be confirmed. | Details regarding Stream 53400 (Stream 7) are provided in Section 3.2.4 of the FHCP March 21, 2011. | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | Noted | | |
| DFO-016a | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | HADD rationale and proposed compensation plan | | | | DFO will require a more detailed conceptual fish habitat compensation plan to determine if the options are feasible and adequate to offset predicted HADDs. Also the HADD calculation must also include losses of riparian function (as included in the original application), impacts from the installation of the diffuser, rational for the HADD calculation for 'partial' loss in streams, loss of fish-bearing streams, removal of riparian vegetation associated with transmission lines and pipeline installation. | Additional details are provided in the Aug 09, 2010 "Fish Habitat Compensation Options" as presented to DFO. Riparian removal is considered and included in the compensation plan (Dec 2010). | Unresolved: Updated Consolidated Habitat balance table requested. | Consolidated habitat balance table including riparian areas is provided Table 4.1 of the FHCP March 21, 2011. | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | Noted | | |
| DFO-017 | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | 9.2 Habitat Mitigation and Compensation Plan | | | | Section 13.6 should provide a table of projected HADD's (including any impacts from effluent diffusers, road and pipeline crossings and reduced flow) and projected habitat units gained by the proposed compensatory ponds. Can enough ponds be built in this reach of Stream 53400 to offset the productive capacity of all HADD's to the proposed 2:1 ratio? (NOTE: DFO has not endorsed this ratio as the desired target) | | Unresolved: Updated Consolidated Habitat balance table requested. | Consolidated habitat balance table including riparian areas is provided Table 4.1 of the FHCP March 21, 2011. | No further comment. | | Noted | | |
| DFO-017a | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | 9.2 Habitat Mitigation and Compensation Plan | | | | Table 13.6.2 remains unchanged. Appendix AB has a different table than the original and has removed the reference to riparian removal impacts. Impacts from the installation of the diffuser and riparian removal from installation transmission lines, pipelines and diversions are not included in the addendum table. | Additional details are provided in the Aug 09, 2010 "Fish Habitat Compensation Options" as presented to DFO. Further details are provided in the FHCP (December 2010). | Unresolved: Updated Consolidated Habitat balance table requested. | Consolidated habitat balance table including riparian areas is provided Table 4.1 of the FHCP March 21, 2011. | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | Noted | | |
| DFO-017b | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | 9.2 Habitat Mitigation and Compensation Plan | | | | If detailed HADD/Compensation values are not available at this time, the section should at least provide a general range of expected HADD's and a specific max. area (or HIS) that can be constructed in this reach. Until this information is provided, DFO can not determine id the compensation option is feasible to offset teh project HADD's. December 2010: HADD associated with the Freshwater intake as described in Appendix AC is not included in FHCP | Additional details are provided in the Aug 09, 2010 "Fish Habitat Compensation Options" as presented to DFO. Further details are provided in the FHCP (December 2010). | Unresolved: Updated Consolidated Habitat balance table requested. | Consolidated habitat balance table including riparian areas is provided Table 4.1 of the FHCP March 21, 2011. | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | Noted | | |
| DFO-017c | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | 9.2 Habitat Mitigation and Compensation Plan | | | | Compensation locations were identified but the application is still devoid of any detail as to what habitat enhancement/creation is proposed. DFO cannot determine the extent of the predicted HADDs and will not be able to determine the significance of effects based on the compensation information provided. The application recommends that a preliminary fish habitat compensation plans is developed for discussion with DFO and EAO. This must be part of the application. | Additional details are provided in the Aug 09, 2010 "Fish Habitat Compensation Options" as presented to DFO. Further details are provided in the FHCP (December 2010). | Resolved. | | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | | | |
| DFO-017d | DFO, Jack Smith/Alasdair Beatty/Patty Menning | 11-Jun-10 | 9.2 Habitat Mitigation and Compensation Plan | | | | No maps of the proposed compensation options, design drawings or description of the enhancement or creation of habit were provided. | Additional details are provided in the Aug 09, 2010 "Fish Habitat Compensation Options" as presented to DFO. Further maps and drawings are provided in the FHCP (December 2010). | Unresolved; further discussion required and a single, comprehensive and final version of the plan must be provided. | See FHCP March 21, 2011. | No further comment. | | Noted | | |
| DFO-018 | DFO - Jack Smith/Alasdair Beattie | 24-Jan-11 | Fish habitat | | Dec 2010 - FHCP | | In regards to the description of environmental effects of the project, the potential impact on flow levels in Stream 7 should be clarified. The effect of the project on the flow volumes of stream 7 is described differently in the Application, the Addendum and the Fish Habitat Compensation Plans of August 2010 and December 2010. The potential for flow reduction in Stream 7 should be clearly described based on current understandings along with a description of the resulting need for compensation if an impact to fish habitat appears unavoidable. | | Unresolved. Carry forward. | Details regarding Stream 53400 (Stream 7) are provided in Section 3.2.4 of the FHCP March 21, 2011. | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | Noted | | |

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| DFO-019 | DFO - Jack Smith/Alasdair Beattie | 24-Jan-11 | Fish habitat | | Dec 2010 - FHCP | | The technical feasibility of the off channel rearing/spawning habitat is not suitably demonstrated in the plan. Additional information supporting the predicted fish habitat functionality of these features is requested. Details regarding the maintenance of adequate flow levels within the proposed channels should also be included. | | Unresolved. Carry forward. | Feasibility of the proposed compensation is provided in Section 4.2.1 and Section 4.5.1 of the FHCP. Compensation is provided at a 3:1 ratio. | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | Noted | | |
| DFO-020 | DFO - Jack Smith/Alasdair Beattie | 24-Jan-11 | Fish habitat | | Dec 2010 - FHCP | | As a general comment, it is unclear if the December 2010 version of the FHCP is intended to replace August 2010 version of the plan or if both plans are to be used in conjunction with each other. Both plans are inconsistent and contradict one another and the December 2010 plan does not contain information that is present in the August 2010 version. In order to gain an understanding of issues relevant to fish habitat compensation planning, a single comprehensive document would be preferred. | | Unresolved. Carry forward. | The March 2011 FHCP supersedes all previously submitted plans. | No further comment. | | Noted | | |
| DFO-021 | DFO - Jack Smith/Alasdair Beattie | 24-Jan-11 | Fish habitat | | Dec 2010 - FHCP | | In order to better demonstrate that dialogue with Aboriginal Groups has occurred regarding impacts to fish habitat and habitat compensation, consultation efforts should be better documented in the FHCP. Additional detail regarding specific concerns of Aboriginal groups and proposed solutions should be described. | | Unresolved. Carry forward. | Dialogue with Aboriginal Groups and involvement is provided in Section 1.2 of the FHCP. | No further comment. | | Noted | | |
| DFO-022 | DFO - Jack Smith/Alasdair Beattie | 24-Jan-11 | Fish habitat | | Dec 2010 - FHCP | | The compensation gains anticipated from the improvements to Olympic Lake are not sufficiently described. Since the lake is currently functioning as fish habitat, the benefits to productive capacity from improving fish access are not readily apparent. Improvements to the Olympic Lake outflow stream, however, may present opportunities for contributing to compensation values. | | Unresolved. Carry forward. | This is provided in Section 4.3 with the Habitat Gain described in Section 4.3.4 of the FHCP. | It is DFO's opinion that additional assessments, including those identified in Section 4.3.4 of the Fish Habitat Compensation Plan (March 21, 2011 version), would be needed in order to determine the technical feasibility of this proposal and to estimate how much it may increase productive capacity of fish habitat. Additional information would be needed if this proposal is included as part of a future application for a Fisheries Act authorization. | | EMP | | |
| DFO-023 | DFO - Jack Smith/Alasdair Beattie | 24-Jan-11 | Fish habitat | | Dec 2010 - FHCP | | Habitat balance tables do not appear to include riparian areas in the December 2010 Fish Habitat Compensation Plan. In order for DFO to consider the environmental effects of the project and the mitigation measures proposed in the Fish Habitat Compensation Plan, riparian area values are requested. | | Unresolved. Carry forward. | This is provided in Section 3.5 and Table 4.1 of the FHCP. | No further comment. Additional information may be needed if a Fisheries Act authorization is required. | | Noted | | |
| DFO-024 | DFO | 5-Jun-12 | Surface water quality | | | | Updated effects assessments, mitigation measures, and significance determinations for surface water quantity (e.g. estimates of changes in flow to local streams, Morrison River, and Morrison Lake, accompanied by new mitigation measures if required (e.g. temporary shutdown of mining activities, diverting "clean" pit-dewatering water to Morrison Lake to increase flow). | The report states that the flow reductions are not large enough to have significant adverse effects. | | | Although PBM predicts that the flow reductions will not have significant adverse effects on fish and fish habitat, the claim is unsubstantiated. Without sufficient baseline habitat information for Morrison River and a detailed prediction of flow effects, DFO is unable to determine the magnitude of the impacts to fish habitat and the downstream fishery as a result of the project. It is recommended that a substantiated effects assessment on Morrison River be conducted during the EA phase of the project. It is inappropriate to conduct a follow-up program to verify the proponent's prediction that there will be no adverse effects to physical fish habitat due to flow augmentation without the appropriate baseline data. It is usually necessary to establish a baseline against which follow-up results can be compared. The baseline information for Morrison River habitat is lacking as is the effects assessment. | | Condition #23 | | |
| DFO-025 | DFO | 5-Jun-12 | FHCP | | | | Updated Fish Habitat Compensation Plan including information and commitments related to determining the biological benefits and technical feasibility of the Olympic Lake compensation proposal. | PBM will work with DFO and LBN to design and construct fish habitat compensation measures that meet the habitat compensation replacement requirements identified in the FHCP. PBM are committed to the FHCP and its implementation. PBM will carry out a detailed design of the feasibility of Olympic Lake compensation proposal and work with DFO and LBN to ensure that the compensation measures are successful, or, if they are ultimately not feasible, than other alternative compensation measures will be designed and constructed. | | | DFO is currently unable to determine the extent of the potential habitat loss as a result of the proposed project therefore, it is difficult to assess whether the FHCP as proposed is sufficient to offset that loss. DFO will require a technically, economically, and biologically feasible FHCP prior to issuance of a Fisheries Act authorization, should the project proceed to the regulatory phase. | | Carry Forward to Permitting | | |
| DFO-026 | DFO | 5-Jun-12 | Table of Commitments (TOC) | | | | Update Table of Commitments (TOC) reflecting new mitigation measures, commitments and any associated requirements (e.g. collecting additional baseline winter flow data for Morrison River and the local streams). | PBM has developed a TOC which will be integrated into the Project Description. PBM will incorporate key EMP components into the Project Description and continue to work with the EAO and CEAA to finalize the TOC and Project Description. | | | PBM has provided an updated TOC and has integrated it into the Project Description. | | Project Description and Conditions | | |
| DFO-027 | DFO | 5-Jun-12 | Sockeye Habitat | | | | Additional information regarding the potential effects of the Project on sockeye habitat within Morrison River, its side channels and Morrison Lake relating to reduced stream flows (i. e. an assessment of the amount of suitable habitats resulting from reduced flows) | PBM commits to the flow monitoring station on Morrison River which will be upgraded to ensure winter measurements and access. Baseline mapping of the low flow channels will be carried out to quantify the potential extent of habitat that may be affected during low flow periods. | | | DFO agrees with PBM that additional flow sampling and baseline mapping of the low flow channels are necessary; however it is recommended that this information be collected during the EA phase of the prject to inform the determination of significance of adverse environmental effects. In addition, minimum flow requirements in Morrison River have not been established. Prior to issuance of a Fisheries Act authorization, flow requirements acceptable to DFO will be agreed upon. | | Condition #23 | | |
| DFO-028 | DFO | 5-Jun-12 | Supplemental water augmentation | | | | Suitability of the supplemental water (flow augmentation in to Morrison River) should be assessed to ensure that, if used, it would not result in impacts to physical fish habitat (e. g. metal precipitation in stream beds can fill interstitial spaces and lead to reduced productivity of fish habitat). | Any discharge of water to augment the low flow will be directly into Morrison Lake and will meet all water quality objects described in 3rd Party RRR Addendem1. | | | DFO reiterates the concern that supplemental water augmentation in Morrison River should be assessed to ensure that, if used, would not result in impacts to physical fish habitat. Confirmation of this can occur during the regulatory phase of the project should it proceed. | | Condition #23 | | |

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| EC-01 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix AB | Addendum; RRR | Environment Canada notes the results of the water quality modeling do not appear to correlate with our experience. The model predicts relatively low levels of sulphate and other parameters compared with other tailings ponds. SO4, for example, is predicted to be 64 mg/L for base case at end of mining (Appendix AB, Table 3.2). Compare this to levels typically in excess of 1000 mgIL in tailings ponds where water is recycled to the mill. Some discussion regarding why the model predicts such low levels of SO4 and other parameters is warranted. The text on page 20 in Appendix AB implies tailings slurry was not taken into account as a model input. | Revised water quality predictions are presented in the RRR. | See below. | | | | Noted | | |
| EC-01a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Hydrogeology and Groundwater Quality and Quantity | | | | The revised water quality predictions in the Review Response Report (RRR) acknowledge that Morrison TSF water may be analogous to Bell and Granisle. Predicted impacts on local creeks and Morrison Lake may be significant. The proponent should describe management strategies to reduce these risk factors. | | Unresolved. Carry forward. | The TSF management plans for operations and pre-closure are described in Sections 4.1 and 4.2 with mitigation and adaptive managment described in Sections 4.3 and 4.4 RR Rev.2. The predicted impacts on the receiving streams and Morrison Lake are provided in Section 10.2 of RRR-Rev.2. Management strategies to reduce the risk factors is presented in Section 12.1 of the RRR-Rev.2. | | | PBM will, during detailed design, determine the best application of the alternatives to manage the water balance with the goal of achieving a zero contact water discharge during operations and to minimize the accumulation of surplus water. | | |
| EC-02 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix AC; Appendix AX | Addendum | It is proposed that the TSF will have seepage collection ponds immediately downstream of two dams, and that seepage through the dams will be captured and potentially reclaimed back to the TSF. It is not clear whether these dams are designed to capture all the predicted seepage through the bottom of the facility (as high as 365 m3/hr) or whether tailings pore water will infiltrate through the overburden till formation and/or the underlying fractured bedrock and eventually report to surface receptors downstream of the seepage collection ponds. It is important that seepage from the TSF be reduced as much as possible. | The dams will intercept seepage water, local runoff and residual water from the cyclone sand construction of the dams. Water captured in the pond will be recycled to the tailings impoundment. The TSF seepage collection ponds are not designed to collect 100% of the seepage from the bottom of the TSF. As modelled and reported in the EAC Application some seepage does bypass the seepage dams and report to surface receptors downstream of the seepage collection ponds. | See below. | | | | Noted | | |
| EC-02a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Hydrogeology and Groundwater Quality and Quantity | | | | Seepage that bypasses the collection ponds and reports to surface waters must be monitored and must meet requirements specified by the MMER. | | Information / clarification point. | | | | Noted | | |
| EC-03 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Construction and Operation EMPs | 9.1 | 4.19.1 | I | The Morrison project description currently includes considerable seepage from the TSF (e.g., Chapter 4 Project Description, Section 4.19.1; Table 4-19.1). The requirements of the MMER for a final discharge point do not accommodate seepage from the sides and base of an impoundment. The current mine plan may not comply with the MMER in this regard. | PBM understands that MMER definiton of effluent includes both surface discharge and seepage. As such PBM understands that the MMER regulations will be applicable to the Morrison Project as seepage from the TSF will be > 50 m3. However PBM will seek clarification on the MMER as it applies to the Project from Environment Canada during the permitting phase. | See below. | | | | Noted | | |
| EC-03a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Construction and Operation EMPs | | | | The proponent should understand at the environmental assessment stage how the MMER applies so that risks may be understood and project specifications changed if necessary to manage the risk. | | Information / clarification point. | | | | Noted | | |
| EC-04 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Construction and Operation EMPs | 9.1 | 4 | I | There is one instance where the mine plan describes a discharge to the receiving environment that would clearly be an MMER final discharge point and as such would need to be identified and monitored. On page 4-121 the mine plan includes "Seepage collection dams will comprise a lined polishing pond to receive any excess water together with flows from the dam drainage and seepage systems for final cleaning, if necessary, and monitoring before release. There will also be a discharge system from the polishing pond into the bottom of Morrison Lake terminating with an outlet diffuser." Seepage is defined as effluent by the MMER and as such cannot be released except as a proper final discharge point that is monitored and shows parameters to be within required limits. | The quoted statement from Pg 4-121 is incorrect and superceded by information provided in the Addendum, notably Appendix AC.The seepage collection ponds will intercept seepage water, local runoff and residual water from the cyclone sand construction of the dams. Water captured in the pond will be recycled to the tailings impoundment. The TSF seepage collection ponds are not designed to collect 100% of the seepage from the bottom of the TSF. As modelled and reported in the EAC Application, some seepage does bypass the seepage dams and report to surface receptors downstream of the seepage collection ponds. Some seepage from the TSF to streams and lakes is considered in the effects assessments. PBM commits to monitoring the seepage at discharge points to ensure the water quality meets site specific water quality objectives. | See below. | | | | Condition #13 | | |
| EC-04a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Construction and Operation EMPs | | | | The response is satisfactory. For MMER requirements, the seepage must be monitored at a point where its release to the receiving environment is under the control of the mine operator; up-gradient of the seepage contacting fish-bearing waters. | | Resolved. | | | | | | |
| EC-05 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Construction and Operation EMPs | 9.1 | 2.6 "Water Balance" | RRR | MMER requires that a mine "not combine effluent with water or any other effluent for the purpose of diluting effluent before it is deposited" (sec.6). It is expected that diverted clean water contributes to watercourses down-gradient of the mine site as natural runoff, and drains in due course to Morrison Lake, Diligent diversion of clean water serves to minimize the proportion of runoff lost to the landscape due to the presence of the mine's operational area, as well as address the dilution question. | PBM commits during detailed design to determine the best application of the alternatives to manage the water balance to achieve zero contact surface water discharge during operations and minimize the accumulation of surplus water. For example PBM commits to diverting, as far as practical, clean surface water around the TSF at various stages during operations. Additional details of the water balance are provided in the RRR. | See below. | | | | PBM will, during detailed design, determine the best application of the alternatives to manage the water balance with the goal of achieving a zero contact water discharge during operations and to minimize the accumulation of surplus water. | | |
| EC-05a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Construction and Operation EMPs | | | | Environment Canada understands that, as far as practical, the proponent will divert clean surface water arising outside the operations area away from the operations area, at all stages during mine operations. | | Resolved. | | | | | | |
| EC-06 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Construction and Operation EMPs | 9.1 | Appendix AC; 2.6 "Water Balance" | Addendum RRR | There is a troublesome description of clean water reporting to the TSF. One of the water inputs planned for the TSF is "runoff from undiverted catchment areas" (p.4-191) and Table 4.19-1 includes that item in the inputs to the TSF. The proponent elsewhere reported that the TSF has an uphill drainage area of approximately 5 km2" (p.4-59). Runoff from the uphill drainage to the TSF must be properly diverted away from the TSF as much as practicable. | PBM commits during detailed design to determine the best application of the alternatives to manage the water balance to achieve zero contact surface water discharge during operations and minimize the accumulation of surplus water. For example PBM commits to diverting, as far as practical, clean surface water around the TSF at various stages during operations. Additional details of the water balance are provided in the RRR. | Unresolved; see below. | All non-contact water will be diverted to the maximum extent feasible. Remnant areas are referred to as "undiverted catchment" - Refer to Section 7 of the RRR-Rev.2 | | | PBM will, during detailed design, determine the best application of the alternatives to manage the water balance with the goal of achieving a zero contact water discharge during operations and to minimize the accumulation of surplus water. | | |
| EC-06a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Construction and Operation EMPs | | | | MMER-compliant effluent may be released; but the risks of such release must be assessed during the environmental assessment. | | Unresolved. Carry forward. | All discharges are within the metal mining effluent regulations (MMER). Refer to Section 10.2.2.2 of the RRR Rev.2. | | | | | |
| EC-07 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Construction and Operation EMPs | 9.1 | 2.6 "Water Balance" | RRR | The proponent expresses this plan: "the diversion ditch on the east side of the TSF will be actively managed throughout operations, The upstream catchment area to this diversion ditch is 355 ha (which represents 111 m3/hr of the total "runoff from the undiverted catchment area" in Table 4.19-1). The ditch will be fitted with a flow control structure so that, as necessary, water can be diverted into or around the TSF to achieve management objectives." Routing a clean diverted stream back to the operations area (in this case the TSF) does not meet the expectations of the MMER. If the mine will need make-up water for milling or other processes, then it is expected that the new water (additional to operations area runoff and seepage) would come from a source properly licensed by the province. | PBM commits during detailed design to determine the best application of the alternatives to manage the water balance to achieve zero contact surface water discharge during operations and minimize the accumulation of surplus water. For example PBM commits to diverting, as far as practical, clean surface water around the TSF at various stages during operations. Additional details of the water balance are provided in the RRR. If new water is needed at the mine, it will come from a source properly licensed by the Province. | See below. | | | | PBM will, during detailed design, determine the best application of the alternatives to manage the water balance with the goal of achieving a zero contact water discharge during operations and to minimize the accumulation of surplus water. | | |
| EC-07a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Construction and Operation EMPs | | | | See EC-05 and EC-06. We understand that the proponent would acquire new make-up water for the milling process, if necessary, from a source properly licensed by the Province. | | Resolved. | | | | | | |
| EC-08 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Construction and Operation EMPs | 9.1 | 2.6 "Water Balance" | RRR | When a mine ceases operation and wishes to stop monitoring under the MMER, the mine must give notice that it intends to become a "recognized closed mine". This status is achieved three years after the notice is received if conditions are met. During the three years the mine must conduct one final Environmental Effects Monitoring (EEM) program and otherwise continue all routine monitoring. Additional monitoring may be required by the MMER if new discharge points are introduced during the three-year conditional period. PBM currently predicts that the Morrison TSF "will fill to the closure spillway elevation within three years after mining ends" (Figure 4.19-1). If Morrison succeeds in operating as a mine with no MMER discharge, PBM may choose to manage their water balance to avoid making a "last minute" discharge point under MMER. Subsequent discharges are subject to the Fisheries Act, subsection 36(3). | Clarification of the MMER pertaining to new discharge points developed within the three-year conditional period is appreciated. PBM may choose to manage the water balance to avoid making a "last minute" discharge point under MMER. The updated water balance documenting expected discharge is provided in the RRR. | No further comment received from agency. | | | | Noted | | |

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| EC-09 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Construction and Operation EMPs | 9.1 | Appendix AC | Addendum | All runoff resulting from precipitation falling on the operations area, including waste rock dumps, low grade ore and overburden stockpiles, the TSF, buildings. roadways and open areas is considered effluent. This effluent should be managed and only released through a proper final discharge point, which is monitored to ensure releases are within required MMER limits. Further, the mine should exercise due diligence in diverting all clean water from areas outside the operations area. There is also a risk of uncaptured seepage from the waste rock dump reporting directly to Morrison Lake. PBM estimates that 10% of waste rock dump seepage will not be captured (Vol_ 2, Section 8.6.5,2). | Acknowledged. PBM understands the definition of effluent as stated in the MMER includes surface discharge and seepage. The runoff from precipitation that by definition is effluent will be managed and will only be released through monitored discharge points. PBM commits during detailed design to determine the best application of the alternatives to manage the water balance to achieve zero contact surface water discharge during operations and minimize the accumulation of surplus water. For example, PBM commits to diverting, as far as practical, clean surface water around the TSF at various stages during operations. The "10% seepage" has been updated in Appendix AC to be 0.63 m3/hr from the LGO rather than 3.5 m3/hr from the WRD. | See below. | | | | PBM will, during detailed design, determine the best application of the alternatives to manage the water balance with the goal of achieving a zero contact water discharge during operations and to minimize the accumulation of surplus water. | | |
| EC-09a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Construction and Operation EMPs | | | | See EC-06. We understand that the proponent plans to manage effluent and to release it only through monitored discharge points. | | Resolved. | | | | | | |
| EC-10 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | 3.1 "Open Pit Proximity to Morrison Lake", DWG: Waste Rock Dump and Open Pit Cross Section | RRR | The proximity of the proposed pit to Morrison Lake and the potential for contaminated groundwater flux from the pit lake to Morrison Lake during operations and especially on closure represents one of the most significant potential risks to water quality in the study area as a result of the Project. This is exacerbated by the risk of significant acid drainage from the waste rock dump to the pit lake and the risk of significant acid drainage from exposed pit walls. It is recognized that pit lake water quality may be very poor post-closure and not suitable for discharge to the receiving environment without treatment. A clear understanding of the hydrogeological interaction between the pit and Morrison Lake and implementation of proper hydraulic control of pit water levels will be essential for mitigating potential impacts to Morrison Lake. | The proponent agrees that a clear understanding of the interaction between the pit and Morrison Lake and proper hydraulic controls of pit water levels is very important. Morrison Lake at a position adjacent to the open pit attains has a maximum depth of 9.1 m whereas the open pit has a maximum depth of 372 m. The open pit will be dewatered during operations, thus eliminating the risk of poor quality water seeping into Morrison Lake during this period. During closure, the pit will fill with water until at an elevation several metres below the level of Morrison Lake. This ensures hydrodynamic containment of pit water and eliminates seepage out of the pit into Morrison Lake, again reducing risk of contaminating Morrison Lake. Furthermore, a water treatment plant will operate after closure to ensure that the pit water reaches permitted water quality before being released. | See below. | | | | Noted | | |
| EC-10a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Hydrogeology and Groundwater Quality and Quantity | | | | The proponent appears to assume in the RRR that the flow of potentially contaminated groundwater from the pit to Morrison Lake is the only concern in terms of hydrogeology for this area. The proponent does not quantify or discuss the impact that dewatering the pit and the adjacent rock formation may have on the overall water balance of Morrison Lake. It is our view that the area is not sufficiently characterized to have confidence that proposed monitoring and management actions can deal with the risk of negative impact to water quality to Morrison Lake and/or significant effects on the overall water balance of Morrison Lake. Further studies should be designed and carried out to advance our understanding of this risk factor and actions to mitigate and manage risk should be described. | | Unresolved. Carry forward. | The overall water balance of Morrison Lake is addressed in Section 10.2.3 of the RRR Rev.2. The Adaptive Management Plan for the potential flows between the lake and the open pit are shown in Section 6.4 and summarized in Table 12.1 of the RRR Rev.2. | | The water balance has been updated for the 3rd Party Review Response Report. | | | |
| EC-11 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Table 18.4-1; Appendix 4; Appendix I, AG | III; IV; Addendum | A good understanding of the hydraulic conductivity of the formation between the two water bodies will be important. The presence of faults and fractures has been identified in the bedrock between the proposed pit and nearby Morrison Lake. We are not certain whether the substrate of Booker Creek has been evaluated. ... Such structural features between the pit and Morrison Lake will control and facilitate the movement of water within, the formation and could not only lead to significant inflows to the pit during excavation but also to significant fluxes of groundwater from the pit to Morrison Lake. As such, it will be important to implement proper mitigation measures to reduce the permeability of the fractured rock and/or faults which may be intersected during pit excavation. Such mitigation would not only reduce pit inflow rates but could greatly reduce the potential for contaminated groundwater movement between the pit and Morrison Lake. | The pit wall stability has been assessed in geotechnical studies for the Project (EAC Appendix 4, Addendum Appendices I & AG). Dominant discontinuities in the west wall of the pit are generally steeply oriented and favourable for pit slope stability (see MEMPR Peter Lighthall comment on Open Pit). Regarding the evaluation of Booker Lake and Ore Pond substrate, please see the response to MEMPR (Peter Lighthall) Comment #1. PBM will undertake a comprehensive stability management program for the open pit as part of the requirements for Mines Act Permitting. In addition, PBM has committed to a pit wall stability program during construction, operations and closure (EAC Application, Vol III, Table 18.4-1 item #4.81). | See below. | | | | Noted | | |
| EC-11a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Hydrogeology and Groundwater Quality and Quantity | | | | The proponent's response focuses on the issue of pit wall stability and appears to assume that water flow rates are sufficiently understood so as to be manageable. Data supporting this assumption are not presented. Pumping tests and more characterization of the area between Morrison Lake and the pit should be done now to predict not only groundwater inflow rates to the pit but also possible impact to the Morrison Lake water balance. anagement actions to reduce risk should be described. | | Unresolved. Carry forward. | Seepage between Morrison Lake and the open pit is addressed in Section 6.3 and 7.3 of RRR Rev.2. The Adaptive Management Plan for the potential flows between the lake and the open pit are shown in Section 6.4 and summarized in Table 12.1 of the RRR Rev.2. | | The seepage between Morrison Lake and the open pit is addressed in the 3rd Party Review Response Report. | | | |
| EC-12 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix AB, Fig. 3.3; Figure 3.1 | Addendum; RRR | It would be useful to present a cross-section through the proposed pit and to Morrison Lake showing the relative elevations of both with an interpretation of geology, major faults, and groundwater movement between the two during the different phases of training. These should include pit dewatering phases during pit excavation through to long-term closure. Environment Canada did not find any such information in the sections reviewed. | A cross-section through the open pit and Morrison Lake is found in Addendum Appendix AB 'Lake Effects', figure 3.3 (this section has 2x vertical exaggeration). Additionally, a new drawing in the RRR "Waste Rock Dump and Open Pit Cross Section" shows a cross section through the waste rock dump, the open pit and Morrison Lake. Cross-sections at various stages of pit dewatering were not a requirement of the TOR and thus not included in the EAC Application. PBM commits to generate the indicated diagrams and supporting information during the detailed engineering phase of the Project. | | | | | Noted | | |
| EC-12a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Hydrogeology and Groundwater Quality and Quantity | | | | While federal agencies participate in the cooperative environmental assessment led by the British Columbia Environmental Assessment Office (BCEAO) process, if, as in this case, an issue arises that requires additional information, this information may be requested under federal mandates. The predicted depth of the water table and groundwater flow patterns between the lake and the pit during dewatering and mining is important to demonstrate understanding of the interaction between the pit and Morrison Lake. This information should be provided now so risk factors can be assessed and alternate management strategies developed if necessary. | | Unresolved. Carry forward. | The hydrogeology database and groundwater modeling are addressed in Section 6.3 of the RRR Rev.2. | | The hydrogeology database and groundwater modeling are addressed in the 3rd Party Review Response Report. | | | |
| EC-13 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | | | Hydraulic conductivity (K) values for the pit have been estimated from hydraulic testing of monitoring wells installed within the proposed pit area, Hydraulic testing (ie., packer testing) was performed for estimating bedrock K values. It was noted that K values for the pit were measured to a maximum depth of 150 m (Section 3.2.2.13, Hydrogeology Baseline Report). However, the pit is proposed to extend to a depth of more than 450 m which means that no K values have been measured for the bottom 250 m of the proposed pit. | PBM commits to additional hydrogeologic study of dewatering during detailed design phase as well as on-going during operations as required to ensure pit wall stability. | See EC-10a. Unresolved. Carry forward. | The hydraulic conductivity at depth has been reasonably interpreted from the data from the site, which generally indicates decreasing hydraulic conductivity with depth, which is a reasonable assessment. The pit dewatering flows and Morrison Lake potential inflows is addressed in Section 6.3 and 7.3 of the RRR Rev.2. . | | | Condition #15 | | |
| EC-14 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | 3.1 "Open Pit Proximity to Morrison Lake", DWG: Waste Rock Dump and Open Pit Cross Section | RRR | Ongoing active treatment of pit water to maintain hydraulic gradients from Morrison Lake to the pit (i.e. maintaining an elevation difference of 4 m) is the proposed long-term closure water management strategy. It is conceivable that water levels in the pit may periodically rise to levels above those of Morrison Lake due to events such as storms, mechanical pump failure, loss of power to the site, problems with the treatment process, etc. The predicted flux of groundwater towards Morrison Lake under such conditions and the resulting impacts should be discussed. Additionally, a technical rationale should be presented to explain the adequacy of the 4 m elevation difference to achieve the management goal. | PBM emphasizes that the depth of Morrison Lake immediately adjacent to the open pit is a maximum of 10 m deep (see drawing "Waste Rock Dump and Open Pit Cross Section"). Therefore the relative head, even if the pit lake elevation marginally exceeds Morrison Lake elevation, will cause negligable seepage. A significant increase in pit lake elevation above the level of Morrison Lake for an extended period of time is required to cause seepage of any signficance into Morrison Lake. Additionally, the rate of pit re-fill is slow such that the 4m elevation difference represents ~ 6 months pit filling with no water extracted and treated. As such no single storm event will fill the pit to an elevation in excess of Morrison Lake. Furthermore, the interrruption of operation of the treatment plant due to failure will be limited in duration as the design for the Water Treatment Pump includes dual redundant pumping systems and back-up power generation and remote monitoring in real time to guard against such events. | See below. | | | | | | |
| EC-14a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Closure, Decommissioning and Reclamation | | | | See EC-10. The proponent should provide information to support their assertion that maintaining Pit Lake level 4 m below Morrison Lake on closure will be sufficient to protect water quality in Morrison Lake. | | See EC-10a. Unresolved. Carry forward. | With the revised closure plan presented in the RRR Rev.2, the pit pond level will be kept the same as Morrison Lake. The hydrogeolgical assessment of potential contaminant transport from the PAG porewater to Morrison Lake is presented in Section 10.2.4 of the RRR Rev.2. | | The hydrogeologic modeling presented in the 3rd Party Review Response Report supports the assessment that maintenance of the pit lake level below the elvevation of Morrison Lake, will virtually eliminate seepage from the open pit to the Lake. | Conditon #16 | | |

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| EC-15 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | | | The issue of chemical stratification within the pit should be discussed. | PBM will monitor the pit lake after the pit refills to the maximum level. If stratification occurs and has the potential to degrade the open pit water quality, such that the water treatment plant efficiency was compromised, PBM will implement strategies to artificially mix the pit lake waters. | See below. | | | | | | |
| EC-15a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Closure, Decommissioning and Reclamation | | | | The proponent appears to assume that the potential for chemical stratification is sufficiently understood so as to be manageable. Data supporting this assumption are not presented. Further analysis should be done now, and management actions to reduce risk should be described. | | Unresolved. Carry forward. | The revised Closure Plan presented in the RRR Rev.2 pit lake is replaced by a pond of approximately 10 ha in area and 3m deep therefore for the current design seasonal turnover of pit lake water is not at issue. | | | Conditon #10 | | |
| EC-16 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | 16.4 Appendix AC | III Addendum | The proponent states that when the plant site is decommissioned, industrial waste will be stored in the base of the open pit and any hazardous waste will be either disposed in an engineered facility or shipped off site. The disturbed areas will be covered with soil and reclaimed. More detail should be provided regarding the type and amount of industrial waste proposed to be stored in the base of the open pit. | Details regarding closure of the mine, reclamation activities and disposal of industrial waste are found in EAC Application Vol III, Section 16.4, also in Addendum Appendix AC, section 6.5. As stated, disposal of material will be done under permits and with due attention to environmental concerns and contamination. Materials earmarked for disposal in the open pit may include inert industrial waste, some concrete structures from plant site buildings (mill, administration buildings, truck shop, explosive facilities) and TSF structures (tailings conveyance and cyclone preparation facilities). Contaminated soils or materials will be disposed (under permit) in an engineered landfill or shipped off-site to a suitable waste management facility. Materials will be checked for contamination before being disposed in the open pit. | No further comment received from agency. | | | | | | |
| EC-17 (1) | Environment Canada, Stephen Sheehan | 1-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix AC, DWG D-3303 | Addendum | More detail is required in the Application regarding where the plant will be sited, how it will be designed, when it will be constructed and when it will be operational. It should be recognized that the treatment plant may be required to operate indefinitely. Additional details should include where the lime for the treatment plant will come from, how if will be transported to the site, where it will be stored, and where the high density sludge will be disposed of. | WTP will be constructed Year 45 when the pit lake is full and will be operational in Year 45. Pit lake levels will be monitored from Year 19 onwards in order to better predict filling and timing for the construction & commissioning the WTP. The WTP will be situated at the former mill building site and a temporary sludge containment structure will be located at the site of the former coarse ore stockpile (see App. AC, DWG D-3303). (Continued below) | Unresolved; see below. | See below. | | | Condition #17 | | |
| EC-17 (1)a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Closure, Decommissioning and Reclamation | | | | The response is incomplete: the type of chemical proposed for pH adjustment/-neutralization (acid) as well as locculation chemicals mentioned in Appendix AA, section 3.2.3, page 19 were not identified in the documents nor were the expected rates of consumption, storage and handling addressed. The proponent should clarify the types of chemicals that will be utilized as this could affect the final effluent quality (i.e., using H2S04 for pH adjustment can increase sulphide concentrations in effluent). | | Unresolved. Carry forward. | Refer to RRR Rev.2, Section 9.4. The water treatment plant uses conventional technology with CO2 bubbling systems and aeration for pH adjustment. | | | Noted | | |
| EC-17 (2) | Environment Canada, Stephen Sheehan | | Closure, Decommissioning and Reclamation | 9.3 | Appendix AA, AC, AB | Addendum | | PBM recognizes the WTP may be reqired indefinitely; the reclamation bond will cover operations and maintenance requirements for the WTP as required by MEMPR. Details pertaining to the WTP are found in App. AA 'Conceptual Design for a High Density Sludge WTP', App. AC 'Water Management Design, section 6) with further details on WTP technologies to be assessed as part of an adaptive management plan (as stated in App. AB, section 13.3). MEMPR (Lorax, section 4.6, para 3) states that the WTP conceptual design represents a proven technology for treating mine waste waters and is adequate for EAC Application evaluation. Lime is to be sourced from a regional supplier and be transported to the mine site via highway legal truck. | Unresolved. Carry forward. | Refer to RRR Rev.2, Section 9.4. The water treatment plant uses conventional technology with CO2 bubbling systems and aeration for pH adjustment. | | The water treatment plant design has been modified to reduce concentrations of aluminum, cadmium, iron and zinc. | Condition #19 | | |
| EC-18 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | | RRR | Consideration should be given to water management strategies post-closure that account for plant downtime due to maintenance or plant upsets. Contingency plans should be in place to deal with water that is unacceptable for discharge when the plant is not operating or when plant treatment capacity is exceeded. | See reply to EC-10. Further the rate of pit re-fill is slow such that the 4m elevation difference represents approximately 6 months pit filling with no water extracted and treated. Further the plant has sufficient latent capacity (ie 50% excess design capacity) to process any excess accumulated water. This provides significant contingency sufficient for the major plant repair. | Unresolved. Carry forward. | The water management plan for the open pit assumes that all water within the pit area requires treatment. The attenuation pond is designed to contain 4.5 months of storage plus ice, providing sufficient attenuation for "upset" conditions. Addtionally the general pit area has a large capacity for storage of water during plant shutdowns or system "upsets" or unusual rain events. | | | Condition #16 | | |
| EC-19 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Assessment of Alternative Options | 3.9 | Appendix T | Addendum | The alternatives analysis for different tailings storage facility locations appears to have been extensive. However, an analysis of different disposal methods was not done. The proponent apparently considers co-disposal of waste rock in the tailings facility to be too expensive. The proponent should provide some discussion of the technical merits of co-disposal so that the option can be accepted or rejected on that basis. Other methods of managing tailings should also be considered. | Addendum App. T discusses waste rock storage alternatives including co-disposal of waste rock in the TSF. Consideration was given to environmental factors as well as economic factors. Technical merits of co-disposal are well known and documented in the literature. Some of the drawbacks associated with co-disposal for the Project include: increased TSF footprint, increased mine influence on a second watershed (Nakinilerak) and concommitant environmental risks, increased GHG emissions due to longer waste rock haul distances. Co-disposal does not necessarily eliminate the need for a water treatment plant. Also, the configuration of terrain in the Project area lends itself separate disposal because the WRD is situated in a natural amphitheatre that drains towards the open pit, lessening environmental risks of deleterious seepage & runoff. Finally, the Proponent emphasizes that there is no variety of feasible designs to choose from, rather, the Project as presented is the sole economically feasible configuration and has been designed with high standards of environmental protection. | Unresolved; see below. | See below. | | | | | |
| EC-19a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Assessment of Alternative Options | | | | It is Environment Canada's view that the current mine plan configuration poses unacceptable risks of significant adverse environmental effects. The proponent should consider other configurations and/or mitigation strategies to enable the project to proceed. | | Unresolved. Carry forward. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The segregation of Rougher and Cleaner tailings for management purposes represents the best "State of Practice" for tailings management. | | 3rd Party Review Response Report - Addendum | | | |
| EC-20 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Assessment of Alternative Options | 3.9 | Appendix Z | Addendum | Environment Canada has reviewed the plant locations and notes that the plant sites that were considered were all located near the pit. While plant site location near the pit would normally be a reasonable siting approach, there is a greater potential for impacts to water quality from plant activities at this particular mine site. Were any other locations considered? What other locations further away from the pit and lake are possible? | Addendum App. Z discusses plant location alternatives. The Commentor's statement that there are greater risks to water quality from near-pit plant site locations for the Morrison Project, presumable due to the proximity of the pit to Morrison Lake, is not supported by any references or comparisons that PBM can respond to. Groundwater is everywhere in the ground and accidental spills and seepage are risks attendant at any plant site for all mining project. The Morrison plant site will be constructed with due attention to drainage containment and protection of water quality. Finally, the Proponent emphasizes that there is no variety of feasible designs to choose from, rather, the Project as presented is the sole economically feasible configuration and has been designed with high standards of environmental protection. | Information / clarification point. No further comment from agency. | | | | | | |
| EC-21 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Assessment of Alternative Options | 3.9 | Appendix T | Addendum | The waste dumps and low grade stockpiles are located near the pit and Morrison Lake. The proponent argues that the waste rock cannot be co-disposed because it is not cost effective. However, co-disposing the potential acid generating (PAG) waste rock in the tailings storage facility may reduce risk to water quality at the mine site. | See response to EC Comment #19. | Information / clarification point. No further comment from agency. | | | | | | |
| EC-22 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Assessment of Alternative Options | 3.9 | | RRR | If the dumps remain in place as stated in the Application, an extensive leachate collection and treatment system may be needed. Not only does the operation of a collection system pose a cost but the system has long term risks to receiving water quality that can be avoided if the waste is co-disposed. Also, the location means that dusting from the dumps is likely to contribute to deterioration in water quality of the receiving waters. | Co-disposal of waste rock in the TSF will not eliminate the need for a water treatment plant as even without the waste rock dump water will still accumulate in the open pit that is not suitable for direct discharge and the open pit will still fill to a level that requires water be pumped out, treated and discharged. | Further discussion required. Carry forward. | The RRR Rev.2 presents a new mine closure plan, which includes placement of PAG waste rock back into the open pit. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. These | | | Noted | | |

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| EC-23 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Assessment of Alternative Options | 3.9 | Appendix AA, Appendix AB | Addendum | There is a greater area of water drainage that will need to be captured and treated should the waste dumps be established. Using a treatment plant to resolve water quality issues should be viewed as a last resort rather than the key management tool to control water quality characteristics of the effluent leaving the site. The location and management of the waste rock as outlined in Section 15.6 of the Application presents a high risk of discharge of contaminated water via ground and surface water to the receiving waters of Morrison Lake. | Use of a High Density Sludge Water Treatment Plant is an acceptable and proven technology for managing mine waste waters at minesites around the world. For the Morrison Project, the waste rock dump is favourably situated in a natural amphitheatre that drains towards the open pit. This terrain configuration provides an additional level of risk control for any contact runoff or seepage that may come from the waste rock dump. Drainage and/or seepage from the waste rock dump will drain towards and/or be captured by the open pit before reaching Morrison Lake. | Further discussion required. Carry forward. | The RRR Rev.2 presents a new mine closure plan, which includes placement of PAG waste rock back into the open pit. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. These changes result in significant environmental benefits to the project. | | | Noted | | |
| EC-24 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Assessment of Alternative Options | 3.9 | Appendix Y | Addendum | Other locations for the low grade ore and overburden stockpiles may reduce the risk to receiving water quality. The proponent should present their assessment of alternate locations or material handling methods. | Low grade ore stockpile location alternatives are discussed in Addendum Appendix Y. The location of the overburden stockpile may be re-assessed by PBM when LBN submits their site investigation report. | Further discussion required. Carry forward. | RRR Rev.2 provides an update of plan pre-stripping and storage of overburden and soil for use in reclamation. Quantities and storage location(s) modified with overburden stockpile removed from Morrison Point and placed 700m inland per Section 5.1.3 of RRR Rev.2. On closure, PBM commits to placement of any un-milled LGO into the open pit. A contingency plan for ensuring adequate storage is provided in Section 4.4.3 of RRR Rev.2. | | | Noted | | |
| EC-25 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrology and Surface Water Quality and Quantity | 6.6 | 7.5; 2.6 "Water Balance" | I; RRR | Based on the information contained within the Application, Environment Canada concurs with the proponent that the proposed mining operations will have a low effect on surface hydrology. Mine processing water will be recycled from the engineered tailings storage facility, and augmented with local runoff and groundwater to meet the Project's water requirements. The techniques used by the consultant (refer to Section 7.5 of the Application) to estimate watershed runoff for various return periods are accepted methods found in hydrologic practice. According to the report, the TSF, as designed, will not reach overflow potential throughout the mine life. The proponent has selected the design capacity of the diversion channels and TSF make-up water control structure, again based on accepted hydrologic methods, in order that the capacity of the TSF will not be adversely affected by local runoff. | Acknowledged that the project will have a low effect on surface hydrology. An updated water balance re-asserting the viability of zero surface discharge during operations is provided in the RRR. | Resolved. | | | | | | |
| EC-26 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix AB, Pg iii; 2.1 | Addendum; RRR | Baseline groundwater monitoring programs involved the installation of monitoring wells and the collection of samples for total and dissolved metals analyses. Although both total and dissolved metals concentrations are discussed in the project material, it should be recognized that total metals concentrations are not relevant for the interpretation of baseline groundwater quality and the interpretation of metals transport in groundwater. Total metals concentrations from conventional monitoring well sampling are affected by the presence of suspended solids (i.e., turbidity associated with well development, sampling techniques, drilling methods) and as such can be quite elevated and variable between samples. Dissolved metals concentrations should be used for the interpretation of groundwater quality and impact predictions. | Dissolved metals concentrations were used for the interpretation of groundwater quality and impact predictions as documented in the Addendum and RRR. TSF seepage and closure pond water quality assessment has been changed on the basis of using dissolved concentrations. | Resolved. Information / clarification point. | | | | | | |
| EC-27 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | | | Well elevations have not been surveyed accurately as required for detailed and accurate hydrogeological predictions of groundwater gradients and water levels, and flow directions. The proponent should ensure that all existing and future monitoring wells and stations are accurately surveyed for both position and elevation. Differences of a few centimeters in water levels can be quite significant when interpreting hydraulic gradients and consequently groundwater flow directions and velocities. | PBM commits to ensure that all existing and future monitoring wells and stations are accurately surveyed for both position and elevation. | Requires further discussion; carry forward. | | | | PBM will ensure that all existing and future monitoring wells and stations are accurately surveyed for both position and elevation. | | |
| EC-28 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix 24 | VIII | A very elevated pH of 12.1 was detected in groundwater from well MW07-07A (Section 4.2, Hydrogeology Baseline Report). Chemistry data is included in the baseline hydrogeology reporting, although it is recognized that the anomalous elevated value could be attributed to interference from grout seal and that data from the well is questionable (Section 4.5, Hydrogeology Baseline Report). This should be further investigated and reliability of the data should be assessed. | PBM commits, for MW07-07A, investigating the cause of the elevated pH and assessing the reliability of the data. | Requires further discussion; carry forward. | | | | Comment noted | | |
| EC-29 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrology and Surface Water Quality and Quantity | 6.6 | Appendix 26; Appendix 27 | IX | Baseline water quality monitoring was conducted from 2006 to 2008. Most sampling was conducted monthly with weekly freshet monitoring completed in May/June 2008. Raw data is presented in Appendices 26 and 27 and summarized in Vol. 1, Table 7.4-2. Summary data provides minimum, maximum, and median values but not number of samples, average, and 95$^{th}$ percentile values; this additional data summary would be useful. Data are summarized for 15 stations, though four of these have too few data to be useful. The other 11 stations are well located and provide a good baseline dataset. Additional pre-2006 baseline results are reported in the Addendum but do not appear to be summarized. | Acknowledged | Resolved. Information / clarification point. | | | | | | |
| EC-30 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrology and Surface Water Quality and Quantity | 6.6 | Appendix25; Appendix AB; 4.0 "Morrison Lake Effects" | Vol IX; Addendum; RRR | Downstream water quality predictions are made only for Streams 7, 8, and 10 (Appendix 23). Predictions for Morrison Lake and Morrison Creek would be useful. It would also be useful to predict water quality in Stream 6. as this is the key fisheries creek on the property that may be affected. The predictions that are made suggest the Project may have significant effects on water quality, but predictions may not be useful due to the conservative nature of the modeling process. When conservative assumptions are used significant impacts may be predicted when, in reality, effects may be smaller: this makes it difficult to interpret the results of modeling exercises. The proponent could explore the effects of their water quality model assumptions by predicting water quality at a reference site which is not expected to change. | The tailings storage facility is located in a transition zone of groundwater discharge and groundwater recharge, receiving flow from the high land in the southeast, and discharging flow into the neighbouring watersheds MCS-7, MCS-8 and MCS-10 (ie not MCS-6), towards Morrison Lake and Nakinilerak Lake. Morrison Creek and Lake are included within the water quality, aquatic resources, and fisheries assessments, but are NOT considered a VEC based on their standalone value. Babine Lake has been included within the cumulative effects assessment. Morrison Lake effects are addressed in the Addendum and updated in the RRR and were assessed to not be signficant. | Unresolved; see below. | See below. | | | | | |
| EC-30a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Hydrology and Surface Water Quality and Quantity | | | | Our assessment of the information presented suggests there is a risk of unacceptable water quality effects on Morrison Lake. It is immaterial to us whether Morrison Lake is recognized as a VEC in the BCEAO process. Our concern relates to the water quality that should be maintained in Morrison Lake. Additionally, the risk of cumulative effects on Babine Lake is considered to be high, and must be better understood. | | Unresolved. Carry forward. | The RRR Rev.2 presents a new mine closure plan, which includes placement of PAG waste rock back into the open pit. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. These changes result in significant environmental benefits to the project. The residual effects on Morrison Lake and cumulative effects on Babine Lake have been assessed and documented in the RRR Rev.2 (Sections: 10 and 11). The cumulative effects of the water flow and water quality, particularly on Morrison River and Babine Lake, are negligible and not significant. | | The effects on receiving streams and Morrison Lake have been further mitigated as described in the 3rd Party Review Response Report - Addendum 1 | Condition #20 | | |

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| EC-31 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Hydrology and Surface Water Quality and Quantity | 6.6 | Table 5.2.4, Pg 5-10; Appendix AB; 4.0 "Morrison Lake Effects" | I; Addendum; RRR | Conservative water quality predictions are useful if they indicate that standard water quality guidelines (i.e.. CCME or BC Water Quality Criteria) are not exceeded even in worse case scenarios. This works because we can then be confident that water quality is protected for aquatic life or other valued uses even if the Project has effects. We can not be certain this is the case for the proposed Project because predictions are not made for Morrison Lake or Creek. It is, however, Environment Canada's position that the conservative, worst-case scenario approach is not adequate for the proposed Project. Given the potential for cumulative effects on the Babine Lake system as a result of the proposed Project interacting with the effects of the existing closed mines, in addition to our low risk threshold tolerance for effects from the Project, it is our view that more stringent water quality objectives than the generic standards should be applied to Morrison Lake and Creek. The current water quality modeling process is not adequate to determine whether more stringent objectives could be achieved. | Morrison Creek & Lake are included within the water quality, aquatic resources, and fisheries assessments, but are NOT considered a VEC based on their standalone value. Babine Lake is included within the cumulative effects assessment. Morrison Lake effects are addressed in the Addendum and this assessment is updated in the RRR. Morrison Lake effects are assessed to not be significant. The water quality entering Morrison Creek is expected to be equivalent to the Morrison Lake steady state water quality. The cumulative effects on downstream water bodies including Morrison River and Babine Lake should result in only minor effects to some parameters within the variability of the baseline data.<br><br>Regarding the closed mines, PBM is unaware of any material documenting changes in Babine Lake water quality that are directly attributable to the two closed mines. PBM understands that, per 2009 reporting to MOE, both mines are in compliance with MOE permits, and that water management & ongoing monitoring at the mine sites will continue to ensure that water quality in Babine Lake remains protected into the future. | Unresolved; see below. | See below. | | The effects on receiving streams and Morrison Lake have been further mitigated as described in the 3rd Party Review Response Report - Addendum 2 | Condition #20 | | |
| EC-31a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Hydrology and Surface Water Quality and Quantity | | | | Our assessment of the information presented suggests there is a risk of unacceptable water quality effects on Morrison Lake. It is immaterial to us whether Morrison Lake is recognized as a VEC in the BCEAO process. Our concern relates to the water quality that should be maintained in Morrison Lake. Additionally, the risk of cumulative effects on Babine Lake is considered to be high, and must be better understood. | | Unresolved. Carry forward. | The RRR Rev.2 presents a new mine closure plan, which includes placement of PAG waste rock back into the open pit. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. These changes result in significant environmental benefits to the project. The residual effects on Morrison Lake and cumulative effects on Babine Lake have been assessed and documented in the RRR Rev.2 (Sections: 10 and 11). The cumulative effects of the water flow and water quality, particularly on Morrison River and Babine Lake, are negligible and not significant. | | The effects on receiving streams and Morrison Lake have been further mitigated as described in the 3rd Party Review Response Report - Addendum 3 | Condition #20 | | |
| EC-32 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Aquatic Biology and Fisheries | 6.8 | 8.8.6.1; 8.8.6.2; Appendix 26; Appendix 27 | III Addendum | Sediment particle size baseline data (Appendix 26, Figure 3.2-1 and Appendix 27, Figure 3.2-1) is not comparable between years. For example, Stream 5 has the finest sediment of all sites in 2006 but the coarsest sediment of all sites in 2007. It is intermediate in 2008. Other sites show the same variability. The data suggest that sites are pseudo-replicated and are not representative of the streams they are intended to characterize. These results suggest considerable uncertainty for all sediment quality data. | The significance of most residual effects to sediment quality was assessed as negligible with one exception that was assessed as minor. Based on the current available information the confidence level in the predictions made for this effects assessment is high for almost all effects. Where this was not the case (effects at the mine site for ML/ARD and discharges; all phases) a confidence level of intermediate was chosen. | Unresolved; see below. | See below. | | | | | |
| EC-32a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Aquatic Biology and Fisheries | | | | Collected baseline data is insufficient to make any conclusions. | | Unresolved. Carry forward. | Appendix I RRR Rev.2 documents overall data collection. Note that PBM collected additional data in 2009, 2010 and 2011. The data collected up to January 2011 was used in preparing RRR Rev.2. | | | Noted | | |
| EC-33 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | Appendix G | Addendum | It is noted in Section 8,1.1 (Volume II) of the Application that "The proposed Morrison mine will be a 30,000 tpd open pit operation with ore processed in a conventional milling plant and the copper/gold concentrate transported to the Port of Stewart for shipment to offshore smelters." Environment Canada recommends that the Application provide detailed information regarding the distance to/from the Port of Stewart from the project site, as well as the route and mode that will be used to transport materials to/from the Port of Stewart | Detailed information on the concentrate haul route from minesite to Port of Stewart is outlined in Addendum Appendix G 'Off-site Access, Roads and Vehicles'. Section 4 discusses the haul route along Forest Service Roads, Section 5 discusses the haul route along MOTI roads and provides maps, and Section 6 outlines alternate transportation routes. In addition, this report describes the type of haul truck configuration that will be used (Section 2). | Resolved. Information / clarification point. | | | | | | |
| EC-34 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | Appendix 20 | VIII | Section 8.2.3 (Volume II) of the Application states, "Diesel, propane, and electricity will provide the primary energy sources for the Project. All mobile and transportation equipment will use diesel'. Environment Canada recommends that each of the emission sources be accompanied by relevant supporting information to confirm that the emissions are minor. For example, necessary supporting information for combustion sources includes details on all of the diesel combustion equipment, heavy duty vehicles, stationary sources, etc... to verify emissions estimates and could include: • The number of pieces of equipment used; • The model years of the equipment; • The power of each piece of equipment (in units); • The hours of operation for each piece of equipment (some provided); • The total volume of fuel used (in units); • Assumed emission factors and clear identification of assumptions and references (it is acknowledged that some are provided); • Models used in developing emission profiles (some provided): and • Description of any pollution control devices. | Detailed enumeration of the model, number, hours of usage and specifications of equipment used and their rated emission rates for Nox, CO, PM and SO2 are found in EAC Application Appendix 20 'Air Dispersion Modelling Detailed Model Plan', Section 2. | Resolved. Information / clarification point. | | | | | | |
| EC-35 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | 8.2.3 | II | Section 8.2.3 (Volume II) of the Application states `Total emissions from the Project are minor in comparison to total national, provincial, and metal mining industrial emissions." While it is helpful to calibrate the facility emissions to the provincial and national totals, this is not an adequate rationale for classifying greenhouse gas (GHG) emissions as 'minor." It is highly unlikely that a single project would ever represent a significant portion of national or provincial GHG emissions. Environment Canada recommends that the assessment of project-related GHG emissions include the emissions intensity of the operation, with a comparison to GHG emissions for similar mines. It is acknowledged that a comparison of the emissions intensity projected for the Project to the metal mining sector is provided. Environment Canada recommends that supporting information be provided on the metal mining sector that this project was compared to i.e. size of mines, capacity of mines, numbers of mines etc. | Environment Canada has 2008 data on GHG for industrial projects across Canada availbale from their website at http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=DF08C7BA-1#section3. Although there are few mining projects listed in the database, the Morrison Project GHG emissions can be compared with Highland Valley Copper Mine GHG emissions (in 2008). Highand Valley Copper (copper and molybdenum) reported a total of 151.2 ktonnes CO2-eq with a milling rate of 130,000 tonnes per day; this is in comparison with projected values for Morrison Copper/Gold Project of 30.2 kt CO2-eq for Year 1 Operations with a milling rate of 30,000 tonnes per day. This translates to a rate of 3.2 kg CO2-eq per tonne of ore milled for Highland Valley Copper and 2.8 kg CO2-eq per tonne of ore milled for Morrison Project. The Morrison Project therefore will emit less GHG per tonne of ore milled than Highland Valley Copper Mine. | Resolved. Information / clarification point. | | | | | | |
| EC-36 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | 8.2.3 | II | Note as well, that the assessment of GHG emissions should include both on-site and off-site emissions, including transport of materials to/from the site to the Port of Stewart. | GHG emmissions were calculated for the transport of materials to/from the site on the Access Road. The on-highway segment of transport of concentrate trucks will travel 2.5 million km per year. Based on 1.75 km/litre these trucks will consume 1.43 million litres of diesel per year. At the same emissions rate as used for other Project diesel emissions this results in approximately 4 kt CO2-eq or 0.4 kg CO2-eq per tonne of ore milled. Therefore inclusion of the on-highway segment results in CO2-eq equal to that of Highland Valley Copper. | Resolved. Information / clarification point. | | | | | | |
| EC-37 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | Appendix 20 | VIII | As part of Mitigation and Management, Section 8.2.4 (Volume II) of the Application states "Where possible use mobile equipment/vehicles powered with liquefied natural gas (LNG)", Environment Canada recommends that detailed information be provided on the equipment/vehicles (as described in comment above, 8.2.3) in order to verify that emissions are minor. | PBM has completed a study of the use of Liquified Natural Gas for on-site mobile equipment including mine haul trucks and intends to investigate this option further during detailed design. If the use of LNG is implemented significant reductions in emissions should result. The EAC Application was not based on the use of LNG. Detailed enumeration of the model, number, hours of usage and specifications of equipment used and their rated emission rates for Nox, CO, PM and SO2 are found in EAC Application Appendix 20 'Air Dispersion Modelling Detailed Model Plan', Section 2. | Resolved. Information / clarification point. | | | | | | |
| EC-38 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | | | PBM's environmental policy includes commitments to foster a healthy environment and protect air quality, as well as the application of best industry practices and techniques to company operations,....These commitments extend to energy consumption and GHG emissions." Please note that recommendations 341 and 415 of the Environmental Code of Practice for Metal Mines suggest carbon reduction and measures to control GHG emissions respectively. As such, Environment Canada suggests that GHG emissions should be minimized to the extent practicable (i.e. within economic and technological capabilities). | PBM commits to minimizing GHG emissions to the extent practicable (i.e., within economic and technological capabilities) for a viable and profitable project. PBM commits to the use of only modern and properly maintained equipment for the Project and Ultra Low Sulphur diesel subject to its regional availability. NB: PBM has completed a study of the use of Liquified Natural Gas for on-site mobile equipment including mine haul trucks and intends to investigate this option further during detailed design. If the use of LNG is implemented significant reductions in emissions should result. | Certificate commitment required. | | | | Condition #27 | | |

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| EC-39 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | 8.2.3 | II | As part of the Assessment Assumptions (Section 8.2.7.3. Volume II) it is stated "The calculated GHG emissions were based on the estimated annual diesel, propane, and hydroelectrical consumption provided by PBM for the Project.' Environment Canada recommends that supporting information be presented regarding the methodology used to estimate annual diesel, propane and hydroelectrical consumption. | Propane consumption, energy, and intensity were calculated using section 12, Tier C Method from the Climate Registry's General Reporting Protocol (2008). Diesel consumption, energy, and intensity were calculated using section 13, Tier B Method from the Climate Registry's General Reporting Protocol (2008). Indirect emissions, energy, and intensity from electricity were calculated using section 14, Tier B Method from the Climate Registry's General Reporting Protocol (2008). | Resolved. Information / clarification point. | | | | | | | |
| EC-40 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | Appendix 19, Appendix 20 | VIII | With reference to Section 8.3.1.1 (Volume II) of the Application. supporting information is not provided regarding the exclusion of the Village of Granisle in the RSA as a receptor. It is well established that pollutants can travel significant distances under the right meteorological conditions and would not only impact nearby communities, but would become a portion of the contaminant burden in the region. | The air dispersion modelling domain includes Granisle within the Regional Study Area (RSA). The receptor grid spacing was configured according to Guidelines for Air Quality Dispersion Modelling in BC (BC MOE 2008), and sensitive receptors were located separately to obtain the most accurate air quality concentrations at these locations. | Resolved. Information / clarification point. | | | | | | | |
| EC-41 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | 8.8.8 | II | In section 8.8.8 (Volume II) of the Application, it is stated that 'In general, the following mitigation measures will be implemented to ensure preservation of the pristine ambient air quality at the Morrison mine site: Use low sulphur fuel. Environment Canada refers the proponent to the Sulphur in Diesel Fuel Regulations under the Canadian Environmental Protection Act, 1999 (CEPA 1999). Please note that under this regulation, ultra low sulphur diesel (ULSD is fuel with a concentration of sulphur in diesel fuel of no greater than 15 mglkg) is currently required for on-road vehicles. ULSD will be required for off-road engines in October 1, 2010 and for rail and marine diesel engines in 2012, Environment Canada recommends the proponent commit to using ULSD for all phases of the Project. The Sulphur in Diesel Fuel Regulations can be found at: http://www.ec.gc.ca/ceparegistry/documents/reg/ga_guid/questions.cfm. The use of ULSD will reduce emissions of particulate matter and S02. | PBM commits to minimizing GHG emissions to the extent practicable (i.e., within economic and technological capabilities) for a viable and profitable project. PBM commits to the use of only modern and properly maintained equipment for the Project and Ultra Low Sulphur diesel subject to its regional availability. NB: PBM has completed a study of the use of Liquified Natural Gas for on-site mobile equipment including mine haul trucks and intends to investigate this option further during detailed design. If the use of LNG is implemented significant reductions in emissions should result. | Certificate commitment required. | | | | Condition #27 | | |
| EC-42 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | Appendix 20; Appendix C | VIII; Addendum | The proponent will "Use large haul trucks for ore and waste transport to minimize the number of trips required between the source and the destination." Detailed information regarding the expected operation of haul trucks and other transport to/from the source and destination should be presented (see comment under 8.2.3). | The specified haul trucks are 227 tonne capacity (ie Caterpillar 793C). The mine will operate 24 hours per day 365 days per year. Overburden and waste dumps will be located in separate areas close to the open pit. Diesel hydraulic shovels will be used to load overburden, waste and broken ore into 227t diesel powered haul trucks. Waste will be placed in designated disposal sites adjacent to the pit and ore will be hauled to the primary crusher located northwest of the pit. Crushed ore will then be conveyed to the coarse ore stockpile and subsequently to the crushing, grinding and flotation sections of the process plant. | Resolved. Information / clarification point. | | | | | | | |
| EC-43 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | 8.3.4 | II | Table 8,3-4, and Section 8.3.4 discussing Potential Residual Effects, includes the statement "Exceed the Canada-wide Standards and BC ambient air quality objective (level B) for fugitive dust PM ,5 and PM10 during the operational phase of the Project," | Acknowledged | Resolved. Information / clarification point. | | | | | | | |
| EC-44 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | | | Environment Canada recommends that the Application present information regarding how the Project aligns with the provisions in the Canada Wide Standards for Keeping Clean Areas Clean and/or Continuous Improvement..... The provision for Keeping Clean Areas Clean states: "Jurisdictions recognize that polluting "up to a limit" is not acceptable and that the best strategy to avoid future problems is keeping clean areas clean. Jurisdictions should work with their stakeholders and the public to establish programs that apply pollution prevention and best management practices. Environment Canada's position is that in order to meet the provision in the Canada Wide Standards for Keeping Clean Areas Clean, decision-making authorities must require the application of best available technologies and practices to new and existing emissions sources, and must also require that no significant impacts to health or the environment result from the remaining emissions from such sources. | PBM commits to complying with or exceeding applicable existing and future environmental regulations or permits. | Requires further discussion; carry forward. | PBM understands that the publication "Canada Wide Standards for Keeping Clean Areas Clean and/or Continuous Improvement" is directly application to governmental jurisdictions. PBM believes the project is aligned with the provisions of KCAC/CI in that we have articulated an Air Quality Management Plan and Air Quality Effects Monitoring Programs in Sections 13.2 and 14.2.3.2 in Vol III of the EAC Application. Further PBM commits to complying with or exceeding applicable existing and future environmental regulations or permits. | | | PBM will comply with or exceed applicable existing and future environmental regulations or permits. | | |
| EC-45 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | 13.2.6 | III | Section 13,2.6 (Volume III) of the Application states "Using low-sulphur diesel fuel when practical (diesel fuel sulphur content equal to 0.05% in accordance with the Environment Canada Sulphur in Diesel Fuel Regulations; BC MOE 2009)". As explained above, Environment Canada refers the proponent to the Sulphur in Diesel Fuel Regulations under CEPA 1999). | PBM commits to the use of only modern and properly maintained equipment for the Project and Ultra Low Sulphur diesel subject to its regional availability. NB: PBM has completed a study of the use of Liquified Natural Gas for on-site mobile equipment including mine haul trucks and intends to investigate this option further during detailed design. If the use of LNG is implemented significant reductions in emissions should result. | Certificate commitment required. | | | | Condition #27 | | |
| EC-46 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | 13.2.6 | III | Section 13.2.6.1 (Volume III) states "During the construction phase diesel emissions will be produced primarily by light- and heavy-duty vehicles and stationary construction equipment….Depending on the atmospheric stability and other meteorological conditions, the contaminants will disperse into the surrounding air mass and be quickly and efficiently diluted by prevailing winds." Given the variability in meteorological conditions, as well as the specific health and environmental impacts of diesel PM Environment Canada suggests that the proponent commit to minimizing diesel emissions. | PBM commits to the use of only modern and properly maintained equipment for the Project and Ultra Low Sulphur diesel subject to its regional availability. NB: PBM has completed a study of the use of Liquified Natural Gas for on-site mobile equipment including mine haul trucks and intends to investigate this option further during detailed design. If the use of LNG is implemented significant reductions in emissions should result. | Certificate commitment required. | | | | Condition #27 | | |
| EC-47 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Air Quality | 6.2 | | | Also stated, "...during drier months and when required water trucks will be used on-site to further mitigate against fugitive emissions. Water will be applied as required as a dust suppressant to unpaved roads and active earthworks areas." Environment Canada recommends that the proponent commit to watering gravel-surfaced roads as a mitigation measure to reduce PM on an on-going basis, rather than assuming that watering will occur "as required" during drier months. | PBM commits to watering on an on-going basis within the reasonable limits of maintaining vehicle safety and ensuring no excess contact water runoff is produced from road watering. | Certificate commitment required. | | | | Condition #27 | | |
| EC-48 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Wildlife and Wildlife Habitat | 6.1 | Appendix 36 | X | Environment Canada notes the data presented within the Avian Baseline Report does not cross reference the Point Count Station # in Appendix 2 to the species observations in Appendix 3. It is therefore unclear how the species observed have been linked to their habitats, i.e., how species are distributed across different habitats within the Project area. | Acknowledged | Requires further discussion; carry forward. | Habitat for each point count station is believed to be on record with Rescan. At present, PBM does not have access to this data. | | | Noted | | |
| EC-49 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Wildlife and Wildlife Habitat | 6.1 | Appendix 36 | X | There appears to have been no surveys conducted for marsh birds and bats (including roosts for the latter) during baseline studies, Were standardized surveys completed for these species? If not, what was the reason for not completing such surveys? | Neither marsh birds nor bats were specifically identified as Valued Ecosystem Components. No bats were confirmed as being present. Waterbird observations included marsh birds. Surveys were adequate to meet the objectives of determining typical avian species associated with broad habitat types and detecting species at risk in the study area. | Requires further discussion; carry forward. | Neither marsh birds nor bats were specifically identified as Valued Ecosystem Components. PBM has no record that either targeted marsh bird or bat surveys were completed. However water and shoreline surveys did include observations of marsh birds. PBM believes the surveys were adequate to meet the objectives of determining typical avian species associated with broad habitat types and detecting species at risk in the study area. | | | EMP | | |
| EC-50 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Wildlife and Wildlife Habitat | 6.1 | Appendix 36 | X | Further. Environment Canada notes surveys for waterfowl included only informal late fall/early winter surveys. Were surveys conducted for staging/molting birds (e.g., Barrow's Goldeneye) within the Project area? | Surveys were adequate to meet the objectives of determining typical avian species associated with broad habitat types and detecting species at risk in the study area. | Requires further discussion; carry forward. | PBM has no record that specific surveys were conducted for staging/molting birds (e.g., Barrow's Goldeneye) within the Project areas. PBM believes completed surveys were adequate to meet the objectives of determining typical avian species associated with broad habitat types and detecting species at risk in the study area. | | | EMP | | |

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| EC-51 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Wildlife and Wildlife Habitat | 6.1 | | | EC recommends that industry avoid activities that will result in the disturbance or destruction of active migratory bird nests. Where the proponent determines its activities will unavoidably overlap with the breeding bird season, Environment Canada recommends that the proponent employ an Active Migratory Bird Nest Survey Program (AMBNS) to reduce the likelihood of disturbing or destroying active nests. Doing so in turn reduces the likelihood that the proponent will be in contravention of the MBCA. The migratory bird breeding season varies between regions across British Columbia. The proposed general breeding bird season for the Project area is May 01 - July 31. EC recommends that an AMBNS be employed if potentially harmful activities are proposed for a period immediately before, during or immediately after the general breeding bird season. EC may provide advice to the proponent in the development of an AMBNS if the proponent makes that request. | PBM commits to employ an Active Migratory Bird Nest Survey Program (AMBNS) to reduce the likelihood of disturbing or destroying active nests. | Certificate commitment required. | | | | PBM will employ an Active Migratory Bird Nest Survey Program (AMBNS) to reduce the likelihood of disturbing or destroying active nests. | | |
| EC-52 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Wildlife and Wildlife Habitat | 6.1 | | | The proponent should be aware the Olive-sided Flycatcher is now listed on Schedule I of the SARA as 'Threatened'. As a consequence of the listing, the protective measures for individuals and residences - sections 32 and 33 of SARA - apply to this species wherever it is found in Canada. We note that breeding bird surveys detected this species in the Project area; clearing and constructing-related activities are recommended to be undertaken outside of the breeding bird season to avoid harm to this (and possibly other) listed migratory birds. In the event clearing and/or construction is proposed during the breeding season, the proponent should be aware that Environment Canada is not in a position to issue a permit under the MBCA or SARA (for migratory birds) in the context of incidental take. | PBM commits to consider the potential implications of the listing of the Olive-sided Flycatcher and other species in relation to the proposed Project. For permitting and prior to construction, as part of the EMS, PBM commits to updating the Wildlife Management Plan and Wildlife Effects Monitoring Progams. | See below. | | | | See below | | |
| EC-52a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Wildlife and Wildlife Habitat | | | | Environment Canada requests clarification as to what is intended by the following : 'updating the Wildlife Management Plan and the Wildlife Effects Monitoring Programs'? | | Further discussion required and may result in a commitment. | | | | EMP - PBM will consider the potential implications of the listing of the Olive-sided Flycatcher and other species in relation to the proposed Project. | | |
| EC-53 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Wildlife and Wildlife Habitat | 6.1 | | | It is prudent therefore that the Project evaluates any potential SARA permit requirements for anticipated impacts to migratory birds under federal jurisdiction listed as Threatened or Endangered. The conditions under which a SARA permit can be issued are stringent. New species are added to Schedule I of the SARA on an annual basis. while others are removed. The above-referenced Olive-sided Flycatcher has been documented in the Project area, and others may occur that hitherto have not been detected in surveys conducted to date (e.g.. common nighthawk). Environment Canada recommends that the proponent consider the potential implications of the listing of this and other species in relation to the proposed Project. | PBM commits to consider the potential implications of the listing of the Olive-sided Flycatcher and other species in relation to the proposed Project. For permitting and prior to construction, as part of the EMS, PBM commits to updating the Wildlife Management Plan and Wildlife Effects Monitoring Progams. | See below. | | | | See below | | |
| EC-53a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Wildlife and Wildlife Habitat | | | | Environment Canada requests clarification as to what is intended by the following : 'updating the Wildlife Management Plan and the Wildlife Effects Monitoring Programs'? | | Further discussion required and may result in a commitment. | | | | EMP - PBM will consider the potential implications of the listing of the Olive-sided Flycatcher and other species in relation to the proposed Project. | | |
| EC-54 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Wildlife and Wildlife Habitat | 6.1 | 8.16.10; 13.10, 14.9 | II; III | The residual effects for the loss of breeding habitat for western toad are rated as minor, on the basis of the mitigation proposed (Volume II, page 8-456), However, the mitigation proposed does not speak directly to the breeding habitat that will be lost in association with the Project (i.e., as a result of the pit), rather it will assist in maintaining non--breeding habitat that remains post-construction (Volume II. page 8-455). Further, the mitigation proposed states that roadside ditches in the mine site will be constructed to minimize standing water to prevent toad breeding, In contradiction, the wetlands effects assessment indicates the Project will have beneficial effects due to the creation of new wetland habitat in depressions, resulting from the construction of roads. etc (Volume II, page 8-278). | The EAC Application presents a Wildlife Management Plan and Wildlife Effects Monitoring Progams that address monitoring and mitigation proposed including for the western toad. The Wildlife Management Plan addesses toad breeding and toad breeding habitat. Additional mitigation is also addressed including *access restrictions* and *key wildlife habitat avoidance* . For permitting and prior to construction, as part of the EMS, PBM commits to updating the Wildlife Management Plan and Wildlife Effects Monitoring Progams to address any issues or inconsistencies. | See below. | | | | See below | | |
| EC-54a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Wildlife and Wildlife Habitat | | | | Environment Canada requests clarification as to what is intended by the following : 'updating the Wildlife Management Plan and the Wildlife Effects Monitoring Programs'? | | Further discussion required and may result in a commitment. | | | | EMP | | |
| EC-55 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Wildlife and Wildlife Habitat | 6.1 | 8.16.10; 13.10, 14.9 | II; III | The Application states "because western toad is a CGSEWIC species of Special Concern, the CEA Agency requires that a monitoring plan records and assesses western toad mortalities caused by road traffic" (Volume II, page 8-450). There are several inaccuracies in this statement. Western toad is listed on Schedule 1 of the Species at Risk Act (SARA), it is Section 79(2) of SARA that states "...the adverse effects of the project on the listed wildlife species and its critical habitat and, if the project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them...". | For permitting and prior to construction, as part of the EMS, PBM commits to updating the Wildlife Management Plan and Wildlife Effects Monitoring Progams. PBM commits that where any adverse effects of the project on the western toad and its critical habitat may occur it will ensure adaptive management measures are taken to avoid or lessen those effects and to monitor them. | See below. | | | | See Below | | |
| EC-55a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Wildlife and Wildlife Habitat | | | | Environment Canada requests clarification as to what is intended by the following : 'updating the Wildlife Management Plan and the Wildlife Effects Monitoring Programs'? | | Further discussion required and may result in a commitment. | For permitting and prior to construction, as part of the EMS, PBM commits to updating the Wildlife Management Plan and Wildlife Effects Monitoring Progams. PBM commits that where any adverse effects of the project on the western toad and its critical habitat may occur it will ensure adaptive management measures are taken to avoid or lessen those effects and to monitor them. | | | PBM will update the Wildlife Management Plan and Wildlife Effects Monitoring Progams. If any adverse effects of the project on the western toad and its critical habitat may occur PBM will ensure adaptive management measures are taken to avoid or lessen those effects and to monitor them. | | |
| EC-56 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Wildlife and Wildlife Habitat | 6.1 | 8.16.10 | II | The effects assessment and mitigation strategies relating to the potential chemical hazards for western toad speak only to the TSF, and do not mention the open pit which will also have questionable water quality post-closure. Further. the residual effects for the chemical hazards for western toad are rated as negligible, and reversible in the long-term. Given the water quality of the TSF is unlikely to be fully determined until post-closure, and the success of any proposed wetland habitat compensation in relation to the TSF is unknown, Environment Canada suggests the residual effects and the long-term potential for reversibility are, in fact, largely unknown as this time. | The TSF is not identified as compensation habitat for mitigation purposes. Rather the TSF is identified along with all other potential poor water quality sources in the mine footprint area, which includes the open pit, as an area that it is anticipated that toads will be attracted to and exposed to chemicals of potential concern. The effects assessment was based on mitigation measures that include minimizing the attractiveness of poor quality water. | See below. | | | | | | |
| EC-56a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Wildlife and Wildlife Habitat | | | | These responses are incorrect and contradictory. Environment Canada does not support the use of a tailings management facility for the purposes of wetland habitat or habitat functions compensation. Given that the project involves application of federal programs and permits and linkages to federal mandates (including migratory birds under the Migratory Birds Convention Act, 1994 and species under the Species at Risk Act). Environment Canada recommends that the proponent develop a Wetland Habitat Compensation Framework for review prior to completion of the environmental assessment. | | Unresolved. Carry forward. | Refer to RRR Rev.2, Section 9. The revised closure and reclamation plan establishes viable wetlands closer to natural conditions 25 years sooner. Additionally the TSF water is dischargeable a few years after mine closure (as opposed to ~75 years after closure in the EAC Application). | | | | | |

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| EC-57 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Wetlands | 6.9 | 8.12<br>Appendix 31 | II<br>X | It appears the Application has misunderstood Environment Canada guidance regarding the assessment of wetland functions. While Environment Canada did not specifically request such an assessment, the guide referenced in the Application (Appendix 31 and Section 8.12. Volume II) is not correct for this type of assessment; however, the wetlands evaluation that was completed appears to be comprehensive. For future reference, the relevant guide for assessing wetland function can be found at: http:www.ec.qc.ca/nature/default.asp?lang=En&n=132ADBFC-1&parent=0C1743A2-4D49-4183-AC5F-1DE909D2FEB1&searchoffset=11&searchdisplaycount=10#resulttop | Acknowledged. | See EC-56a | | | | | | |
| EC-58 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Wetlands | 6.9 | 13.9.4.2; 13.9.7.1 | III | Compensation for permanent loss of wetland habitat is proposed in Application in the form of wetland creation in the TSF area post-closure (Volume III, pg 13-74). However, EC does not support the use of TSF for habitat compensation for migratory birds & species at risk. EC recommends a Wetland Habitat Compensation Plan (WHCP) be developed to address impacts to wetland & riparian habitats supporting migratory birds & species at risk. WHCP serves as a guiding document for proponent, agencies & stakeholders should a project proceed to detailed design, construction & operation. A WHCP includes: • purpose, goals of the WHCP .... • spatial & temporal scope of potential compensation options including 'on-site' and 'off-site' considerations; • No net loss of privately & publicly funded conservation investments in wetlands in BC; • consultation with non-government conservation partners that would design, cost out, and implement the compensation projects; • a legally binding agreement that identifies roles & responsibilities... ; • project funding commitments; and • follow-up monitoring... | Although there are no comprehensive statutes exclusively for conserving BC wetlands with respect to private sector development activities, mitigation and compensation are addressed in 13.9 Vegetation and Ecosystems Management Plan. Losses of wetlands totals 57 ha. The TSF will offer approximately 44 ha of beach area and 78 ha of shallow open water (<2 m deep) that could be vegetated with wetland plants to compensate for wetlands lost during the construction and operations phases of the Project (Figure 13.9-2). Planting these areas could result in the creation of approximately 72 ha of shallow open water, 40 ha of marsh, and 10 ha of swamp. PBM believes the proposed wetlands compensation using the TSF is both adequate and compliant with regulations. The proposed compensation includes diversion ditches and sediment ponds. In fact, PBM's proposed compensation, although deferred for 25 years, provides excessive compensation area in relation to the impact. For permitting and prior to construction, as part of the EMS, PBM commits updating the Wetland Management Plan to address the recommended points | Unresolved. Carry forward. | Refer to RRR Rev.2, Section 9. The revised closure and reclamation plan establishes viable wetlands closer to natural conditions 25 years sooner. Additionally the TSF water is dischargeable a few years after mine closure (as opposed to ~75 years after closure in the EAC Application). | | | Carry forward to Permitting | | |
| EC-58a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Wetlands | | | | These responses are incorrect and contradictory. Environment Canada does not support the use of a tailings management facility for the purposes of wetland habitat or habitat functions compensation. Given that the project involves application of federal programs and permits and linkages to federal mandates (including migratory birds under the Migratory Birds Convention Act, 1994 and species under the Species at Risk Act). Environment Canada recommends that the proponent develop a Wetland Habitat Compensation Framework for review prior to completion of the environmental assessment. | | Unresolved. Carry forward. | Refer to RRR Rev.2, Section 9. The revised closure and reclamation plan establishes viable wetlands closer to natural conditions 25 years sooner. Additionally the TSF water is dischargeable a few years after mine closure (as opposed to ~75 years after closure in the EAC Application). | | | Noted | | |
| EC-59 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Cumulative Effects | 8 | 11;<br>4.0 "Morrison lake Effects" | III;<br>RRR | We know from our discussions with provincial agencies that the Bell and Granisle mines will require collect and treat systems to be operational in the near future. We also know that these two historical mine sites are contributing to changes in the water quality of Babine Lake now, and will continue to do so into the future. As a starting point, we consider that any cumulative effects of the Morrison project on Babine Lake are likely to be unacceptable. The proponent needs to provide assurance that no measurable effects on Morrison Lake and Creek water quality, water quantity, or sediment quality (including both chemistry and particle size distribution) will occur. To achieve this, it may be necessary to set site-specific water quality guidelines for Morrison Creek that are more stringent than the generic Canadian Council Ministers of the Environment (CCME) guidelines. | PBM does not own the Bell and Granisle Mine so is unable to comment on the requirements for collect and water treatment. PBM is also unaware of any material documenting changes in Babine Lake water quality that are directly attributable to the two closed mines. However PBM understands that, per 2009 reporting to MOE, both mines are in compliance with their MOE permits. Also that water management and ongoing monitoring at the mine sites will continue to ensure that water quality in Babine Lake remains protected into the future.<br>Data available from Bell and Granisle mines has been used to develop analogue water quality predictions for the Morrison Project using EDCM models. These water quality predictions have been used to develop effects assessments. The assessed residual cumulative effects are documented with the EAC Application Volume III, Chapter 11 and updated in the RRR. PBM commits to pursue permitting based on reasonable guidelines and where required to site specific water quality objectives. | See below. | | | | PBM will meet or exceed the requirements of applicable existing and future environmental regulations or permits. | | |
| EC-59a | Environment Canada, Stephen Sheehan | 12-Jan-11 | Cumulative Effects | | | | Environment Canada is concerned that the proponent will not be able to attain the water quality objectives that are established, resulting in cumulative effects on Babine Lake. | | Further discussion required and may result in a commitment. | PBM commits to pursue permitting based on guidelines and, where required, to site specific water quality objectives. | | The effects on receiving streams and Morrison Lake have been further mitigated as described in the 3rd Party Review Response Report - Addendum 1 | Condition #20 | | |
| EC-60 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Accidents and Malfunctions | 6.23 | 9 | III | Following review of the Executive Summary and Section 9 "Accidents and Malfunctions" (with regard to environmental emergencies) Environment Canada has concluded that Section 9 seems quite inclusive. Table 9.1-1 covers the highest risk activities that may result in a spill (activities at tailings darn, tailings pipeline, tailings storage facility, vehicle transport and barge transport, vehicle fueling). | Acknowledged. | Resolved. | | | | | | |
| EC-61 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Accidents and Malfunctions | 6.23 | 13.18 "Spill Contingency and Emergency Response Plan" | III | The documents mention Emergency Preparedness and Spill Response and Clean Up, but lack detail (these plans were not included in the Application), Environment Canada requests the opportunity to comment on: • The contingency plan to be in place prior to commencement of the construction phase as well as the draft plan for the operations phase prior to commencement of any mining work. Both plans should be developed using the CSA-Z731-03 Standard for Emergency Preparedness and Response (or the most current version at the time of plan development); • Detailed hazmat inventories for the construction phase as well as the operations phase. Environment Canada advises that there is a distinct possibility (based on the inclusion of other similar mining activities) that the proposed Project could be subject to the Environmental Emergencies Regulation under the Canadian Environmental Protection Act, 1999. This can be clarified prior to commencing operations. | Acknowledged. Per the EAC Application PBM has already provided a spill contingency and emergency response plan that provides general guidelines for spill prevention, mitigation, and follow-up, as well as emergency response for the Project. For permitting and prior to construction, as part of the EMS, PBM commits to updating the existing plan and providing an appropriate Emergency Preparedness and Spill Response and Clean Up for construction and operations phases. | Further discussion required and may result in a commitment. | | | | For permitting and prior to construction, as part of the EMS, PBM will update the existing plan and providing an appropriate Emergency Preparedness and Spill Response and Clean Up for construction and operations phases. | | |
| EC-62 | Environment Canada, Stephen Sheehan | 1-Oct-10 | Accidents and Malfunctions | 6.23 | Appendices T, Z | Addendum | In Environment Canada's view, avoiding degradation of receiving water quality should be a stated goal at the mine site and should therefore influence mine design decisions, such as the location of the waste rock dumps and the plant site. A thorough and rigorous examination of alternate mine design options with this goal in mind is recommended at this time. | PBM believes that the environmental assessment should be completed on the project as designed. PBM believes the alternatives as presented show a signficant cost benefit for the selected alternative that will not be outweighed by further refinements. Many alternatives have been considered including alternative locations for the plant site and WRD, which are outlined in Addendum Appendices T and Z. Given the current project design, no direct surface discharge will occur until Year 45 and only then with permitting based on appropriate water quality objectives. For permitting and prior to construction, as part of the EMS, PBM commits to updating the Surface Water Quality Management Plan. | Unresolved. Carry forward. | Consistent with EC's recommendation, the RRR Rev.2 presents a new mine closure plan, which includes placement of PAG waste rock back into the open pit. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. These changes result in signifiicant environmental benefits to the project. | | | EMP | | |
| EC-63 | Environment Canada, Stephen Sheehan | 19-May-11 | | | | RRR | "….,the proponent has not provided sufficient data to support the hydrogeological and geochemical inputs to the water quality modeling process" | The baseline hydrogeology report (EAC Appendix 24) covers the above data requirements, including hydraulic conductivity values from over 70 test sections in soils and bedrock to depths of approximately 150 m. The data also includes water level measurements from over 62 drillhole/piezometer locations. The 3-D MODFLOW regional model is based on site data (as opposed to literature) and is presented in Appendix 25 of the EAC Application.<br>Groundwater quality data has been collected since 2006 and continues to be collected from 15 dedicated groundwater wells. Geochemical loading inputs are further described in the Review Response Report. | | | | Additional assessment and analysis is included in the 3rd Party Review Response Report. And Addendu 1 to that report. | | | |
| EC-64 | Environment Canada, Stephen Sheehan | 19-May-11 | | | | RRR | "… some key additional information needs with respect to baseline groundwater conditions and dynamics are:<br>1. "baseline regional hydrogeology and groundwater recharge/flow/discharge patterns, incorporating and extending spatially beyond the proposed pit and TSF locations: | The 3-D MODFLOW baseline groundwater model covers the entire ground watershed for the project area and extends from the groundwater divide to Morrison Lake. The model is presented in Appendix 25 of the EAC Application. | | | | see above | | | |
| EC-65 | Environment Canada, Stephen Sheehan | 19-May-11 | | | | RRR | "… some key additional information needs with respect to baseline groundwater conditions and dynamics are:<br>"..Deeper hydrogeologic characteristics and flow regime across the mine site, extending downward to the ultimate pit floor elevation (or deeper). | The 3-D MODFLOWS model extends to approximately 450 m below the pit floor elevation. Hydrogeological characterization at depth has been appropriately assessed on the basis of trend plots relating hydraulic conductivity and depth (Figures 2.1-6, 2.1-7 and 2.1-8 of the Hydrogeological Modeling Report (Appendix 25) of the EAC Application. Measured data extends to approximately 150 m depth. The trend of the data does not suggest that extremely anomalous high hydraulic conductivities should be expected below 150 m depth. A review of drill core at depth has not identified anomalous fracture density. The typical trend of hydraulic conductivity in bedrock is to reduce with depth as the confining pressure increases. | | | | see above | | | |

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| EC-66 | Environment Canada, Stephen Sheehan | 19-May-11 | | | | RRR | "… some key additional information needs with respect to baseline groundwater conditions and dynamics are: "hydrogeologic characteristics, including three dimensional hydraulic conductivity patterns and fracture characteristics, and groundwater flow and potential contaminant transport pathways and dynamics, in the area between the proposed pit and Morrison Lake" | The 3-D MODFLOW model for the open pit inflows is presented in the Hydrogeological Modeling Report (Appendix 25) of the EAC Application. The model includes the major northwest-southeast trending faults in the area of the open pit. In addition, the Review Response report assessed a 2-D model for assessing potential pit inflows, and analog data from the Bell Mine and Granisle Mines, which are in similar hydrogeologic conditions, adjacent to Babine Lake. The weight of evidence of these three models has been incorporated into the Expected Case and Upper Bound Case estimates of seepage effects. | | | | see above | | | |
| EC-67 | Environment Canada, Stephen Sheehan | 19-May-11 | | | | RRR | "… some key additional information needs with respect to baseline groundwater conditions and dynamics are: "characterization of baseline groundwater quality around and under the locations of the proposed TSF, pit and plant facilities." | The baseline groundwater quality for the proposed TSF (broken down by receiving streams) and the pit/plant site area is presented in the Review Response report – Appendix I. The groundwater monitoring program has been carried out since 2006 and includes 15 dedicated groundwater monitoring wells. | | | | see above | | | |
| EC-68 | Environment Canada, Stephen Sheehan | 19-May-11 | | | | RRR | "… some key additional information needs with respect to baseline groundwater conditions and dynamics are: "…Environment Canada acknowledges that the proponent has made changes and commitments that may reduce the potential for adverse effects on water quality, such as replacing waste rock in the pit at closure. However, the changes are such that we no longer have a full understanding of the current mine plan." | The mine plan, with respect to development of the open pit and extraction of ore and waste rock including storage of the waste rock during operations, remains unchanged from the submission of the EAC Application. The Project changes are limited to the management of the tailings and post closure disposal of waste rock (i.e. replacing the waste rock into the open pit after closure). These Project changes are documented in the RRR and are to be implemented to satisfy authority's expectations for PBM to reduce the Project long term environmental liability. | | | | see above | | | |
| EC-69 | Environment Canada, Stephen Sheehan | 19-May-11 | | | | RRR | "… some key additional information needs with respect to baseline groundwater conditions and dynamics are: "Further, the effects on water quality of the changes are not fully described. We need to know, for example, whether replacing waste rock in the pit has residual effects on water quality." | The water quality effects are presented in Section 10 of the Review Response report. The water quality effects of replacing waste rock in the pit are presented in Section 10.3.2.2 of the same report. | | | | see above | | | |
| EC-70 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | In general, the proposed 60 mm liner seems to be a reasonable compromise between a heavier and thicker material (e.g., 80 mm) or a thinner one (e.g., 40 mm) which might be too thin and easily compromised during installation as a result of rips, punctures, or burns during seam welding and patching. | Agree | | | | | | | |
| EC-71 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | The proponent has chosen a mid-range liner perforation case rather than a worst-case condition to estimate the effects of liner failure on receiving water bodies. Furthermore, in this proposed TSF seepage mitigation scenario, the proponent plans to leave some areas of the TSF unlined, which is of concern since the proponent has not adequately assessed the seepage properties of these areas. | The poor installation qulaity category is specifically for old installations. Given advancements in liner technology and installation QA/QC it is unlikely the defect intensity associated with this installation quality would result. The seepage estimate for tailings/liner system is also not as sensitive to the liner installation basis as a water only system. | | | | | | | |
| EC-72 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | The proponent recognizes that quality control and assurance during installation is important to ensure liner performance. While the number of small holes, punctures, and defects in the liner are to be minimized, some of the TSF is to be left unlined. The proponent should line the entire TSF, especially given that it has already predicted that more than 80% of the tailings seepage to groundwater would occur though the unlined portion. | The effects assessment is based on not lining the pond area and the rationale is provided in the Addendum 1, Section 2, Hydrogeology - TSF Assessment | | | | | | | |
| EC-73 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | Section 2.1 - General – The proponent states: "The sediments in the base of the ponds provide a naturally low hydraulic conductivity barrier." The proponent should present data to substantiate this claim. | The assessment to-date is a qualitative assessement. Detail design will further confirm hydraulic conductivity. | | | | | | | |
| EC-74 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | Section 2.1 – The proponent has selected a linear low density polyethylene (LLDPE) geomembrane as a single liner to cover a majority of the TSF. Erickson et al1 suggest that "…there still exists (and most probably always will) several quality issues related to the long-term performance of geomembranes". While the authors indicate that LLDPE geomembranes are suited for high load conditions and where differential loads can result with settling, they also cite "…excessive expansion and contraction … [as a] …primary drawback…". Expansion/contraction should receive particular consideration during installation in order to counteract the tendency for these materials to develop wrinkles, which can lead to increased leakage under certain conditions. Additionally, the authors cite "…an approximate failure rate of 1% of all welded seams…" requiring robust construction quality assurance (CQA) to counter for this potential source of leakage. The proponent should provide additional details on the proposed CQA for review, including a summary of known LLDPE weaknesses and mitigation approaches. | The Proponent notes that the majority of literature on liner leakage is focussed on landfill and heap leach applications, not on tailings/liner systems. These behave very differently as discussed in Addendum 1. | | | | | | | |
| EC-75 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | There are several known and unknown performance indicators for the LLDPE product (it is only assumed the material is stable for about 100 years). In general, Environment Canada's assessment of the available information suggests that the proposed mitigation may not be permanent, that installation requires a very robust CQA program; and, that performance requires close monitoring throughout operation and closure/post-closure. Therefore, the proponent should describe how it is planning for long-term monitoring of liner performance and how it will implement such a program. | A long term monitoring program focussed on groundwater and receptors will be initiated to fulfil this objective. | | | | | | | |
| EC-76 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | Section 2.2.1 - Liner Seepage Assessment – The liner seepage assessment follows a standard industry approach which assumes a maximum number of leaks due to manufacturing defects and subsequent puncture of the geomembrane for a liner installed using good CQA practices. The proponent applies the assumed number of puncture leaks and assumed standard puncture size to various theoretical solutions/calculations to estimate leakage rate through the proposed liner, assuming good liner installation CQA practices are followed. Several available references which provide theoretical calculations are often used where composite liner systems consisting of geomembrane are installed over various configurations of geo-synthetic clay layer (GCL – bentonite clay sandwiched between layers of geo-synthetic fabric) / compacted clay layer (CCL), geonetting, or other configurations. While the proponent commits to prepare the tailings impoundment foundation soils, including importing clay till (of unspecified/untested hydraulic conductivity) as necessary, it is not clear how well the proposed approach is suited to the basic liner design/installation that has been suggested. This clarification should be provided. | Similar liner base preparation has been carried out for the Greenwood Gold Project (Southeaster BC) and Wolverine Mine (Yukon). The foundation soils are stripped of all organics and the insitu soils are graded and compacted with a large smooth drum roller. Fine fill or getextile is used in areas of coarse angular materials. | | | | | | | |
| EC-77 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | Section 2.2.1 – The proponent uses a tailings upper bound hydraulic conductivity of 10-7 m/s. It isn't clear where this upper bound value is derived from since no apparent testing information could be found detailing the actual K of synthesized tailings. Environment Canada does note that Appendix 8 (Tailings, Pumping and Associated System Requirements) of the Addendum report contains data on final tailings particle size distribution where it was determined that the final tailings have a d50 of 70u (essentially very fine sand – see section 2.1 and Figure 2.1 of Appendix 8). If it is assumed the tailings are therefore a silty sand, the theoretical hydraulic conductivity for this material would range between approximately 10-7 to 10-3 m/s – possibly up to four orders of magnitude greater than the value of K chosen by the proponent for the leakage calculations. The resulting seepage estimates provided within the report could be understated by up to four orders of magnitude. The impact upon downstream / down gradient loading of contaminants could therefore also be substantially underestimated. This issue should be addressed given the implications for confidence in impact predictions. | A tailings hydraulic conductivity of 10-3 m/s is not conceivable. Seepage estimates of four orders of magnitude are, correspondingly, unrealistic. Hydraulic conductivity of tailings can be estimated using Hazens formula $k=d_{10}^2$ Based on the $d_{10}$ of (1)coarse tailings (cycloned sand and short length of spigotted beach) $d_{10}$=4.50E-02 mm and k= 2.03E-07 m/s; (2) fine tailings $d_{10}$ (mm)=1.25E-03 mm and k= 1.56E-10 m/s. | | | | | | | |
| EC-78 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | Section 2.2.1 - The proponent does not use the worst case liner perforation range but rather the middle of the "fair" range. Further justification should be offered for this choice. The proponent's reference information suggests that "old" liners have a greater density of perforations, suggesting potential increases in liner hydraulic conductivity over time. | See 1.2, The worst case from older operations is due to advances in construction procedures and QA/QC, which reduce the risk of liner perforations. Old is not related to degradation of liner over time - it is a generational term in this instance. | | | | | | | |

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| EC-79 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | Section 2.2.1 - The proponent indicates that an analytical equation from a model that is based on estimated risk of leaching losses from landfills (HELP model – "Hydraulic Evaluation of Landfill Performance" model) has been used as an additional comparison to the analytical Darcy flux calculations. No explanation of this equation (and associated assumptions and/or limitations) is provided. Rather than borrowing a portion of the HELP model and applying it in a different context, the proponent should apply the full HELP model to the Project. The model relies on a range of climate data, surface runoff characteristics, soil and liner characteristics and information on groundwater conditions; poor baseline characterization data may have been considered insufficient to support a proper HELP seepage model study, but if so, this information should be presented with supporting rationale. The method used to determine seepage cannot be adequately evaluated based on the information provided. | HELP model is used for cover designs and landfill applications and is not very appropriate for predicting tailings/liner leakage rates. Other inputs/processess considered by HELP were conservatively rationalized in the input terms. Eg. evaporation/transpiration, soil moisture storage and unsaturated processes were not considered. The assessment assumed full head on the liner, which makes it insensitive to rate of recharge, etc. | | | | | | | |
| EC-80 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | Section 2.2.2 - Seepage from Unlined TSF Portion – Environment Canada is unclear why the proponent has proposed an arrangement whereby portions of the TSF are unlined. Construction may be a challenge in relation to how the unlined portions are integrated with the liner system. The proponent may wish to explore keying-in of the liner system to ensure there is no bypassing at the transition zone. | Agree | | | | | | | |
| EC-81 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | Section 3 – It is not apparent that the proponent has considered incorporating the liner underdrain as a component of a long-term monitoring program for the liner system. A long-term monitoring program should be presented for review including a description of appropriate triggers (action leakage rate) and management responses. | A long term monitoring program focussed on groundwater and receptors will be initiated to fulfil this objective. | | | | | | | |
| EC-82 | Environment Canada | 4-Jun-12 | TSF Seepage Estimates | | | 3rd Party Review Response Addendum 1 | Section 3 – The proponent has not indicated how it plans to integrate the liner with the unlined pond areas. The proponent should provide additional information as to the zone of influence for the liner to pond transition, and how this would affect seepage estimates (e.g., is it possible that the connectivity between the pond / pond drainage system and the liner along the perimeter would be compromised such that leakage is increased?) | Unsure what is being requested. | | | | | | | |
| EC-83 | Environment Canada | 4-Jun-12 | Water Treatment Facility | | | 3rd Party Review Response Addendum 1 | Section 4 - Water Treatment Plant – The proponent indicates there are potential secondary water treatment steps it may take to reduce concentrations of contaminants of potential concern (COPCs) to acceptable levels. While it is commendable that the proponent is prepared to commit to enhanced water treatment, it should be understood that the water treatment plant may be required early in the operational stage of the project and needed indefinitely post closure. | Agree | | | | | | | |
| EC-84 | Environment Canada | 4-Jun-12 | Water Treatment Facility | | | 3rd Party Review Response Addendum 1 | The Addendum document does not present information to indicate that the proponent has undertaken bench-scale testing of a synthesized effluent (e.g., analyzing lixiviant from locked cycle testing / post-primary treatment) to ensure the potential mitigation would work as required. Without proper testing and planning, it is possible the proposed mitigation may not work for the suite of COPCs needing treatment (synergies / antagonistic effects – e.g., if influent iron is sufficiently high, overall settling could be inhibited requiring additional steps and/or addition of specific flocculants or other amendments to effectively remove metals). | Agree | | | | | | | |
| EC-85 | Environment Canada | 4-Jun-12 | Water Treatment Facility | | | 3rd Party Review Response Addendum 1 | The proponent is relying upon a high density sludge system, incorporating lime, as the primary (or perhaps only) means of water treatment. The potential for escalating lime costs (as an example) related to long-term water treatment cannot be ignored. Costs for lime increased by 36% to 38% over the five-year period to the end of 2007, at a rate which outstripped "[…] historic industry standards […]." These increases continued despite a reduction in core market demand and a downturn in the US economy (Miller, 20072; Miller, 20083). In the ensuing four-year period to the end of 2011, costs for lime continued to outstrip the core inflation rate with an average annual increase of 7.4% (Miller, 20124) – again in spite of the downturn in the North American economy during that same period. Production of lime is very energy intensive and as a result, lime prices can be expected to climb primarily in relation to "[…] high fuel prices" (USGS, 20065). Thus, sensitivity analysis for water treatment costing over the long term should be considered. | Agree | | | | | | | |
| EC-86 | Environment Canada | 4-Jun-12 | Water Treatment Facility | | | 3rd Party Review Response Addendum 1 | Environment Canada notes that the proponent does not appear to have examined the long-term geochemical stability of sludge produced by the water treatment plant. Such a testing program should be undertaken, and implications to the water quality effects analysis described. | Refer to Tracking Table Item No. MOE-250. Also, the sludge is chemically inert provided it is not leached with low pH solutions, which would re-mobilize the metals. The sludge produced is very stable, passing TCLP (Toxicity Characteristic Leaching Procedure) and SPLP (Synthetic Precipitation Leaching Procedure) tests designed to determine the mobility of toxic organic and inorganic contaminants to groundwater, provided the plant is operated properly as an HDS plant with proper oxidation in the reactor tanks and sufficient sludge recycle. The sludge characteristics are suitable for land disposal in a free-draining sludge pond where the sludge density would increase to 45-50% solids or higher. | | | | | | | |
| EC-87 | Environment Canada | 4-Jun-12 | Water Quality Effects | | | 3rd Party Review Response Addendum 1 | Section 5 - Water Quality Effects Assessment – The proponent utilizes previous estimates of liner leakage to estimate water quality in the receiving environment. Given the uncertainties related to such variables as liner design, installation, and long-term stability, Environment Canada questions the accuracy of the water quality assessment presented in the Addendum document. The proponent should revisit its assessment and underlying calculations with attention to the full range of possibilities and support its chosen scenario with solid evidence from field observations and material testing. | Upper bound case addresses this - inputs deliberately skewed to account for uncertainty in data collectively - ie. a perfect storm of expected case inputs being non-conservative. Liner design/installation can be controlled through engineering and QC, so uncertainty reduced. Also, WQ predicted assuming TSF is permanent loading source and concentrations equilibrate in GW outside TSF -- highly conservative. | | | | | | | |
| EC-88 | Environment Canada | 4-Jun-12 | Water Quality Effects | | | 3rd Party Review Response Addendum 1 | Section 5 – Environment Canada is unclear from the information presented how long it will take captured tailings pore water to clear via various flux mechanisms (diffusion, displacement) under truly 'tight' or, alternately, 'leaky' containment scenarios. This range of possibilities should likewise be considered in the context of the water quality effects work. | Time series plots (Addendum, Section 2.3 Seepage Plume Modelling from the TSF) show SO4 loading to Morrison Lake over time. | | | | | | | |
| EC-89 | Environment Canada | 4-Jun-12 | Water Quality Effects | | | 3rd Party Review Response Addendum 1 | Section 5.1 - Morrison Lake Effects – The simulation of the extent of sulfate groundwater conditions within the shallow groundwater beneath the TSF considers background sulfate concentrations of 0 mg/L. These simulations should use actual background sulfate concentrations. | Per report, this was done so % solute could be estimated for other parameters, not just focussing on SO4. Applying a background concentration will not change results. | | | | | | | |
| EC-90 | Environment Canada | 4-Jun-12 | Water Quality Effects | | | 3rd Party Review Response Addendum 1 | Section 5.3 - Morrison Lake Effects for Operational Discharges – The proponent indicates that some unspecified additional monitoring and mitigation would be implemented in the event the expected effluent quality is not met. The proponent should specify what the action triggers and responses would be in the event this situation arises. There should be similar documentation to cover the closure and post-closure period. | This is a reference to unknown - unknowns, and it is standard practice to monitor and react appropriately. | | | | | | | |
| EC-91 | Environment Canada | 4-Jun-12 | Hydrogeology | | | 3rd Party Review Response Addendum 1 | The proponent does not show a cross sectional representation of predicted or conceptual groundwater flow lines beneath the TSF. As a result, it is not clear where seepage from the TSF is expected to report downstream (i.e., where groundwater flow will report or how deep the flow lines extend). The TSF will be constructed with seepage ponds and diversions to capture shallow seepage through and beneath the dams. It is not clear whether these seepage ponds are expected to intercept and capture the seepage from beneath the facility or whether some seepage is expected to report further downstream of these ponds but upstream of Morrison Lake. This distinction is important in terms of performance monitoring of the lined facility since it impacts the location of groundwater monitoring wells and surface water monitoring stations that will need to be established along these flow lines. | These can be output - the plan view plots in Appendix 1 of the 3rd Party Review Response Report and Addendum 1, Section 2.3 basically show where seepage will daylight. Seepage ponds weren't simultated, but wil be used to passively capture seepage within their catchment - these are not designed to capture all seepage. In the current assessment this seepage is conservatively assumed to reach Morrison Lake. | | | | | | | |

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| EC-92 | Environment Canada | 4-Jun-12 | Hydrogeology | | | 3rd Party Review Response Addendum 1 | There are two typical approaches to monitoring liner performance; these are 1) the installation of a seepage interception and collection system (i.e., an engineered drainage layer beneath the facility) which would prevent contamination of groundwater and 2) the installation of groundwater monitoring wells down-gradient of the facility. The first approach is commonly used for seepage collection beneath ponds in heap leach operations. It does not appear that a collection system is proposed for this facility; however there is a proposal to construct some kind of drainage layer in certain sections beneath the lined facility to prevent build-up of pore pressure beneath the liner. Presumably, these drains would capture not only shallow groundwater beneath the facility but also some impacted water from the facility. It isn't clear whether these drainage layers were considered in groundwater modeling and the predictions of groundwater impact in terms of preferential pathways for groundwater movement. The second approach is more likely to be the one used for the Morrison Project, however, with such an approach, groundwater contamination must first occur before it is detected. Therefore, it is crucial that groundwater transport, contaminant transport and attenuation mechanisms be | A drainage layer under the liner is not proposed. The reference to drains is in areas where groundwater could uplift the liner prior to placement of tailings - in this case they act as pressure relief drains. A groundwater monitoring well system is proposed for Morrison. | | | | | | | |
| EC-93 | Environment Canada | 4-Jun-12 | Pit-Lake Interaction | | | 3rd Party Review Response Addendum 1 | Federal authorities have previously identified the relatively narrow area between the pit and Morrison Lake as a third major source of potential water quality impacts. Potential seepage through this area into the pit during operations may affect lake levels, Morrison River flows, site water balance estimates, and water treatment plant (WTP) capacity estimates. Many of these issues were addressed in the Review Response Report #2 when waste rock deposition in the open pit on closure was developed as a mitigation measure. Some concerns regarding potential seepage from the PAG rock filled pit post-closure to Morrison Lake remain outstanding. However, to be consistent with a "no effects" objective, the proponent should develop and commit to a contingency measure such as grouting the area between the pit and the lake such that water fluxes in either direction could be minimized. The alternative is further investigation of the area to generate more reliable information about the flux rates and potential impacts. | Seepage from PAG rock (pit at closure) to Morrison Lake --- Tables 5.1 and 5.2 (Concentrations (mg/L) of Key Parameters in Morrison Lake). The pit is maintained as a net sink at closure. | | | | | | | |
| EC-94 | Environment Canada | 4-Jun-12 | Pit-Lake Interaction | | | 3rd Party Review Response Addendum 1 | The integrity of the rock barrier is also an issue. Environment Canada has not seen evidentiary support for the proponent's assertion that the area will not fail. Water flux into the pit during operations may affect site water balance, strain WTP capacity, or affect Morrison River flow levels. Water flux out of the filled pit post-closure may introduce acid drainage and metal loads to Morrison Lake, affecting water quality. | Knight Piesold completed a Feasibility Pit Slope Design Report in 2006. Further assessent to be conducted during detailed engineering. | | | | | | | |
| EC-95 | Environment Canada | 4-Jun-12 | Pit-Lake Interaction | | | 3rd Party Review Response Addendum 1 | Mitigation actions such as dewatering, bolting, or grouting the area between the pit and the lake should be assessed. The effectiveness of any measures implemented should be monitored. It is important that thresholds which indicate unacceptable performance and trigger follow-up mitigation be agreed upon in advance. Thresholds for follow-up mitigation, if needed, cannot be determined until sufficient information on the integrity of the rock barrier is available. | To be assessed in detail during detailed engineering. | | | | | | | |
| EC-96 | Environment Canada | 4-Jun-12 | Water Balance | | | 3rd Party Review Response Addendum 1 | The proponent assumes a uniform rate of recharge for the entire TSF, which is equivalent to the highest rate predicted for the unlined portion of the TSF, to simulate groundwater conditions beneath the TSF and the extent of the contaminant plume in groundwater beneath the facility. Although this may be conservative for contaminant transport modeling in terms of predicted impact to groundwater, in reality the rate of recharge to groundwater beneath the TSF would be much smaller for most of the TSF area (i.e., the area which is lined). Using an artificially high predicted recharge rate over the TSF area is not realistic in terms of the overall water balance. Intuitively, there would be more water retained in the TSF and much less water infiltrating through the TSF and reaching the groundwater system. It is not clear if and how the effect of reducing groundwater recharge as a result of TSF construction was considered in the water balance and whether there would be significantly less base flow available for recharge to streams down-gradient of the TSF. | Non-contact water diversions must be maximized to the maximum practical extent. The site wide water balance must be reconciled annually. Surplus water may be temporarily stored in the TSF fo ra few years, however if water balance surplus continues then PBM mustassess and implement, as required, the following measures: 1) collection and discharge, as far as practical, pit dewatering water; and 2) construct a water treatment plant to treat surplus water. Surplus water will be discharged into Morrison Lake via a diffuser; and 3) land area application of surplus water. | | | | | | | |
| HealthCan-01 | Health Canada, Christie Nelson | 9-Sep-10 | Human Health | 6.21 | 8.22 | II | HC suggests that the proponent work with the owners of the local Wilderness Lodges (Tukii and Ookpik) to develop mutually agreeable mitigation strategies to ensure there is no risk to their health due to the close proximity to mining activities and the haul road. | The human health effects assessed for Ookpik Lodge are of negligible significance while noise is the only human health effect at Tukii Hunting Camp that has a major signficance. PBM is committed to working with both Tukii and Ookpik regarding any issues and particularly any residual human health effects. | Response satisfactory. | | | | Condition #34 | | |
| HealthCan-01b | Health Canada, Christie Nelson | 9-Dec-10 | Human Health | | | | HC notes the proponents commitment to working with the two lodges regarding any of their issues. HC suggests this be reflected in the Table of Commitments | | Resolved. Certificate commitment required. | | | | Condition #33 and 34 | | |
| HealthCan-02 | Health Canada, Christie Nelson | 9-Sep-10 | Land and Resource Use | 6.15 | 7.18.5.3 Traplines, Pg 7-248 | I | HC suggests the proponent describe any traplines that run through the project area including across the project access road and transmission line right-of-way. If traplines exist, HC suggests the proponent assess the potential effects that project activities may have on them. | Traplines are already identified and addressed as requested in the EAC Application. | See below. | | | | | | |
| HealthCan-02b | Health Canada, Christie Nelson | 9-Dec-10 | Land and Resource Use | | | | HC suggests in the future that traplines be discussed as part of the country foods effects assessment. | | Response satisfactory. | | | | | | |
| HealthCan-03 | Health Canada, Christie Nelson | 9-Sep-10 | Human Health | 6.21 | 8.21 Noise, Tables 8.21-5 and 8.21-6 | II | HC finds the Ld and Ln values for the Ookpik Lodge (BN1) and Tukii Hunting Camp (BN2) to be very low and would characterize the area as a quiet rural area. In quiet rural areas, which would characterize the Project study area, it is proposed that a 10 dB adjustment be applied to project noise. This is a precautionary adjustment based on the statement in ISO1996-1:2003 (ISO, 2003) indicating that research shows there is a greater expectation for, and value placed on "peace and quiet" in quiet rural settings which may be equivalent to up to 10 dB. HC suggests the proponent adjust the project-related noise levels accordingly and re-evaluate the potential noise effects at BN1 and BN2. Reference: ISO (2003). "Acoustics-Description, measurement and assessment of environmental noise-Part 1: Basic quantities and assessment procedures," ISO 1996-1:2003(E). | PBM is committed to working with both Tukii and Ookpik regarding any issues and particularly any residual human health effects. PBM will consider applying the 10 dB adjustment to project noise when working with the Tukii and Ookpik owners. | Resolved. Certificate commitment required. | | | | Condition #32 | | |
| HealthCan-03b | Health Canada, Christie Nelson | 9-Dec-10 | Human Health | | | | HC notes the proponents understanding that the Tukii and Ookpik lodges are considered rural areas where the 10dBA adjustment would be applied to project noise. | | No further response required. | | | | | | |
| HealthCan-04 | Health Canada, Christie Nelson | 9-Sep-10 | Human Health | 6.21 | 8.21.5 Mitigation, Enhancement and Management Measures | II | HC suggests the proponent provide more information on what 'visual warning signals' will be adopted to manage potential noise effects of blasting. HC is interested in how these visuals will be communicated to the public to protect their safety. Please provide this information. | Unsupervised public assess to the mine site will be restricted. Any public access will be conditional upon prior safety awareness orientation and/or training. Visual signals are an alternative to audible signals. Worksafe BC Section 21.69 (2) allows alternative warning procedures acceptable to the Board. Such procedures may include flags and lights. As well, evacuation and clearing protocol of employees, personnel accounting system, examination and guarding blast area, blasting time and signal, access control to blast area, and communication protocol. | See below. | | | | | | |
| HealthCan-04b | Health Canada, Christie Nelson | 9-Dec-10 | Human Health | | | | HC suggests the proponent ensure that any local users of the area be notified of such visual signals in advance of their use when appropriate. | | Resolved. Certificate commitment may be required. | | | | Condition #40 | | |
| HealthCan-05 | Health Canada, Christie Nelson | 9-Sep-10 | Human Health | 6.21 | 8.21.7 Significance of Residual Effects | II | HC agrees with the proponent that project activities will have a major noise effect on the Tukii Hunting Camp and notes that although the effect is reversible, it is not short term. HC considers noise events lasting less than three months to be short term. As this project is expected to operate for 21 plus years, HC considers noise from the mine to be a long term effect that would greatly impact the wilderness lodges. | PBM is committed to working with Tukii regarding any issues and particularly any residual human health effects. | Resolved. Certificate commitment required. | | | | Condition #34 | | |
| HealthCan-06 | Health Canada, Christie Nelson | 9-Sep-10 | Human Health | 6.21 | 8.22.2.6 Identification and Description of Potential Effects | II | The Application indicates that the Project noise impacts on receptors along HWY 118 cannot be known due to the uncertainty in estimating project activity, however it then concludes that the impacts will be negligible. HC suggests the proponent provide a commitment to a noise mitigation plan that includes receiving and resolving noise complaints by members of the public. | PBM commits to a noise mitigation plan that includes receiving and resolving noise complaints by members of the public. | Resolved. Certificate commitment required. | | | | EMP | | |
| HealthCan-07 | Health Canada, Christie Nelson | 9-Sep-10 | Human Health | 6.21 | Table 8.22-5 Predicted Mine Site Noise at Tukii Hunting Camp and Extent of Effects | II | The World Health Organization threshold for sleep disturbance will be exceeded at the Tukii Hunting Camp location if residents sleep with their windows partially opened. HC notes that the current indoor noise levels at night in the Tukii Hunting Camp are lower than they will be during mine operation. The increase in sound levels in the bedroom, while close to the WHO levels, would be considered much louder by the home owners who are accustomed to a lower noise level at night. HC suggests the Proponent consider upgrading the quality of the windows to improve the transmission loss at Tukii Lodge so that a 15 dBA level is attainable with windows partially opened and much greater with windows fully closed. | PBM is committed to working with Tukii regarding any issues and particularly any residual human health effects. | Resolved. Certificate commitment required. | | | | Condition #34 | | |

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| HealthCan-08 | Health Canada, Christie Nelson | 9-Sep-10 | Noise | 6.19 | Table 8.22-7 Sound Level Predictions Including Measured Baseline Noise Levels; Section 8.22, Pg 8-795 | II | HC suggests the proponent provide the calculations for Percent Highly Annoyed (%HA), as calculated %HA figures do not appear to adjust for quiet rural area, impulsive sounds, tonal sounds or a night time adjustment. HC would like verification for these calculations. | Health Canada considers an acceptable percent highly annoyed as <6.5%. All modelled scenarios (e.g. Ookpik 0.5% Ha) are below 6.5% with the exception of the Tukii Hunting Camp during construction. Although the percent highly annoyed matrix would indicate negligible effects at Tukii Hunting Camp during operations, the Tukii Hunting Camp owners are considered sensitive receptors, and thus the percent highly annoyed matrix may not be considered an appropriate measuring tool for this assessment. Consequently, the magnitude of effects caused by average daytime noise at the Tukii Hunting Lodge remains moderate, as described above. | Unresolved. HC is still awaiting the information requested to verify the proponent's calculations. | Please note that noise effects on Tukki Hunting Camp will be mitigated by a confidential compensation agreement between Pacific Booker Minerals and Babine Guide Outfitters. The agreement involves financial compensation and relocation of the Hunting Camp. | | | Condition #34 | | |
| HealthCan-09 | Health Canada, Christie Nelson | 9-Sep-10 | Country Foods | 6.17 | Appendix 43, Page 4-2 | XI | Comment: Collection of additional baseline data for metals in individual country foods that are consumed in high frequency and/or magnitude by local residents and First Nation populations is suggested. This must be achieved by involving First Nations and other local hunters and fishers. The only country food samples collected from the project for metal analysis were trout (n = 10), huckleberry (n = 6), and raspberry (n= 9). However, it was reported that moose, grouse and other country foods were also important food sources for the local residents and First Nations and therefore should also have been sampled. Action: HC suggests augmenting the baseline database which would provide a more complete baseline reference against which to compare any future data that are collected throughout the life of the project and validate the predictions from the model. | As part of the Country Foods Baseline Study, Rescan participated in meetings with Lake Babine Nation to request moose muscle tissue samples from people who had harvested moose from the Project area. However, no tissue samples were submitted after these meetings. During the country food interviews, only one interviewee indicated currently using the proposed Project area for hunting and guiding purposes. The interviewee indicated that he could collect moose samples from hunters who shoot moose during the upcoming hunting season. To date, no samples have been received, but any future tissue samples submitted will be analyzed and assessed. | Resolved. Certificate commitment and/or permitting requirement. | | | | Condition #29 | | |
| HealthCan-09b | Health Canada, Christie Nelson | 9-Dec-10 | Country Foods | | | | HC suggests the proponent be more proactive in acquiring such samples, but understands that it can be difficult. HC notes the proponents commitment to analyzing and assessing any moose tissue samples received in the future. | | See above. | | | | | | |
| HealthCan-10 | Health Canada, Christie Nelson | 9-Sep-10 | Country Foods | 6.17 | Appendix 43, Table 6.4-1 | XI | Although fish consumption was not considered in the country food screening level risk assessment, it is noted that the fish serving size for children (73 g/meal) that results from scaling down from the adult portion is lower than the figure recommended for use by HC (106 g). Although fish consumption was not considered, if the country food screening level risk assessment were expanded to include fish, then the correct children serving size should be used to avoid underestimating the potential health risks. | Acknowledged | Response satisfactory. | | | | | | |
| HealthCan-11 | Health Canada, Christie Nelson | 9-Sep-10 | Country Foods | 6.17 | Appendix 43, Appendix A | XI | The consumption quantity for each commodity is reported as being large or small, without defining how many grams/meal is considered to be a small meal size. HC suggests the proponent define a small serving for each commodity. | The reference to large or small serving size is in relation to the interviews and the large serving size is defined as a footnote to the Table that comprises Appendix A Country Foods Interview Results. With the exception of moose these large serving sizes are used in the analysis per Table 4.5-1 Human Receptor Characteristics . For moose a lower figure is used that is assumed to be the average of small and large serving sizes. | Unresolved. Small serving size is still not defined. | | | | Comment noted | | |
| MEMPR-01 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 5.3 | Appendix AC, AG, T | Addendum | 1. The number of static samples collected as part of the geochemical characterization programs appears generally adequate to characterize the waste materials to be generated as part of the Morrison Project. It is clear that there is an overall propensity of waste rock to be PAG and this needs to addressed through management plans. (Comment) | Acknowledged. Further to the comments, the difficulty of segregation of not-PAG waste rock influenced PBM's decision to store all waste rock together in the waste rock dump; thus all the rock in the waste rock dump is stored as PAG. This management plan places all the waste rock in the catchment of the open pit such that waste rock dump ML-ARD runoff and seepage will be captured in the open pit. The waste rock and water management plans are presented on this basis. | Response satisfactory. | | | | | | |
| MEMPR-02 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 5.3 | Appendix AQ1, AQ2 | Addendum | 2. The number of humidity cell samples (5) is considered low for the quantities of waste rock to be generated at site. The limitation on the number of humidity cell samples is principally offset by the large water quality database for both the Granisle and Bell Mine sites which has been used as an analogue comparison for Morrison waste rock. (Comment) | Acknowledged. | Response satisfactory. | | | | | | |
| MEMPR-03 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 5.3 | | | 3. Field kinetic testing should be continued throughout the permitting process and during operations in order to develop more site specific data to be compared directly to the Granisle and Bell Mine databases and predictions for the Morrison project. (Mines Act Permitting Requirement) | PBM commits to continuing field kinetic testing throughout the permitting process and during operations. | Response satisfactory. | | | | PBM will continue field kinetic testing throughout the permitting process and during operations. | | |
| MEMPR-04 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 5.3 | Appendix 15 | Vol VI | 4. Based on the information provided, the proposed criteria for definition of PAG waste rock and tailings are considered appropriately conservative. While there is some evidence that an NPR of less than 2 could possibly be used as the non-PAG/PAG boundary for some materials at this site, the uncertainty in NP estimations does not support a lower non-PAG/PAG cut-off criteria. (Comment) | Acknowledged. | Response satisfactory. | | | | | | |
| MEMPR-05 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 5.3 | 2.1 "TSF Impoundment Water Quality" | RRR | 5. In many instances, the application has utilized available information on waste rock from Bell and Granisle as analog information for the Morrison project, although comparisons to Bell and/or Granisle tailings geochemistry are generally absent. Summary data on Bell and Granisle tailings geochemistry should also be provided, along with a comparison to expected Morrison tailings geochemistry and its appropriateness as an analog. (EA Information Requirement) | A comparative table for tailings as well as discussion of use of Bell and Granisle as analogue is provided in the RRR. | Not adequately addressed. Additional clarification required. See response review memorandum. | Updated water quality predictions for the TSF and open pit are presented in Section 8 of RRR Rev.2. | | 3rd Party Review Response Report-Addendum | | | |
| MEMPR-06 | MEMPR/Lorax | 30-Sep-10 | Environmental Management System | 9 | 13.17.3.4; 2.6 "Water Management" 2.7.1 "Water Cover" | III; RRR | 6. Current geochemical information on the tailings suggests that the tailings will be non-PAG in nature (with the exception of cleaner tailings). However, the design of the impoundment is for a water cover over the tailings during operations and at closure to prevent geochemical concerns. Additional data and rationale is required to support the current tailings impoundment design for operations and post-closure. For geotechnical stability reasons, a significant water cover should not be maintained during operations or at closure if it is not necessary for ML/ARD prevention and water quality protection (see also MEMPR geotechnical review comments). (EA Information Requirement) | Based on the ML/ARD prediction results to date, the potential of acid generation from tailings is considered to be very low. However, the ML/ARD and water quality predictions for the tailings and TSF pond water indicate metal leaching will occur. As a result, the TSF has been designed and will function during operations and after closure with a pond water cover to prevent and minimize metal leaching. A water cover is a proven reliable method of ML/ARD prevention and control for tailings. Further information regarding water management is provided in the RRR. PBM commits during detailed design to determine the best application of the alternatives to manage the water balance to achieve zero contact water discharge during operations and minimize the accumulation of surplus water. For example PBM commits to diverting, as far as practical, clean surface water around the TSF at various stages during operations. | Not adequately addressed. EA Information Requirement. Additional comments in response review memorandum. | A revised tailings management plan incorporates separate disposal of higher suphide Cleaner tailings and lower sulphide Rougher tailings as described in Sections 4.1 and 4.2 of the RRR Rev.2. The revised plan removes the requirement for a closure water cover. Additionally it results in improved TSF water quality years earlier. | | | PBM will during detailed design determine the best application of the alternatives to manage the water balance to achieve zero contact water discharge during operations and minimize the accumulation of surplus water. | | |
| MEMPR-07 (1) | MEMPR/Lorax | 30-Sep-10 | Environmental Management System | 9 | | | 7.The Application does not specifically commit to use of a pyrite reduction circuit for the tailings. Experience with other low sulphur tailings deposits employing the centre-line construction method has shown that the cycloning process can have the tendency to preferentially deposit pyrite with the tailings sands. It is understood that Morrison testwork has indicated that the majority of sulphides are associated with the tailings fines and, ideally should report to the interior of the impoundment in the overflow slimes. (Cont. Below) | Cont. Below | See below. | | | | | | |
| MEMPR-07 (2) | MEMPR/Lorax | 30-Sep-10 | Environmental Management System | 9 | | | However, because the density of pyrite is much greater than that of the fines, it has been observed that sulphides can also report (in significant quantities) to the underflow sands with the potential to produce PAG embankment sands. The proponent should commit to adding a desulphidization circuit to the tailings processing to ensure clean construction sand is available for tailings dam construction. At permitting, a QA/QC testing program and management criteria will be required to guide tailings sand placement. (EA Commitment and Mines Act Permitting Requirement) | PBM commits to producing a non-acid generating cylcone sand for dam construction. PBM commits that if producing the non-acid generating sand requires adding a desulphidization circuit to the tailings processing one will be installed. PBM further commits to a QA/QC testing program and management criteria as required to guide tailings sand placement. | Response satisfactory. Certificate commitment required. | | | | | | |
| MEMPR-08 | MEMPR/Lorax | 30-Sep-10 | Environmental Management System | 9 | | | 8. A conceptual monitoring program and identification of geochemical criteria that will be used to determine disposal location of Booker Lake and Ore Pond sediments is required. (EA Information Requirement, detailed program required for Mines Act Permitting) | PBM commits to submit a conceptual monitoring program for permitting. Selection of the disposal location for sediment considered geochemical data PBM acquired from core samples. PBM commits to further geochemical testing of the sediments during detailed design and during construction. | Not adequately addressed. EA Information Requirement. Additional comments in response review memorandum. | Storage and handling of Booker Lake and Ore Pond sediments, and a conceptual monitoring program is updated in Sections 5.1.1 of RRR Rev.2. | | | Condition #1 | | |
| MEMPR-09 | MEMPR/Lorax | 30-Sep-10 | Environmental Management System | 9 | Appendix AC, AD | Addendum | 9. Both Booker Lake and Ore Pond have monitoring data included in the Application which indicate that the water bodies are anoxic at depth (see Appendix AD of 2010 Addendum; pg 22). This will be a concern for discharge to fish-bearing receiving streams and to Morrison Lake. This concern has been forwarded to the Ministry of Environment reviewers as it pertains to their mandate. (Comment; to be resolved with MOE) | PBM commits to resolving the discharge of anoxic water from Booker Lake and Ore Pond with MOE prior to construction. NB: The entire water bodies, Booker Lake and Ore Pond, are not anoxic. However at depth the water is expected to be anoxic. If confirmed this may be dealt with using an aeration system prior to discharge. | Response satisfactory for MNRO. Should be confirmed with MOE. | The direct release of anoxic waters to the receiving environment may have deleterious effects on biota. These effects can be prevented by the simple expedient of oxygenating the waters prior to final release and design of the works will be carried out as part of detailed design and permitting. | | | Project Description, Section 5.3.2 | | |

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| MEMPR-10 | MEMPR/Lorax | 30-Sep-10 | Environmental Management System | 9 | Appendix 15; Appendix AC, 2.4.3, 2.5.3 | Volume V; Addendum | 10. A management plan for water quality (beyond management of TSS) is needed for the open pit pre-stripping phase, given the possibility of encountering PAG overburden and general associated metal leaching concerns under neutral drainage conditions (see Section 4 of review comments). (EA Information Requirement) | PBM commits to ABA testing of disturbed materials during construction. PAG sediment will be placed in the TSF and other PAG materials will be placed in the WRD. Water that is not suitable for direct discharge will be transported to and stored in the TSF. PBM commits to, as part of the EMS, to further developing the water management plan for permitting. | Response satisfactory. Storage of poor quality water in the TSF is considered a viable management strategy, especially for the pre-stripping phase. See also comments 11 and 21 on | | | | | | |
| MEMPR-11 | MEMPR/Lorax | 30-Sep-10 | Environmental Management System | 9 | Appendix AX; 2.6 "Water Management" | Addendum; RRR | 11. It is unclear whether the TSF will be able to operate as a zero discharge facility during operations. Refer to water balance comments below and MEMPR geotechnical review comments. (Comment) | PBM commits during detailed design to determine the best application of the alternatives to manage the water balance to achieve zero contact water discharge during operations and minimize the accumulation of surplus water. For example PBM commits to diverting, as far as practical, clean surface water around the TSF at various stages during operations. Additional details of the water management plan are provided in the RRR. | Not adequately addressed. EA Information Requirement. Additional comments in response review memorandum. | Water management and water balance is updated in Section 7 of RRR Rev.2. Rationale for zero discharge is updated for the Expected Case and a management plan is defined for the Upper Bound water balance case. Adaptive Management is also identified and summarized in | | A water treatment plant will be ocnstructed is surplus water accumulates in the TSF. This is further described in the 3rd Party Review Response Report. | Condition #17 | | |
| MEMPR-12 | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | 16.5.5.2; | III; | 12. Conceptual design information is required for the low permeability cover to be placed over the WRD. (EA Information Requirement, detailed design at Mines Act Permitting) | PBM commits to providing a detailed design for the cover for permitting. Conceptual design of the low permeability cover is provided in the EAC Application. A 1 m thick layer of overburden will be spread over the surface of the smoothed waste rock surface. This material will be compacted to reduce the amount of infiltration into the PAG rock. The upper 0.2 m of the overburden will be ripped to ensure a 0.5 m effective rooting depth on this site once the final 0.3 m thick layer of soil is applied. The soil cap will also be ripped in two directions. The soil will then be tracked before revegetating. Care will be taken not to re-compact the soil. | Response satisfactory. | As the waste rock will be placed into the open pit and submerged upon closure no cover will be added to the waste rock during operations. | | | Condition #8 | | |
| MEMPR-13 | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | | | 13. Directing TSF water to the open pit at closure is a valid strategy for minimizing oxidation of lower pit wall benches. (Comment) | Acknowledged. | Response satisfactory. | | | | | | |
| MEMPR-14 | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix AB, Y, AI, AU | Addendum | 14. Portions of the Ore/LGO stored in the stockpile are expected to become acid generating during the life of the mine. Experience suggests that flotation processes can be significantly affected by weathering and metal recoveries reduced. A management plan is needed for the Ore/LGO stockpile in the event it is not milled. If collection and treatment of seepage is planned, then a model run of water quality effects should be produced that includes the LGO as a long-term loading source. (EA Information Requirement) | The Ore/LGO seepage is limited to 0.63m3/hr. PBM has considered the impact of both Temporary Suspension and Early Extended Mine Closure. In the event that the ORE/LGO is not milled, PBM commits that any un-processed material from the LGO stockpile will be placed in the open pit and flooded. | Response satisfactory. Certificate commitment required. More details will be required at permitting. | | | | Condition #9 | | |
| MEMPR-15 | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix AU | Addendum | 15. Significant long term environmental liability exists for the Morrison Project due to the planned on-land storage of PAG wastes and possibly LGO. It is recommended that the financial security include resources for installation, operation, monitoring and maintenance of the low permeability cover and HDS lime treatment systems. (Mines Act Permitting Requirement) | The requirement for managing ML/ARD in perpetuity (ie treating of water from the open pit and monitoring the TSF) exists even with the waste rock disposed of in the TSF. In the event that the LGO is not milled, PBM commits that the material will be placed in the open pit and flooded. PBM has evaluated the Reclamation and Closure Financial Security for various options. PBM commits to resolving the appropriate required level and form of financial security with MEMPR during Permitting. | Response satisfactory. | | | | PBM will resolve the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | | |
| MEMPR-16 | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | | | 16. There is potential that impoundment seepage collected in the seepage collection pond will need to be pumped for a period of time post closure. It is recommended that a commitment be made to capture and treat impoundment seepage for as long as is required, and that the financial security required at the Mines Act Permitting phase incorporate an allowance for longer term pumping. (EA Commitment and Mines Act Permitting Requirement) | PBM commits to pumping water from the seepage collection ponds to the TSF impoundment as long as is required (ie until seepage meets discharge criteria). PBM does not propose to treat the seepage collection pond water as it is being returned to the TSF. PBM commits to resolving the appropriate required level and form of financial security with MEMPR during Permitting. | Response satisfactory. Certificate commitment required. | | | | | | |
| MEMPR-17 (1) | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | | | 17. The Application and Addendum indicate that significant seepage from the TSF will occur during operations and closure from the interior of the facility that will not be captured by seepage collection dams and will report to both downgradient surface water (e.g. streams MCS-7 and MCS-8) as well as Morrison Lake. For example, when the TSF is completely full at closure, upwards of 208 $m^3/h$ (~60 L/s) is predicted to emanate as seepage from the interior of the TSF and discharge to the receiving environment. (Cont. Below) | Acknowledged | See below. | | | | | | |
| MEMPR-17 (2) | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix AC; 2.6 "Water Balance" | Addendum; RRR | Updated water balance schematics presented in the Addendum (Appendix AC; Figures 1.3, 1.4 and 1.5) do not accurately depict this scenario and none of the figures indicate TSF seepage loss to the environment. Because TSF seepage represents a significant flow (208 m3/h) in the closure scenario and roughly equivalent to the anticipated open pit surplus requiring treatment during post-closure (e.g. 214 m3/h), this uncontrolled seepage that bypasses the seepage collection ponds below the dams needs to be clearly represented in the Application figures. (EA Information Requirement) | Revised Figures 1.3, 1.4 and 1.5 are provided in the RRR. | Response satisfactory. | | | | | | |
| MEMPR-18 | MEMPR/Lorax | 30-Sep-10 | Environmental Management System | 9 | Appendix 11, Appendix IX; Appendix 23; Appendix AC; 2.6 "Water Balance" | V; VIII; Addendum; RRR | 18. Upgradient diversions are proposed for the TSF and WRD to minimize the amount of contact water generated during operations and closure. It appears that water balance modeling has assumed that these diversions ditches to be 100% efficient with no seepage losses through the base of the diversion channels (see water balance tables included in Appendix IX of Appendix 11 of EAC Volume V; pg 723 of pdf). This assumption is not considered realistic nor appropriately conservative given that it does not appear the ditches are designed as lined conveyances. Future water balance modeling should consider diversion ditch efficiencies that are more conservative, perhaps on the order of 80% effective. (EA Information Requirement) | Acknowledged, however the diversion ditch around the TSF is subsequently disregraded in analysis by Rescan *"For the purposes of the water balance modelling, the full upstream catchment area of 11.1 km 2 is input into the TSF (e.g., no diversion around TSF) throughout the mine life."* The efficiency of the diversion channels will influence the flow that is diverted. The diversion channels for the TSF are primarily located within clay tills and, consequently, their efficiency should be >90%. During detail design the requirements for the diversion and the necessity of using clay liners and/or synthetic geomembrane liners will be assessed in more detail. | Response satisfactory. | | | | | | |
| MEMPR-19 (1) | MEMPR/Lorax | 30-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | | | 19. There is uncertainty as to how WRD seepage is accounted for in the water balance for operations and closure. The EAC (2009) water balance, developed by Rescan and used as a basis for the KCB 2010 Addendum water balance modifications, assumed that 50% of total precipitation falling on the WRD would runoff and infiltrate, respectively during the operations phase of the project. This infiltration would presumably report as WRD seepage and be collected in the pit as per the water management plan. However, this scenario is not depicted in the open pit water balance schematic for operations and closure of the EAC (Volume VIII; Appendix 23; Figures 6.1 and 6.2). In both cases, WRD infiltration is shown to report to groundwater and Morrison Lake which is inconsistent with the text and the water management plan. (Cont. Below) | See below | See below. | | | | | | |
| MEMPR-19 (2) | MEMPR/Lorax | 30-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appednix AB | Addendum | Seepage collection ditches are proposed to be constructed for the WRD to collect seepage and use this water in the process plant. Neither the Rescan water balance summary (Table 4.2-2 of Volume VIII; Appendix 23) nor the KCB water balance summary (Table 3.1 of Addendum Appendix AB) include a WRD seepage term in the water balance for the operations or closure phases. Conflicting information exists in the application. For example, KCB - in describing their approach to estimating pit lake water quality at closure using a load-based assessment - assume a direct loading to the pit lake from WRD seepage (see 2010 Addendum; Appendix AB and Appendix I; Section 4 of that document). Specifically, KCB assumes that 7.7 $m^3/h$ will report to the pit lake as WRD seepage; however, this seepage volume is not included in their water balance summary (see Table 3.1 of Appendix AB). (Cont. Below) | The WRD seepage values were used for the "check" pit lake water quality assessment. It is assumed that the pit lake groundwater inflows sufficiently captured the total quantity of inflows including the WRD. PBM commits that this will be clearly accounted for during the permitting phase. | Not adequately addressed; additional comments in response review memorandum. | The predictions of water quality and water sources have been updated to reflect the revised closure plan with waste rock placed inot the open pit and submerged and these are presented in Section 8 of the RRR Rev.2. The water balance sources are presented in Section 7 of the RRR Rev.2. | | 3rd Party Review Response Report - Addendum | | | |
| MEMPR-19 (3) | MEMPR/Lorax | 30-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | | | The origin of the 7.7 $m^3/h$ WRD seepage estimate is from closure runoff values for the WRD developed by Rescan (Volume VIII; Appendix 23). Rescan provided an estimate of WRD runoff at 77 $m^3/h$, which was based on an assumption of 70% runoff of total precipitation. Rescan also assumed that 30% infiltration occurred through the low permeability cover; assuming a 175 ha dump at closure and 550 mm of precipitation, infiltration of approximately 33 $m^3/h$ is derived. (Cont. Below) | See above and below | See above. | | | | | | |
| MEMPR-19 (4) | MEMPR/Lorax | 30-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | | | In their estimate of WRD seepage reporting to the pit lake at closure, KCB only assumed that 10% of the 77 $m^3/h$ (i.e., 7.7 $m^3/h$) infiltrated the dump and reported as seepage to the pit lake. How/where has the 33 $m^3/h$ of infiltration been included in the balance? It is unlikely that the 33 m3/h has been assumed in the water balance to be included in regional groundwater flow to the pit. Indeed, KCB conducted modeling of Low Grade Ore seepage and determined that: *Less than 2% of precipitation infiltrates through the WRD/LGO to the till layer. The remaining discharges at the toe. (Section 3.2.4; App. AB) (Cont. Below)* | See above and below | See above. | | | | | | |
| MEMPR-19 (5) | MEMPR/Lorax | 30-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | | | This would suggest that most of the 33 $m^3/h$ should be included in the water balance as seepage reporting to the pit lake; seepage values should also be included in the operations balance. (Cont. Below) | See above and below | See above. | | | | | | |

| Issue No. | Commenter & Agency | Date | Issue Theme | Section in TOR | EAC Chapter or Supporting Document | EAC Volume | Additional information or clarification required in Application | Proponent Response | Status of Issue as of 01-24-2011 | Additional Proponent Response | Additional Working Group Comments | Additional Proponent Response | Final PBM Response | Key Project Component Number | Status of Issues as of May 2012 |
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| MEMPR-19 (6) | MEMPR/Lorax | 30-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix AB, AC; 2.6 "Water Balance" | Addendum; RRR | Based on the above, it is unclear if the seepage from the WRD/LGO is correctly included in the operations and closure site water balance. Infiltration estimates utilized in the modeling appear unrealistic compared to experience with engineered soil covers. WRD/LGO seepage volumes and how these report to the pit need to be clarified and updated assuming more realistic cover infiltration rates based on the conceptual cover design, as well as assuming that WRD upgradient diversion ditches are not 100% efficient. (EA Information Requirement) | With respect to water flow, KCB assumed that WRD seepage is part of the groundwater inflow values. With respect to load, KCB assumed a flow rate of 10% of 77 m3/hr. Seepage from the WRD will report to the open pit however a small amount of seepage from the LGO (0.63 m3/hr) will report to Morrison Lake. To be correct, the runoff coefficient of 70% and infiltration rate of 30% used by Rescan does not account for evapotranspiration. KCB believe an infiltration rate of 10% through compacted clay till cover is a reasonable assumption. The efficiency of the diversion channels will influence the flow that is diverted. The diversion channels for the TSF are primarily located within clay tills and, consequently, their efficiency should be >90%. During detail design the requirements for the diversion and the necessity of using clay liners and/or synthetic geomembrane liners will be assessed in more detail. In either event the overall flow (whether surface or groundwater) is within the accuracy of the estimates and does not change the overall water balance or water quality estimates. | Response satisfactory. Adequately addressed with respect to water quantities; however the deferral of the water balance to permitting is not adequate. See comment 21 | A detailed monthly life-of-mine water balance is included in RRR-Rev.2 for the Expected Case and Upper Bound Case. | | 3rd Party Review Response Report - Addendum | | | |
| MEMPR-20 (1) | MEMPR/Lorax | 30-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Section 3.6 "Open Pit Groundwater Flows" | RRR | 20. Sensitivity results for potential maximum pit dewatering rates varied between approximately156 m3/h to 592 m3/h with a base case of 291 m3/h assumed for the water balance. To ensure that the TSF can truly be operated as a zero surface water discharge facility under a wide range of conditions, the higher pit dewatering rates should be included in a water balance sensitivity analysis. (EA Information Requirement) | The EAC groundwater model for the open pit assumed that perimeter dewatering wells would be used to draw down the water table in the perimeter rock to the base of the open pit. These dewatering wells would draw down the groundwater table in a cone. Using this model the dewatered area is excessive extending well beyond the extent of dewatering required for pit wall stability. This approach was used due to limitations of the software and, as the dewatered area is too large, "over-predicts" the required open pit dewatering flow rate.<br><br>The actual dewatering will consist of a combination of pit wall drainage holes, combined with some dewatering wells. The dewatered area around the open pit will be only as required to meet pit wall stability requirements. Thus a smaller dewatered area will be achieved resulting in a lower dewatering flow rate than was predicted in the initial EAC Application. (cont'd below) | Response satisfactory. See also comments 11 and 21 on water balance. | | | 3rd Party Review Response Report - Addendum | | | |
| MEMPR-20 (2) | MEMPR/Lorax | 30-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | | | | | As the dewatered area in the EAC Application is considered excessive, the Base Case pit dewatering flows presented in the EAC Application are also considered excessive, and are therefore considered to be Upper Bound flows for open pit dewatering. The result is that the extent of dewatering modeled exceeds that required to achieve pit wall stability. This would not be the case - as such, the base case 291m3/hr is considered by KCB to be an upper bound case. | See above. | | | | | | |
| MEMPR-21 | MEMPR/Lorax | 30-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix 23, Appendix AC | Volume VIII, Addendum | 21. The Rescan 2009 water balance and the revised Addendum balance should be provided on a monthly time step evaluating wet and dry years. Presently, only the original 2007 KCB water balance is provided on a monthly time step; however, revisions to the balance and the requests for additional sensitivity should be evaluated on a monthly basis and provided for review. (EA Information Requirement) | PBM commits, during detailed design, to developing a life of mine, monthly, integrated geochemical-water balance model based on the GoldSim platform, to provide more clarity and flexibility in assessing potential loading and water flow options, and for carrying out sensitivity analyses. | Not adequately addressed. EA Information Requirement. Additional comments in response review memorandum. | Section 7 and Appendix III of RRR Rev.2 provide additional details of the water management plan and life of mine monthly water balance for the Expected Case and the Upper Bound case. | | | Condition #17 | | |
| MEMPR-22 | MEMPR/Lorax | 30-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix AC; 2.6 "Water Management" | Addendum; RRR | 22. The site wide water balance summary presented in Table 1.2 of Appendix AC appears to have some errors and is not consistent with the text. (Clarification) | Additional details of the water management plan are provided in the RRR. | Response satisfactory. | | | | | | |
| MEMPR-23 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 6.3 | Appendix AB, Table 3.11, Pg 44 | Addendum | 23. The use of the Granisle, and to a lesser extent Bell Mine, water quality data as an analogue for potential water quality from mine waste at Morrison is reasonable and provides a potentially very useful constraint on water quality predictions given the apparent similarity in geological setting. The final water quality prediction for the WRD using this approach should be provided along with a comparison and rationale for the KCB estimates for WRD seepage being used in the water quality modeling. (EA Information Requirement) | The WRD water quality prediction using the EDCM approach is shown in Table 3.11. The KCB Load Based Model estimate was developed as an alternative "check" on the EDCM prediction. | Not adequately addressed. EA Information Requirement. Additional comments in response review memorandum. | Updated water quality predictions for the TSF, waste rock, and open pit are presented in Section 8 of RRR Rev.2. | | 3rd Party Review Response Report - Addendum | | | |
| MEMPR-24 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 6.3 | | | 24. While arbitrary, the pH designations assigned to each of the four adjusted SNPR categories defined in the block model and that are then used to link the Granisle water quality database to Morrison appear reasonable. (Comment) | Acknowledged | Response satisfactory. | | | | | | |
| MEMPR-25 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 6.3 | | | 25. The assumption that field barrels NOR-1 and NOR-2 represent 90% and 10% of the final WRD is tenuous at best. As well, two sampling events for the field barrels are not sufficient for estimating long-term seepage chemistry from the WRD. (Comment) | Acknowledged. Sampling from the barrels has and will continue to provide further data. | Response satisfactory. | | | | | | |
| MEMPR-26 (1) | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 6.3 | | | 26. It is not clear to what extent the KCB alternative WRD seepage chemistry prediction is used in the Application submission. While KCB uses the WRD seepage chemistry as a source loading term to the overall estimate of post-closure pit water quality, KCB does not use their revised pit chemistry in the water treatment plant analysis. Instead, KCB uses the Rescan EAC pit lake chemistry prediction as a basis for the water treatment plant design and as a basis for estimating treated water quality to be discharged to Morrison Lake. (Cont. Below) | See below | See below. | | | | | | |
| MEMPR-26 (2) | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 6.3 | Appendix AB, Table 3.11, Pg 44 | Addendum | What was the purpose of the KCB modeling approach? The report suggests that the KCB approach represents an "upper bound estimate" (Appendix AB; pg 47); however, comparison of the EAC and KCB pit water quality estimates do not suggest this to be the case for a number of parameters as shown below: (TABLE on Document) An explanation of the use of the KCB mass loading assessment for the WRD and pit lake in water quality predictions is required. (EA Information Requirement) | The KCB Load Based Model estimate was prepared after the initial Application so was not used in the EAC submission. It was developed as an alternative "check" on the EDCM prediction. The results, given the large range of uncertainty, are very similar for most elements. The KCB Load Based Model was not used for the water treatment plant design as the EDCM prediction was considered validated as reasonable by the check against the KCB Load Based Model. | Response satisfactory. | | | | | | |
| MEMPR-27 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 6.3 | Appendix AC, AM | Addendum | A 15 Mt overburden stockpile is scheduled to be built on the peninsula west of the open pit. Drainage chemistry (surface runoff and seepage) originating from this mine component is assumed to be of neutral pH. Shake-flask testing of overburden material from outside the pit outline indicated near-neutral to slightly alkaline leachate of approximately 8.0. The Granisle EDCM for material with SNPR >2.5 and pH 7 was used to provide an estimate of seepage quality from overburden material in water quality modeling. 27. The source term used for overburden seepage appears reasonable and is likely conservative as it utilizes Granisle data for neutral waste rock drainage chemistry which would be expected to be of poorer quality than overburden material. (Comment) | Acknowledged. Note that the volume in the stockpile is reduced to 3.27 Mm3 of glacial till suitable for use in reclamation. The remaining 4.70 Mm3 will be placed in the waste rock dump or used for construction. | Response satisfactory. | | | | | | |
| MEMPR-28 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 6.3 | | | 28. The two predictions converge for most parameters with the exceptions being for nitrogen species and long-term sulphate and cadmium. The EAC predictions for Fe appear anomalously low and are likely a result of the PHREEQC modeling which precipitates out all the Fe; equilibrium modeling was not employed in Addendum approach. (Comment) | Acknowledged. See below. | Response satisfactory. | | | | | | |
| MEMPR-29 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 6.3 | 2.1 "TSF Impoundment Water Quality"; 2.6 "Water Management" | RRR | 29. The assumption that TSF pond water will be similar to the lock-cycle supernatant quality is not adequately conservative and may not be reasonable. The TSF will receive WRD and LGO stockpile seepage, pit runoff and pit water which, at a minimum will contribute significant loadings of sulphate and probably metals. Updated water quality modeling for the TSF is warranted. There could be potential value in also examining Bell tailings as an analog to help constrain conditions. The TSF pond water for Morrison should at least examine the Bell Mine tailings water quality database to be consistent with the general approach in the EAC that repeatedly states that Granisle and Bell Mine are good proxies for the geochemical conditions at Morrison. (EA Information Requirement) | Acknowledged. A revised TSF water pond water quality and effects assessment is submitted in the RRR. The assessment is based on the EDCM model with a pH=8 in the TSF pond. TSF water quality prepared in this manner varies from the lock-cycle test (year 1) to Granisle EDCM values (year 19). Thereafter the water quality will improve, due to residual infows including rain and surface water runoff being of higher quality. For all parameters except cadmium the water will be suitable for discharge in Year 46. As surface discharge from the TSF after the open pit is full may not be required (depending on the final water balance and seepage rates) the exceedance for cadmium is not considered significant. Nonetheless, the actual water quality will be monitored and, if discharge is required, site specific water quality objectives would be proposed prior to discharge. | Response satisfactory. | | | | | | |
| MEMPR-30 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 6.3 | Appendix 15; Appendix 23; 2.1 "TSF Impoundment Water Quality" | Volume VI, VIII; RRR | 30. Tailings slurry water and porewater quality for the TSF was estimated based on aging tests of tailings supernatant from lock-cycle metallurgical testing. The water quality modeling approach employed by Rescan is described in Volume VI; Appendix 15 and Volume VIII; Appendix 23. Tables representing tailings slurry water/porewater quality used in water quality modeling are presented in each appendix (e.g. Table 6.5-1 in Appendix 15 and Table 7.1-2 and Table 11.1-2 in Appendix 23); however the values in each table are notably different for several key parameters. For example, the copper concentration reported as a modeling input value was 0.0018 mg/L, 0.00259 mg/L and 0.033 mg/L in Table 6.5-1, Table 7.1-2 and Table 11.1-2, respectively. Accordingly, it is not clear which source term chemistry for the tailings porewaters was actually used in the modeling - this should be clarified. (Clarification) | A revised TSF water quality and effects assessment is contained in the RRR. | Not adequately addressed. See comment 31 below. EA Information requirement. | Updated water quality predictions for the TSF are presented in Sections 8.1 and 8.2 of RRR Rev.2. | | Water quality predicions have been updated in the 3rd Party Review Response Report - Addendum 1. | | | |

| Issue No. | Commenter & Agency | Date | Issue Theme | Section in TOR | EAC Chapter or Supporting Document | EAC Volume | Additional information or clarification required in Application | Proponent Response | Status of Issue as of 01-24-2011 | Additional Proponent Response | Additional Working Group Comments | Additional Proponent Response | Final PBM Response | Key Project Component Number | Status of Issues as of May 2012 |
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| MEMPR-31 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 6.3 | 2.1 "TSF Impoundment Water Quality" | RRR | 31. Similar to TSF water quality, the use of lock-cycle supernatant water as a proxy for Morrison TSF porewater quality is not conservative enough. Experience from other mines has repeatedly shown that tailings porewaters are often reducing environments, containing elevated concentrations of dissolved Fe and Mn. These conditions are also important in controlling concentrations of redox sensitive species, such as arsenic which can be elevated in reducing environments. Morrison is known to contain mineralization of arsenopyrite and elevated arsenic was observed in early phases of tailings kinetic testing. Predictions should be updated to consider the potential for reducing conditions. Bell Mine tailings monitoring data should be considered if appropriate in estimating TSF porewater from Morrison. (EA Information Requirement) | A revised TSF water quality and effects assessment is contained in the RRR. | Not adequately addressed. EA Information Requirement. Additional comments in response review memorandum. | Updated water quality predictions for the TSF and open pit are presented in Sections 8.1 and 8.2 of RRR Rev.2. The potential for redox conditions is addressed in Section 8.1.3 of RRR Rev.2. Due to the lack of an available oxyanion inventory in solution for initial sorption, the reductive dissolution of oxides is not expected to be a metal(loid) release mechanism. | | see above | | | |
| MEMPR-32 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 6.3 | 2.1 "TSF Impoundment Water Quality" | RRR | 32. The use of the water balance and mass loading approach using GoldSim to develop water quality predictions for each of the key mine site components overtime is reasonable. However, the modeling is presently a black box and the Application would benefit by providing transparency on how the calculations are made for an example time period. Tables outlining water quality modeling calculations are required to demonstrate how calculations were conducted for all components of the water quality model, including the TSF, pit lake, and receiving environment predictions. In this way, each source term and associated chemistry could be viewed and assessed. For example, the WRD seepage chemistry is not presented in the EAC, only the chemistry for individual adjusted SNPR categories for waste that will make up the WRD. As WRD seepage will be collected during operations and within the pit a closure, it is a major source term in the modeling that needs to be defined. (EA Information Requirement) | Consideration that the waste rock dump seepage will be collected during operations and reports to the open pit is made. Both the TSF and pit lake water quality are conservatively predicted using the Bell and Granisle EDCM per RRR. PBM commit to developing, during detailed design, a life of mine, monthly, integrated geochemical-water balance model based on the GoldSim platform, to provide more clarity and flexibility in assessing potential loading and water flow options, and for carrying out sensitivity analyses. | Not adequately addressed. EA Information Requirement. Additional comments in response review memorandum. | Updated water quality predictions for the TSF and open pit are presented in Section 8 of RRR Rev.2. | | see above | | | |
| MEMPR-33 | MEMPR/Lorax | 30-Sep-10 | Geology and ML-ARD | 6.3 | 2.1 "TSF Impoundment Water Quality"; 4.0 "Morrison Lake Effects" | RRR | 33. The importance of TSF porewater quality estimates relates to predicted high seepage rates during operations and closure for Morrison as described in the Application. Seepage rates on the order of 200 $m^3$/hr (~60 L/s) are presented. However, water quality impacts to the receiving environment (e.g. MCS-7 and Morrison Lake) are predicted to negligible because TSF porewater concentrations are assumed in the Application to be of relatively good quality. These potential impacts have likely been underestimated and an updated water quality evaluation, for all receiving environment locations using more conservative porewater concentrations, needs to be performed for both the operational and closure phases. (EA Information Requirement) | Both the TSF pore water quality and effects assessment are updated in the RRR. | Not adequately addressed. EA Information Requirement. Additional comments in response review memorandum. | The RRR Rev.2. presents an updated seepage estimate (Section 6.2.5), updated geochemistry (Section 8.2) and updated effects assessment (Section 10.2). | | see above | | | |
| MEMPR-34 | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix AA | Addendum | 34. The final pit lake water quality predictions appear to be reasonably conservative with assumed low pH conditions and elevated metal concentrations and sulphate. Conceptual water treatment design has been based on treatment of these waters and the proposed HDS water treatment system is a proven technology, capable of treating a wide range of influent chemistries. (Comment) | Acknowledged | Response satisfactory. | | | | | | |
| MEMPR-35 | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix 23; 2.1 "TSF water Quality" | Addendum; RRR | 35. The pit lake water quality predictions (Table 9.2-1) indicate significant alkalinity (e.g. ~250 mg/L) in the presence of elevated amounts (e.g. ~400 mg/L) of acidity which would not appear possible. (Clarification) | Agreed, values may be a typo/model error as the EDCM values for SNPR classes suggest different relative values. Note that Granisle EDCM values used in the current pit lake water quality predictions are presented in the RRR. | Response satisfactory. | | | | | | |
| MEMPR-36 | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | | | 36. The conceptual HDS water treatment plant proposed for Morrison appears conceptually reasonable to treat the potential range of water quality conditions that may exist at closure. (Comment) | Acknowledged | Response satisfactory. | | | | | | |
| MEMPR-37 | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix AA; Appendix AC | Addendum | 37. Please provide diagrams and relevant cross sections of the conceptual layout and design of the treatment plant, water collection and discharge features and sludge storage facilities. (EA Information Requirement) | Details on the water treatment plant, sludge storage piles, and associated works are included in Appendix AC. Water collection is via a pump from the pit lake, discharge is via Morrison Lake diffuser, and sludge storage piles are shown with the WRD on KCB Drawings D-3301 to D-3305. | Response satisfactory. | | | | | | |
| MEMPR-38 (1) | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix AB; 4.0 "Morrison Lake Effects" | Addendum; RRR | 38. The key assumption of the Addendum assessment is that Morrison Lake is and remains a dimictic lake with twice per year complete mixing and turnover. This process would be critical to achieving predicted water quality as it results in the flushing of a portion of the effluent out of the lake, limiting the concentrations that can accumulate over time. If complete turnover did not occur, with concomitant flushing, much higher concentrations than predicted could result in the lake. Stated slightly differently, the important question is whether the discharge of treated effluent, containing much higher concentrations of dissolved salts (e.g. sulphate) as compared to current lake background concentrations, has the potential to disrupt the twice annual turnover of the lake by altering the density of the water column. (Cont. Below) | The additional load from the upper bound TSF seepage has the potential to double the sulphate levels in Morrison Lake (from approximately 25 mg/L to 50 mg/L). The effect of sulphate is negligible and will not effect stratification of the lake. Additional details are provided in the RRR. | Response satisfactory. | | | | | | |
| MEMPR-38 (2) | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | 4.0 "Morrison Lake Effects" | RRR | The potential for worse than predicted water quality in Morrison Lake is heightened by the fact that loadings from TSF seepage are currently not incorporated into the Morrison Lake modeling and effects assessment and the actual status of lake limnology on a seasonal basis are not know. Updates to Morrison Lake water quality predictions are warranted that incorporate all significant loading sources (see next comment). These concerns have been forwarded to MOE reviewers as it pertains to their mandate. (Comment; to be resolved with MOE) | A revised effects assessment considering revised quality of TSF seepage on Morrison Lake are documented in the RRR. | Response satisfactory for MNRO. Should be confirmed with MOE. | | | | | | |
| MEMPR-39 | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | 2.1 "TSF Impoundment Water Quality" | RRR | 39. Water quality estimates for Morrison Lake at closure only consider loadings from the water treatment plant via the diffuser; no loadings are considered from TSF seepage discharge into the lake. The combined TSF seepage flows reporting to the lake (~199 $m^3$/hr) are estimated to be roughly equal to the treatment plant discharge (214 $m^3$/hr). Recognizing that TSF porewater quality has been underestimated, particularly with respect to sulphate, these loadings need to be factored into current long-term water quality predictions and the effects assessment for Morrison Lake at closure. (EA Information Requirement) | Acknowledged.A revised TSF water pond water quality and effects assessment is submitted in the RRR. The assessment is based on the EDCM model with a pH=8 in the TSF pond. TSF water quality prepared in this manner varies from the lock-cycle test (year 1) to Granisle EDCM values (year 19). Thereafter the water quality will improve, due to residual infows including rain and surface water runoff being of higher quality. For all parameters except cadmium the water will be suitable for discharge in Year 46. As surface discharge from the TSF after the open pit is full may not be required (depending on the final water balance and seepage rates) the exceedance for cadmium is not considered significant. Nonetheless, the actual water quality will be monitored and, if discharge is required, site specific water quality objectives would be proposed prior to discharge. | Not adequately addressed. EA Information Requirement. See response to comment 31 in responne review memorandum. | Updated water quality predictions for the TSF and open pit are presented in Section 8 of RRR Rev.2. An updated effects assessment on Morrison Lake is presented in Section 10.2 of RRR Rev.2, which indicates the contribution of the TSF seepage on Morrison Lake water quality. | | | | | | |
| MEMPR-40 | MEMPR/Lorax | 30-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | 2.2 "Seepage Estiamte Basis" | RRR | 40. Depending on the results of updated modeling, the proponent may need to consider the inclusion of more substantial seepage control measures (i.e., natural or synthetic liner system). (Comment and possible EA Information Requirement) | Acknowledged. PBM commit to carrying out a detailing impoundment permeability assessment in the detail design stage and a more refined groundwater model to better predict potential effects. Mitigating factors at this stage include: 1) Assuming a vertical hydraulic gradient of 1 (conservative) and an average permeability of $10^{-8}$ m/s for the impoundment - yields a seepage rate of 150 m3/hr); 2) Clay till permeability measured in the laboratory was $10^{-10}$ m/s. Seepage rates predicted in the EAC are considered to be upper bound estimates. | Response satisfactory. | | | | | Condition #12 | | |
| MEMPR-41 | MEMPR/Lighthall | 1-Oct-10 | Geology and ML-ARD | 6.3 | Appendix AC, 4.3.3; Appendix AM, Chapter 7 "Booker Lake and Ore Pond Sediments" | Addendum | Development of the waste dump foundation area will require dewatering and excavation of sediments: 600,000 m3 for Booker Lake and 50,000 m3 for Ore Pond. There does not, however, appear to have been any investigation carried out to determine either the sediment volumes or material characteristics. The writer is concerned that there is not enough data to properly characterize the sediments in the lake bottoms, or to assess how the material should be handled. If there is a significant depth of soft, organic materials, it may not be feasible to stack these in the proposed Overburden and Organic Sediment Dump. It may require an engineered structure to safely store soft, wet organic sediments. (1) The proponent should carry out investigations to better characterize the lake bottom sediments and better define plans for sediment removal and storage. Depending on project schedule, this work may be done as part of detailed engineering and may not necessarily be an item that would impact project approval. (EA Commitment & Mines Act Permitting Requirement) | 11 sediment samples of Booker lake sediment were taken in 2010 to characterize the sediments and determine the thickness. The sediment characterization was considered in updated ML-ARD predictions as well as planning for sediment storage. Based on drilling, using man-portable drills, through the sediment to bedrock the sediment thickness in Booker Lake has been measured from 0m to 3.7m. This sediment thickness was considered in preparation of the plan for dewatering and removal of sediments. | Not adequately addressed. A conceptual plan for sediment identification, handling and disposal requirements is needed for the EA phase. (See also MEMPR/Lorax comment 8) | Storage and handling of lake and pond sediments, and a conceptual monitoring program is updated in Sections 5.1.1 of RRR Rev.2. A conceptual monitoring program and Geochemical Criteria for Sediments is included. | | | | Condition #1 | | |
| MEMPR-42 | MEMPR/Lighthall | | Environmental Management System | 9 | 13.13, 14.10 | III | The stability of the mine waste dump has been assessed through geotechnical investigation of the dump foundations and stability analyses. The overall waste dump stability appears adequate. The location of the dump will be compatible with constructing the waste dump from the bottom up, so that the overall final slope of 2.75 horizontal: 1 vertical can be developed as the dump is raised. This bottom-up construction will enhance dump stability. Stability will be most dependent on the rate of pore pressure increase and dissipation in the till foundations underlying the dump toes, as a result of the dump loading.(2) The proponent should develop an instrumentation and monitoring plan to ensure waste dump stability. (Mines Act Permitting Requirement) | The EAC Application includes an environmental management plan that addresses instrumentation and monitoring. For permitting and prior to construction, as part of the EMS, PBM commits to further developing an instrumentation and monitoring plan to ensure waste dump stability for permitting. | Response satisfactory. Acknowledged that PBM will develop waste dump instrumentation and monitoring plan for permitting. | | | | | | |

| Issue No. | Commenter & Agency | Date | Issue Theme | Section in TOR | EAC Chapter or Supporting Document | EAC Volume | Additional information or clarification required in Application | Proponent Response | Status of Issue as of 01-24-2011 | Additional Proponent Response | Additional Working Group Comments | Additional Proponent Response | Final PBM Response | Key Project Component Number | Status of Issues as of May 2012 |
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| MEMPR-43 | MEMPR/Lighthall | 1-Oct-10 | Environmental Management System | 9 | 13.13, 14.10 | III | In general, the pit wall stability assessment appears reasonable. The nearby Bell and Granisle open pits experienced acceptable stability in similar rock types. (3) Successful performance of the open pit will require implementing a comprehensive stability management program, which should include: (a) controlled blasting practices to avoid damaging final walls; (b) groundwater depressurization measures; (c) detailed geotechnical mapping of the rock mass once bedrock is exposed during pre-production and ongoing mining; (d) slope deformation monitoring. A program that addresses these is required for Mines Act Permitting. | The EAC Application includes an environmental management plan that addresses instrumentation and monitoring. For permitting and prior to construction, as part of the EMS, PBM commits to further developing an instrumentation and monitoring plan to ensure waste dump stability for permitting. | Unresolved. Clarification required. This response incorrectly refers to waste dump instrumentation and monitoring. My comment was in regard to open pit stability. We require PBM's commitment to developing an open pit wall stability management plan. | | | | EMP | | |
| MEMPR-44 | MEMPR/Lighthall | 1-Oct-10 | Environmental Management System | 9 | | | KCBL (2009) describes the tailings as being relatively coarse, with only 53% by weight finer than #200 mesh (75 microns). However, the stated specification for cycloned sand is a maximum of 20% finer than #200 mesh. In the writer's experience, this is a high amount of fines and would not allow adequate drainage for compaction of cycloned sand. Experience has shown that cycloned sand should have less than 15% fines for successful placement. It may be necessary to double cyclone the tailings to achieve clean enough sand. (4) It does not appear that the proponent has done enough work to demonstrate that the tailings can be successfully cycloned for dam construction, or to allow specification of the process equipment that will be required for sand production. It is recommended that the proponent demonstrate, by cyclone simulation studies or bench trials, how sand for dam construction will be produced from the tailings. (EA Commitment to additional testing and to implement additional cycloning if necessary to generate suitable quality construction sand. Additional info required for Mines Act Permitting) | See KCBL (2009) Appendix 10 Tailings Reclaim and Asssociated Pumping Systems that includes cylcone simulations. PBM commits implement additional cycloning, if necessary, to generate suitable quality construction sand. | Response satisfactory. PBM is required to commit to undertake additional cyclone testing work prior to permitting to assess how suitable cycloned sand for tailings dam construction will be produced, as well as commit to implement additional cyloning if necessary. Both should be reflected in the project commitments. | | | | Condition #6 | | |
| MEMPR-45 | MEMPR/Lighthall | 1-Oct-10 | Environmental Management System | 9 | Appendix AC | Addendum | KCBL (2009) also states that, because the tailings will be relatively coarse, settled density in the impoundment is expected to be higher than normal copper tailings. Tailings densities of 1.4 t/m3 for the starter dam and 1.5 t/m3 for the final dam have been selected. In the writer's experience, such values are unconservative (too high) for tailings which will be deposited into a body of water (subaerially), as opposed to tailings deposited on a beach for which higher densities may be expected. (5) The proponent should review the selection of the expected tailings density and assess the impact on design of a lower density. (EA Information Requirement) | PBM has used the results of laboratory testing to establish the design density of 1.4 t/m3 and 1.5 t/m3. If the density were lower (e.g. 1.3 t/m3) the effect would be to require an additional dam height of 4 m. PBM commits to review the selection of the expected tailings density and to monitor it throughout operations to ensure the dam design is safe and to ensure that the dam has sufficient capacity. | Response satsifactory. PBM commits to reviewing expected insitu densities of tailings in the impoundment, and to adjusting dam heights as necessary to be consistent with realistic densities for sub-aqueously placed tailings. This work will be required to support the Mines Act Permit application. | | | | PBM will review the selection of the expected tailings density and to monitor it throughout operations to ensure the dam design is safe and to ensure that the dam has sufficient capacity. | | |
| MEMPR-46 | MEMPR/Lighthall | 1-Oct-10 | Environmental Management System | 9 | 13.13, 14.10 | III | The tailings dams will be founded on variable depths of glacial till, overlying bedrock, or on bedrock. The glacial till is characterized as clayey sand to sandy clay, with some fine gravel, with low to intermediate plasticity. The density is described as stiff to hard. These conditions should provide adequate foundations for the dams. (6) As proposed by KCBL, till foundation pore pressures should be monitored during construction to confirm dam stability. (Mines Act Permitting Requirement) | The EAC Application includes an environmental management plan that addresses instrumentation and monitoring. For permitting and prior to construction, as part of the EMS, PBM commits to further developing an instrumentation and monitoring plan to ensure dam stability for permitting. | Response satisfactory. Acknowledged that PBM commits to developing an instrumentation and monitoring plan for tailings dam stability. | | | | For permitting and prior to construction, as part of the EMS, PBM will further develop an instrumentation and monitoring plan to ensure dam stability for permitting | | |
| MEMPR-47 | MEMPR/Lighthall | 1-Oct-10 | Environmental Management System | 9 | Appendix AX | Addendum | (7) KCBL (2009) states that the following will be followed as part of TSF stewardship: (a) An operations, maintenance and surveillance manual (OMS), following Mining Association of Canada Guidelines, will be prepared prior to operations; (b) An emergency preparedness plan (EPP) and emergency response plan will be prepared prior to operations; (c) Construction specifications will be prepared for all construction works. A QA/QC program will be carried out for all construction and as-built reports will be prepared; (d) An annual Dam Safety Review will be carried out. The above are appropriate and should be included as minimum requirements of operating permits. (Mines Act Permitting Requirement) | PBM so commits. | Response satisfactory. | | | | | | |
| MEMPR-48 | MEMPR/Lighthall | 1-Oct-10 | Environmental Management System | 9 | Appendix AC; AX; 2.6 "Water Balance" | Addendum; RRR | KCBL (2009) Geotechnical Feasibility Study, Rev. 1, January 9, 2009, states as follows, "... The estimated accumulated volume of water at the end of mine life is approximately 14 Mm3, which is equivalent to approximately 4 m of additional dam height for the Ultimate Dam." KCBL (2010) Water Management Design, Rev. 0, May 20, 2010, states, "On average, the water balance indicates an annual surplus of 270 m3/hr, or approximately 50 Mm3 over the mine life. Surplus contact water will be stored in the TSF by raising the dams." (8) The discrepancy in the above water balance predictions is of significant concern and must be resolved by the proponent. (EA Information Requirement) | A number of alternatives intended to reduce the surplus from 50 Mm3 to 14 Mm3 are presented in the Addendum. The updated water balance in the RRR confirms that the anticipated surplus will be limited to 7.6 Mm3. PBM commits during detailed design to determine the best application of the alternatives to manage the water balance to achieve zero contact water discharge and minimize the accumulation of surplus water. For example PBM commits to diverting, as far as practical, clean surface water around the TSF at various stages during operations. | Not adequately addressed. Water balance issues need to be resolved at the EA review stage to ensure that project effects are fully assessed (see MEMPR/Lorax commment 21). | Water management is updated in Section 7 of RRR Rev.2. Rationale for zero discharge is updated for the Expected Case and management options identified for Upper Bound water balance. Addtionally adaptive management plans are identified. | | | PBM will, during detailed design, determine the best application of the alternatives to manage the water balance with the goal of achieving a zero contact water discharge during operations and to minimize the accumulation of surplus water. | | |
| MEMPR-49 | MEMPR/Lighthall | 1-Oct-10 | Environmental Management System | 9 | Appendix AX | Addendum | (9) The prediction of surplus water is of concern for the proposed tailings dams, which are proposed to be raised by centerline construction. Centreline constructed dams rely on support from the tailings beach upstream of the dams. It is possible to place supporting fills in a shallow body of water for upstream support of centreline construction. However, the upper-end prediction of 50 Mm3 of surplus water would result in over 10 m of water over the entire tailings impoundment, which would be impractical for centreline construction (Comment). | Acknowledge that the centerline method will require a modified upstream compacted cycloned sand zone to support the core (under seismic loading) and to maintain the pond away from the dam to allow the annual raise. (Alternatively, the centerline could be modified downstream at ~0.5H:1V.) PBM commits to finalizing the dam design during detailed design. As discussed above PBM commit to management of water to minimize, as far as practical, the accumulation of surplus water. | Response satisfactory for provision of detailed design of dam for Mines Act Permitting. See comment above for water balance issues. | | | | PBM will manage water to minimize, as far as practical, the accumulation of surplus water. | | |
| MEMPR-50 | MEMPR/Lighthall | 1-Oct-10 | Environmental Management System | 9 | Appendix AC; 2.6 "Water Balance" | Addendum; RRR | (10) The proponent should clarify the water balance and confirm the maximum volume of water that is likely to be required to be stored in the TSF. This should also consider the necessity of a water cover for ML-ARD management of tailings (refer to MEMPRE ML-ARD and water quality review). (EA Information Requirement) | A number of alternatives intended to reduce the surplus water from 50 Mm3 to 14 Mm3 are presented in the Addendum. Additionally an updated water balance establishes that the accumulated surplus in the TSF will be limited 7.3 Mm3 and that no surface discharge from the TSF post closure is required. PBM commits during detailed design to determine the best application of these alternatives to manage the water balance to achieve zero contact water discharge and minimize the accumulation of surplus water. The geochemical nature of the tailings is such that a water cover may not be required. However a water cover was included in the design as a conservative approach to eliminate any possibility of ML-ARD. | Not adequately addressed. The geochemical aspects of the tailings should be resolved so that the tailings impoundment design is justified (See MEMPR/Lorax comments 6 and 21). From the standpoint of long term stability, it would be preferable that the impoundment be closed with wide tailings beaches and generous freeboard. | Water management is updated in Section 7 of RRR Rev.2. Rationale for zero discharge is updated for the Expected Case and management options identified for Upper Bound water balance. The revised closure plan does not require a large water pond on closure. | | | PBM will, during detailed design, determine the best application of the alternatives to manage the water balance with the goal of achieving a zero contact water discharge during operations and to minimize the accumulation of surplus water. | | |
| MEMPR-51 | MEMPR/Lighthall | 1-Oct-10 | Environmental Management System | 9 | Appendix AC | Addendum | (11) The proponent should present details of how the tailings dams would be raised with the expected pond water volume and depth. The dam raising details should show clearly the placement sequence of each zone of the dam so that it can be clearly demonstrated how the raises will be accomplished. (EA Information Requirement) | PBM commits to maintenance of a 15 m wide compacted cycloned sand zone on the upstream side that will provide support for the dam core. Detailed raising schedule and sections will be prepared in detailed design. | Response satisfactory. Acknowledged that detailed dam raising schedule and sequencing will be completed in the detailed design stage to support a Mines Act Permit application. | | | | | | |
| MEMPR-52 | MEMPR/Lighthall | 1-Oct-10 | Environmental Management System | 9 | Appendix AC; 2.6 "Water Balance" | Addendum; RRR | KCBL (2010) states as follows: " During operatiosn there are several opportunities to reduce the annual surplus and thereby the required dam height. The following is a list of potential reductions in site-wide annual surplus water and their approximate magnsitude:..." (12) Given the potential large magnitude of the water surplus, and the ramifications on the feasibility and stability of the TSF, it is recommended that the proponent assess the above and any other possible water balance enhancements, including discharge from the TSF during operations and its potential for effects to the environment. (EA Information Requirement) | A number of alternatives intended to reduce the surplus water from 50 Mm3 to 14 Mm3 are presented in the Addendum. Additionally an updated water balance establishes that the accumulated surplus in the TSF will be limited 7.3 Mm3 and that no surface discharge from the TSF post closure is required. PBM commits during detailed design to determine the best application of these alternatives to manage the water balance to achieve zero contact water discharge and minimize the accumulation of surplus water. For example PBM commits to diverting, as far as practical, clean surface water around the TSF at various stages during operations. Additionally, as a contingency, PBM is prepared to install a water treatment plant and subsurface discharge diffuser to manage excess water. | Not adequately addressed. See comment 48. | Project changes result in water management and water balance updated in Section 7 of RRR Rev.2. Rationale for zero discharge is updated for the Expected Case and a management plan is defined for the Upper Bound water balance case. Adaptive Management is also identified if additional mitigation is required. | | | PBM will, during detailed design, determine the best application of the alternatives to manage the water balance with the goal of achieving a zero contact water discharge during operations and to minimize the accumulation of surplus water. | | |
| MEMPR-53 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Mine Development | 3.5 | | | 41. The option chosen for the location of the tailings impoundment appears reasonably defensible. (Comment) | Acknowledged. | Response satisfactory. | | | | | | |

| Issue No. | Commenter & Agency | Date | Issue Theme | Section in TOR | EAC Chapter or Supporting Document | EAC Volume | Additional information or clarification required in Application | Proponent Response | Status of Issue as of 01-24-2011 | Additional Proponent Response | Additional Working Group Comments | Additional Proponent Response | Final PBM Response | Key Project Component Number | Status of Issues as of May 2012 |
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| MEMPR-54 (1) | MEMPR, Kim Bellefontaine | 13-Oct-10 | Assessment of Alternative Options | 3.9 | Appendix T | Addendum | 42. The information on project alternatives for waste rock is scattered and presented in a very non-systematic manner. Important project components that would be required if waste were stored next to the open pit (such as covers and collection and treatment) have been left out of the analysis. Cost appears to be the main factor considered for determining between options. While MEMPR acknowledges that the final option chosen in any alternatives assessment needs to be both economically and technically viable, these are not the only aspects that should be evaluated as part of a thorough alternatives analysis. All factors considered (environmental, social, economic) need to be presented in a consistent and transparent manner that allows a full comparison and analysis of the options being evaluated. (Comment) | Addendum App. T discusses waste rock storage alternatives including co-disposal of waste rock in the TSF. Consideration was given to environmental factors as well as economic factors. Technical merits of co-disposal are well documented by MEMPR and in the public domain. However for this Project drawbacks associated with co-disposal include: increased haul road footprint, increased tailings dam height and water cover with associated dam stability risk, increased tailings pond depth that increases the head that increases the seepage, increased mine influence on a second watershed (Nakinilerak) and concomitant environmental risks, and increased GHG emissions due to longer waste rock haul distances. (continued below). | Not adequately addressed. See Comment 60. | The RRR Rev.2 presents a new mine closure plan, which includes placement of PAG waste rock back into the open pit. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. These changes results in significant environmental benefits to the project. | | | | | |
| MEMPR-54 (2) | MEMPR, Kim Bellefontaine | | Assessment of Alternative Options | 3.9 | 3.5 "Pit Lake Water Quality with WRD" | RRR | | Co-disposal does not completely eliminate the need for a water treatment plant for water that will have to be discharged from the TSF. Also, the terrain in the Project area lends itself to separate disposal because the WRD is situated in a natural catchment that drains to the open pit, substantially mitigating environmental risks of ML/ARD seepage and runoff. Finally, PBM emphasizes that there is no variety of designs to choose from, rather, the Project as presented is the selected economically feasible configuration submitted for review and has been designed with the required high standards of environmental protection. | Unresolved. Contrary to the first sentence, and based on the additional pit lake model water quality predictions in the RRR (pg 36-38) in which the waste rock dump has been eliminated, it appears there is some possibility that water treatment for the pit lake could be avoided as a primary mitigation if waste rock were co-disposed in the impoundment. Addittional information is required for the model run for pit lake water quality so it can be fully evaluated (see MEMPR/Lorax comment 23). (EA Information Requirement) Also, further enhancements to the mine waste management plans are required to minimize the production of ML/ARD, improve water quality and reduce long term liabilities. Flooding in the | See above | | | | | |
| MEMPR-55 (1) | MEMPR, Kim Bellefontaine | 13-Oct-10 | Assessment of Alternative Options | 3.9 | Appendix T | Addendum | 43. It appears that the only consideration for the ultimate location chosen for the storage of PAG waste rock was cost. Appendix T notes that there are significant additional costs that would be incurred from hauling waste rock to the tailings impoundment and flooding, including additional dam construction costs. The estimated cost of flooding PAG waste in the tailings storage facility is $103 million, whereas the cost of placing the PAG waste rock immediately adjacent and upslope of the open pit is $36 million (a $66 million dollar difference). (Cont. Below) | Appendix T presents the cost savings of the WRD verus TSF disposal of waste rock as being $103 million dollars and does not identify an additional $36 million cost of the WRD. Rather the savings that should be considered are the entire $103 million. | Unresolved. See below. The costing arguments do not appear to be robust, as there is some indication that treatment may be avoidable with alternate waste rock disposal plans. An updated Alternatives Assessment is needed as the current mine waste management strategies do not appear justified. (EA Information Requirement) | See above | | An updated assessment of placement of waste rock in the open pit or in the TSF is presented in the 3rd Party Review Response Report. | | | |
| MEMPR-55 (2) | MEMPR, Kim Bellefontaine | | Assessment of Alternative Options | 3.9 | 3.5 "Pit Lake Water Quality with WRD" | RRR | However, the analysis of the on-land waste storage option does not include the capital and operating costs of the collection and treatment system that would be needed to treat the ARD from the waste rock pile. This represents a significant gap in the alternatives assessment. While it is understood that a treatment plant would likely still be required for treating pit water in either scenario, the amount of water requiring treatment and the loadings associated with waste dump seepage would be expected to increase the costs of the on-land storage option significantly. It is not clear that the full cycle costs of underwater storage would be significantly different than on-land storage of PAG waste rock. (Comment) | Collection and treatment of water is required whether or not waste rock storage is located in the catchment of the open pit. The pit lake water quality with or without the WRD is such that it requires treatment before discharge. The volume of pit lake water attributable to the WRD is minimal because diversion of clean water from the covered WRD will be equal to the diversion of clean water achievable without the WRD. Irrespective of the above, the total PV capital and operating cost of the water treatment plant installed in Year 1 is $35 million and in Year 45 is $17 million. Therefore, even if disposing of the waste rock in the TSF entirely eliminated the water treatment plant, the savings would not justify an the additional $103 million dollar cost of disposing of waste rock in the TSF. | Unresolved. See comment 60. Based on information in RRR, there is some indication that the first two statements may be incorrect. If mine waste source was removed from the open pit, there could be other options for improving pit lake water quality so that treatment could be avoided as a primary mitigation strategy (potential to route impoundment water through pit, site specific objectives). Additional work on mine waste disposal options, alternatives assessment, water quality modelling and mitigation planning are required for the EA. (EA Information Requirement) | See above | | see above | | | |
| MEMPR-56 (1) | MEMPR, Kim Bellefontaine | 13-Oct-10 | Assessment of Alternative Options | 3.9 | Appendix AU | Addendum | 44. The alternatives assessment for waste rock does not include a thorough analysis of cover options over the waste rock. This is another significant gap. However, cover options over waste rock did receive a cursory economic analysis in Appendix AU - Reclamation and Financial Security. This appendix presented three options from a costing perspective including: (a) Waste rock dump covered during operations, open pit filled with water then treated at year 45 (assumes treatment in perpetuity); (b) Waste rock dump uncovered (accelerated ML/ARD), open pit filled with water then treated from year 45 (assumes treatment for a period of 50 years and reclamation at year 99); (c) Waste rock dump backfilled in open pit, open pit filled with water then treated from year 35 to year 70. The application concluded that reclamation bonding of approximately $40 million would be needed for options (a) and (b), and approximately $120 million for option (c). (Cont. Below) | The selected cover option presented by PBM is viable and complies with ML-ARD Guideline and has been acknowledged as such by other MEMPR personnel. It is this selected cover option that PBM has submitted for assessement. The options reviewed in Appendix AU provide supplemental indicative information regarding the impact to the project of selecting various waste rock dump options. PBM commits to providing a detailed design for the selected cover option and resolving the appropriate cover with MEMPR for Mine Act Permitting. | Unresolved. Clarification required. Please clarify where MEMPR staff have acknowledged that the cover complies with ML/ARD Guidelines. Policy feedback has been provided to PBM in October 13, 2010 letter. | As the waste rock will be placed into the open pit and submerged upon closure no cover will be added to the waste rock during operations. | | see above | | | |
| MEMPR-56 (2) | MEMPR, Kim Bellefontaine | | Assessment of Alternative Options | 3.9 | Appendix AU, AI | Addendum | MEMPR believes it is not reasonable to assume that treatment would only be required for 35 to 50 years in options (b) and (c). Theoretically, the time to treat may be reduced overall with no cover, but based on worldwide experience with historic and unmitigated ARD from waste rock dumps, there is extensive precedence to demonstrate that treatment would be required for a very long time (i.e. hundreds of years). The fiscal analysis in the application (alternatives analysis and Appendix AI) also appears to discount the need for long term treatment of pit water, irrespective of the waste rock storage option chosen. (Comment) | PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. Future preliminary liability cost estimates as possible levels of closure financial security prepared by the Proponent will consider MEMPR comments. PBM has not selected Alternative (b) nor (c) but instead presented Appendix AU as an indicative assessment of the possible level of financial security considering various options and scenarios. PBM has presented in Appendix AI the effects and mitigation for temporary suspension or extended mine closure. | Response satisfactory. | | | | PBM will resolve the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | | |

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| MEMPR-57 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Environmental Management System | 9 | 16.5.5.2 | III | 45. MEMPR wishes to clarify that covers are necessary to meet regulatory requirements to reclaim mining lands to a productive use. Covers also serve the very important purpose of reducing flows and contaminant concentrations to levels that they can be effectively handled and treated. Experience at other mines has shown that high flows and contaminant loadings are challenging to manage. (Comment) | PBM understands that per "ML/ARD Guidelines" 1998 *Mitigation measures are commonly categorized as "prevention", "reduction" or "control". For example, a surface cover may be used to reduce the infiltration of precipitation, reducing metal leaching sufficiently that it prevents the impact on aquatic biota at a downstream location.* PBM has submitted a project design that includes a cover installed progressively on the waste rock dump. PBM commits to providing a detailed design for the selected cover option and resolving the appropriate cover with MEMPR for Mines Act Permitting. | Response satisfactory. | As the waste rock will be placed into the open pit and submerged upon closure no cover will be added to the waste rock during operations. | | | | | |
| MEMPR-58 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | 16.5.5.2; Appendix T; 3.3 "Waste Rock Dump Cover" | III; Addendum; RRR | 46. An engineered low permeability cover is proposed for the on-land PAG dump. A cost for this cover is estimated at $14.8 million (appendix T). Conceptual design information for this cover has been requested (previous MEMPR/Lorax comment 12). The conceptual cover design should include details to demonstrate the proposed cover can achieve the infiltration values used in the water quality modelling. As well, details about the quantities of cover materials, source and costs are required. This information should also be used to update the alternatives assessment for waste rock, the liability costs and to rationalize the waste management options chosen. (EA Information Requirement) | See response to MEMPR/Lorax comment 12. Conceptual design of the low permeability cover is provided in the EAC Application. A 1-m thick layer of overburden will be spread over the surface of the smoothed waste rock surface. This material will be compacted to reduce the amount of infiltration into the PAG rock. The upper 0.2 m of the overburden will be ripped to ensure a 0.5 m effective rooting depth on this site once the final 0.3 m thick layer of soil is applied. The soil cap will also be ripped in two directions. The soil will then be tracked before revegetating. Care will be taken not to re-compact the soil. The selected cover option presented by PBM is viable and complies with ML-ARD Guideline and has been acknowledged as such by other MEMPR personnel. It is this selected cover option that PBM has submitted for assessment. PBM commits to providing a detailed design for the selected cover option and resolving the appropriate cover with MEMPR for Mines Act Permitting. | Response satisfactory. See also comment 60. | As the waste rock will be placed into the open pit and submerged upon closure no cover will be added to the waste rock during operations. | | | | | |
| MEMPR-59 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Assessment of Alternative Options | 3.9 | Appendix Z | Addendum | 47. The rationale for the location of the low grade ore is unclear. No figures have been included to illustrate the locations that were considered. (Comment) | To keep transportation costs and vehicle emissions low the low grade ore stockpile needs to be located in close proximity to the open pit and the process plant. The selected location achieves these objectives and has adeqaute storage capacity. Figures showing low grade ore and alternative process plant locations are provided in Appendix Z. | Response satisfactory. | | | | | | |
| MEMPR-60 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Assessment of Alternative Options | 3.9 | | | 48. An updated alternatives assessment for waste rock and low grade ore alternatives is needed that takes a more transparent and systematic approach for evaluating environmental, social and economic factors and considers the full range of mitigation requirements tied to each option, such as collection and treatment, covers, water management etc. (EA Information Requirement) | PBM believes the submitted design is consistent with the MEMPR Policy on ML/ARD. See response to Comments # 42 and # 47 above. PBM emphasizes that there is no variety of designs to choose from, rather, the Project as presented is the selected economically feasible configuration submitted for review and has been designed with the required high standards of environmental protection. | Not adequately addressed. Low grade ore managment is considered acceptable for the EA with the provision to backfill if not milled and to treat water. However the proposed waste rock management plan has not been sufficiently justified. An updated alternatives assessment is required as per original comments. Flooding in the impoundment, open pit, and combinations of the two should be evaluated. (EA Information Requirement) | The RRR Rev.2 presents a new mine closure plan, which includes placement of PAG waste rock back into the open pit. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. These changes results in significant environmental benefits to the project. | | see above | | | |
| MEMPR-61 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Geology and ML-ARD | 6.3 | | | 49. Experience has shown that when taking into account full life cycle environmental, social and economic factors, prevention of ML/ARD is typically preferable to creating acid rock drainage that must be managed in perpetuity. (Comment) | Acknowledged. However, the requirement for managing ML/ARD (i.e., treatment of water from the open pit and monitoring the TSF) exists even with the waste rock disposed of in the TSF. In the event that the LGO is not milled and a cover is not adequate to limit seepage, PBM commits that the material will be placed in the open pit and flooded. PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | See comments 54, 55 and 60. | The RRR Rev.2 presents a new mine closure plan, which includes placement of unprocessed LGO back into the open pit. | | | PBM will resolve the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | | |
| MEMPR-62 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Geology and ML-ARD | 6.3 | | | 50. As currently presented, the Morrison project does not appear to be consistent with Provincial Policy on ML/ARD, as it has not been demonstrated that other prevention strategies are not feasible, and that long-term liabilities have not been reduced to the extent possible. Additional work is required to support the waste and water management options chosen for the Morrison Project. (Comment) | PBM believes the design is consistent with the MEMPR Policy on ML/ARD. Inclusion of the cost difference, $103 milllion dollars for disposal of waste rock in the TSF, would have a signficiant negative impact on the project viability. The Project as presented is the selected economically feasible configuration submitted for review and has been designed with the required high standards of environmental protection. | Not adequately addressed, as per original comment. See also comments 54, 55 and 60. | The RRR Rev.2 presents a new mine closure plan, which includes placement of PAG waste rock back into the open pit. The closure plan for the TSF and mine area has been revised to reduce | | see above | | | |
| MEMPR-63 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Geology and ML-ARD | 6.3 | | | 51. The potential for innovation and advances in treatment technology and metal recovery are noted in the application. MEMPR acknowledges and hopes that advances in these areas will occur at some point in the future. We also agree that it is not appropriate to include these into the project design at this time. The management planning and financial security requirements need to be based on currently proven technologies. (Comment) | Acknowledged. | Response satisfactory. | | | | | | |
| MEMPR-64 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Geology and ML-ARD | 6.3 | Appendix S | Addendum | 52. Appendix T (page 10-24) states that the new GoldSim modelling demonstrates the presence of some contiguous non-PAG zones of waste rock that segregation of these materials during operations will occur, so that this material can be used in drainage channels. Additional information is needed on the volumes of non-PAG materials that will be segregated and the proposed geochemical segregation criteria for metal leaching and acid rock drainage. Conceptual plans are needed to demonstrate that non-PAG materials can be identified, segregated, hauled, and disposed of successfully. (EA Information Requirement) | PBM stresses that waste management plan is not conditional upon segregation. If, however, some segregation is achieved then preferential placement of non-PAG material will be in the natural drainage channels within the waste rock dump. The viability of segregation will be assessed on an on-going basis during oeprations. NB: PBM believes the comment reference to Goldsim should have been to Appendix S GEOSIM 2010. | Response satisfactory. No segregation of mine wastes will be permittable without detailed segregation plans. | | | | | | |
| MEMPR-65 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Environmental Management System | 9 | 2.6 "Water Balance" | RRR | 53. The drainage treatment aspects of the project will need to be reconsidered as a result of additional water quality modelling that is required for the project. Designs for a treatment system during operations (including sludge storage etc) will likely be necessary. Overall, the plans for water management/water treatment need to updated to demonstrate that the systems have the flexibility to manage changes in water quality over time. (EA Information Requirement) | Additional information about the water management plan is presented in the RRR. PBM commits during detailed design to determine the best application of the alternatives to manage the water balance to achieve zero contact water discharge and minimize the accumulation of surplus water. For example PBM commits to diverting, as far as practical, clean surface water around the TSF at various stages during operations. Additionally, PBM commits, if required, to install an operations phase water treatment plant adequate to treat any excess water if discharge is determined to be required. | Not adequately addressed. Refer to MEMPR/Lorax comments above. | Water management and water balance is updated in Section 7 of RRR Rev.2. Rationale for zero discharge is updated for the Expected Case and a management plan is defined for the Upper Bound water balance case. Water treatment during the life of the project is identiifed as an adaptive managment option. | | | PBM will, during detailed design, determine the best application of the alternatives to manage the water balance with the goal of achieving a zero contact water discharge during operations and to minimize the accumulation of surplus water. | | |
| MEMPR-66 (1) | MEMPR, Kim Bellefontaine | 13-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix AA | Addendum | 54. The costs of collection and treatment are likely underestimated if treatment is required during operations. Capital and operating costs outlined in Appendix AA are only for a treatment plant in the post closure phase. The operating costs outlined in the Appendix are also underestimated since there is no costing for sludge handling or storage, power, collection and discharge lines etc. It is also noted that the cost per tonne of delivered lime to the site is also too low. (Comment) | PBM acknowledges that the cost of water treatment during operations is not included directly in the feasibility study. However, per Appendix AD, *"A contingency was applied to these cost estimates based on a risk factor for each discipline as indicated in the estimate details. Contingency is an allowance added to the capital cost estimate to cover cost that will be incurred but at this time cannot be identified because the project is still in its early development phase."* The capital contingency ($59.9 million) is sufficient to address early capital costs of the water treatment plant and the diffuser estimated to be $9.4 million (Appendix AC) (continued below) | Response satisfactory. | | | | | | |
| MEMPR-66 (2) | MEMPR, Kim Bellefontaine | | Closure, Decommissioning and Reclamation | 9.3 | | | | Additionally, per Appendix AE, the feasibility operating cost included contingency. The estimated total annual mine operating cost exceeds $30 million. The estimated annual operating cost of the water treatment plant including labour, power and lime is estimated to be ~ $252,000 with an allowance of $50,000 for sludge disposal would represent an approximately 1.0 % increase in annual operating costs. Therefore included in the feasibility study are sufficient capital and operating contingency allowances that may be allocated to cover Year 1 construction and any operating phase cost of water treatment and lime. | See above. | | | | | | |
| MEMPR-67 (1) | MEMPR, Kim Bellefontaine | 13-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | | | 55. The requirement for long-term collection and treatment of drainage (including operational and post-closure phases) has the potential to change the economic aspects of the project, including the requirements for financial security at the Mines Act Permitting stage. The additional work requested by MEMPR (updated water quality modelling, alternatives assessment, liability costing etc.) should be integrated and re-evaluated. (Cont. Below) | See above. PBM believes that sufficient allowance for post closure and, should it be required, oeprational phase water treatment is included in the feasibility study. Furthermore, there are numerous other changes in the feasibility study inputs, notably the positive upward movement of metal prices, that will also be applicable to a revised project finanical viability report. | See below. | | | | | | |

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| MEMPR-67 (2) | MEMPR, Kim Bellefontaine | | Closure, Decommissioning and Reclamation | 9.3 | Appendix AU | Addendum | This information should be used to assess the sensitivity of project economics, to select the optimal waste management strategy for mining waste, and to better understand the implications for environmental management and the posting of financial security. Experience at other sites has shown that financial security requirements for collection and treatment can exceed $50 million dollars. It's possible that there may not be as significant a cost difference between the underwater storage of waste rock in the tailings facility and on-surface disposal near the open pit as is suggested in the application. (EA Information Requirement) | PBM has considered the effect of the financial security in the project financial viability. As shown in Appendix AU we acknowledge that the financial security may exceed $50 million dollars. PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. Also see above. | Not adequately addressed. See comments 60. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The financial security may now exceed $100 million. PBM has considered the effect of the financial security in the project financial viability. PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | | see above | PBM will resolve the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | | |
| MEMPR-68 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | | | 56. It is recommended that the proponent arrange a site visit to an operating collection and treatment facility such as Equity Silver, to ensure there is a firm understanding of the issues, challenges and commitment required to successfully manage water quality concerns associated with the Morrison Project. Goldcorp has indicated to MEMPR that they would be willing to host such a visit at the Equity Mine. (Comment) | PBM has been diligent in ensuring qualified persons have been executed the design and environmental assessment of the Morrison Copper/Gold Project. Notably, consultants retained by PBM have significant experience and knowledge of collection and treatment facilities. PBM is aware of the issues at Equity Silver and one of our staff has previously visited Equity Silver Mine Site. PBM personnel have also visited other minesites, including Highland Valley Copper, Bell and Granisle, Huckleberry and Cerro Verde (Chile). PBM's Chairman is also a former Senior Vice President of Noranda. | Response satisfactory. However, a visit to Equity Silver would serve the rest of staff who have not visited the site. Consultants will not be operating and managing the Morrison mine. | | | | | | |
| MEMPR-69 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix AU | Addendum | 57. The estimates provided for Reclamation and Closure Financial Security in Appendix AU would be better characterized as preliminary liability cost estimates, and not closure financial security requirements. MEMPR determines the financial security requirements for mining projects (i.e. not the proponent) and these are reviewed in detail at the Mines Act Permitting stage. (Comment) | Acknowledged that MEMPR determines the financial security requirements. PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. Future preliminary liability cost estimates as possible levels of closure financial security prepared by the Proponent will consider MEMPR comments. | Response satisfactory. | | | | | | |
| MEMPR-70 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | | | 58. In general, it appears that the full liability costs of the Morrison project are not well understood by the proponent (e.g. covers, collect and treat etc absent). (Comment) | PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. Any future preliminary liability cost estimates to provide indicative closure financial security such as may be prepared by PBM will be done in full consideration MEMPR comments. | Response satisfactory. | | | | PBM will resolve the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | | |
| MEMPR-71 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix AU | Addendum | 59. Although not clearly stated in Appendix AU, it appears that the main difference in the liability cost estimate between the various sizes of the low grade ore stockpile is the cost of a low permeability cover. The additional costs of treatment from remnant low grade ore have not been included in this analysis. Again, conceptual design information is needed for the cover to validate the infiltration rates used in the water quality predictions, the costs applied in the alternatives assessment and to assess the potential implications of early closure. (EA Information Requirement) | Within Appendix AU, the design and cost for the cover for the low grade ore stockpile are the same as was developed for the waste rock dump. PBM commits to providing a detailed design for the low grade ore and waste rock dump cover for permitting. PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | Unresolved. Clarification required. With the commitment to backfill any low grade ore into the pit if not milled, there would no longer be the requirement to cover the low grade ore stockpile. | On closure, PBM commits to placement of any un-milled LGO into the open pit. A contingency plan for ensuring adequate storage in the open pit is provided in Section 4.4.4 of RRR Rev.2. | | see above | | | |
| MEMPR-72 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix AU | Addendum | 60. Although bonding requirements are assessed in detail at the Mines Act Permitting stage, some comments on the provincial requirements for bonding are warranted here. The main policy document for financial security has not been referenced in Appendix AU, although it was provided to the proponent by email on April 28, 2008. The document is entitled "BC Mine Reclamation Security Policy, April 1996". Mines with active water treatment systems are considered high risk, and as such, Provincial Policy requires that they be fully funded using hard forms of security. Since the ARD liabilities and the requirements for treatment will be created at the inception of mining activities, it is likely that full security for operations and post-closure will be required up-front. (Comment and Mines Act Permitting Requirement) | PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | Response satisfactory. | | | | | | |
| MEMPR-73 | MEMPR, Kim Bellefontaine | 13-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix U | Addendum | 61. The proponent should be aware that when MEMPR reviews the financial security requirements at the Mines Act Permitting stage, the Ministry considers the risk aspects of site management as well as the risk aspects of the owner/operator. The proponent has made it clear of its intent to sell the project and not operate the mine. Depending on the assessed risk of a company defaulting on its management responsibilities, the Chief Inspector of Mines has the ability to apply a risk premium (i.e. greater than 100% security). As well, MEMPR uses third party costs to calculate financial security requirements. | PBM has not stated that its intent is to sell the project and not operate the mine. PBM has commited, in Appendix U, to comply with the Mines Act by appointment of a suitably qualified manager, for each Phase of the Project, who will be responsible. PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | Response satisfactory. | | | | | | |
| MEMPR-74 | MEMPR, Diane Howe | 18-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | | | The approach to the review was to assess the adequacy of information collected to support the Environmental Assessment Certification. Overall, the program for protection of the land and watercourses, reclamation and closure plan concepts, as presented, are generally sound. | Acknowledged. PBM is committed to reclamation and restoration of the minesite using accepted industry best practices. | Response satisfactory. | | | | PBM will reclame and restore the minesite using accepted industry best practices. | | |
| MEMPR-75 | MEMPR, Diane Howe | 18-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | | | The proposed reclamation program directed towards the return to appropriate and functional ecosystems that will facilitate the establishment of self sustaining vegetation communities is acceptable. Performance criteria which specify the sampling parameters to be used to evaluate the success of the reclamation program will be required at permitting. | PBM commits to establishing at permitting, in consultation with MEMPR, performance criteria specifying the sampling parameters to be used to evaluate the success of the reclamation program. | Response satisfactory. | | | | PBM will establish at permitting, in consultation with MEMPR, perform criteria specifying the sampling parameters to be used to evaluate the success of the reclamation program. | | |
| MEMPR-76 | MEMPR, Diane Howe | 18-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | | | It will be important that reclamation trials be established early on all disturbance area. This will allow reclamation methods to be tested and appropriate plant species to be selected. Considerations should be given to establishing an onsite nursery for propagating native species for reclamation. Native species, indigenous to the local area will not become invasive and are far better adapted to the local climate and to sustainable local land uses. | PBM commits to reclamation trials and will consider establishing an on-site nursary for propagating native species for reclamation. | Response satisfactory. | | | | PBM will reclame trials and will consider establishing an on-site nursery for propagating native species for reclamation. | | |
| MEMPR-77 | MEMPR, Diane Howe | 18-Oct-10 | Habitat Mitigation and Compensation Plan | 9.2 | 13.9, 14.8 | III | On the mine site where disturbances will include clearing/grubbing, mining and tailings deposition, riparian and wetland loss will likely be significant. Specific measures to preserve and protect the wetland /riparian habitat, particularly those areas that will not be directly affected by construction will need to be addressed at permitting. | The EAC Application includes an environmental management plan that includes measures to preserve wetland/riparian habitat. For permitting and prior to construction, as part of the EMS, PBM commits to further developing measures to preserve and protect wetland/riparian habitats. | Response satisfactory. | | | | EMP | | |
| MEMPR-78 | MEMPR, Diane Howe | 18-Oct-10 | Habitat Mitigation and Compensation Plan | 9.2 | | | Restoration of riparian habitats will benefit a wide variety of wildlife species and will provide an important link between the aquatic ecosystems associated with the creek and the upland areas that have been reclaimed. Establishment of pioneering- shrubs such as willow as well as trees such as cottonwood will establish a successional trajectory that will ensure a suitable vegetation cover in the riparian zone into the future. Planting conifers within the riparian area will assist in expediting the natural successional processes. | During restoration of riparian habitats, PBM commits to utilize pioneering shrubs, cottonwoods and conifers to expedite the return to productive habitat. | Response satisfactory. | | | | EMP | | |
| MEMPR-79 | MEMPR, Diane Howe | 18-Oct-10 | Habitat Mitigation and Compensation Plan | 9.2 | | | Establishment of tailing beach reclamation trials using wetland species that are proposed for the eventual treatment of this area would allow techniques to be refined and results to be quantified (in terms of wetland habitat creation) in advance of closure. | During Operations, PBM commits to establish tailings beach reclamation trials to enhance the effectiveness of wetland reclamation. | Response satisfactory. | | | | During Operations, PBM will establish tailings beach reclamation trials to enhance the effectiveness of wetland reclamation. | | |
| MEMPR-80 | MEMPR, Diane Howe | 18-Oct-10 | Habitat Mitigation and Compensation Plan | 9.2 | | | In addition, establishment of riparian vegetation along diversion ditches and around sediment control ponds will help reduce sediment generation associated with erosion as well as providing habitat for wildlife. | During Operations, PBM commits to establish riparian vegetation along diversion ditches and around sediment control ponds to reduce sediment generation and provide habitat. | Response satisfactory. | | | | During Operations, PBM will establish riparian vegetation along diversion ditches and around sediment control ponds to reduce sediment generation and provide habitat. | | |
| MEMPR-81 | MEMPR, Diane Howe | 18-Oct-10 | Environmental Management System | 9 | 13.8 | III | For EA certification this section provides a reasonable and acceptable summary for the soil salvaging, handling and stockpiling. The proposed strategy for a 1.3 meter cover on the waste rock and tailings dam areas will certainly provide for a suitable rooting medium towards ensuring success and sustainable growth. For permitting, MEMPR will require a detailed, stand alone plan that will provide guidance and direction for operational management. | Acknowledged. The EAC Application includes an environmental management plan that includes measures to salvage soil and stockpile. For permitting and prior to construction, as part of the EMS, PBM commits to provide to MEMPR a detailed soil salvage and stockpiling plan to provide guidance and direction for operational management. | Response satisfactory. | | | | PBM will provide to MEMPR a detailed soil salvage and stockpiling plan to provide guidance and direction for operational management. | | |
| MEMPR-82 | MEMPR, Diane Howe | 18-Oct-10 | Environmental Management System | 9 | 13.7 | III | For EA certification this section provides a reasonable and acceptable summary for the erosion and sediment control. For permitting, MEMPR will require a detailed, stand alone plan that will provide guidance and direction for operational management. | The EAC Application includes an environmental management plan that inlcudes measures to manage erosion and sediment control. For permitting and prior to construction, as part of the EMS, PBM commits to provide MEMPR a detailed plan for erosion and sediment control to provide guidance and direction for operational management. | Response satisfactory. | | | | EMP | | |

| Issue No. | Commenter & Agency | Date | Issue Theme | Section in TOR | EAC Chapter or Supporting Document | EAC Volume | Additional information or clarification required in Application | Proponent Response | Status of Issue as of 01-24-2011 | Additional Proponent Response | Additional Working Group Comments | Additional Proponent Response | Final PBM Response | Key Project Component Number | Status of Issues as of May 2012 |
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| MEMPR-83 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 2. The RRR2 document notes that, under the proposed mining case (e.g. LGO processed during the final 2.5 years of mine life), the TSF water level will be drawn down during this period while Cleaner tailings are directed to the open pit. Removal of most of the TSF water at closure and flushing with fresh runoff should help improve water quality of tailings pond water prior to discharge, provided that Cleaner tailings are not exposed. It is imperative that Cleaner tailings are placed immediately and permanently under a water cover during operations and fully covered by inert Rougher tailings and remain fully and permanently saturated at closure so that they do not generate ARD or contribute additional loadings to the tailings impoundment water quality. A stronger commitment to appropriately manage Cleaner tailings is required. | For Mines Act permitting, the proponent will be required to prepare a detailed design that meets the objectives of fully saturated conditions in Cleaner tailings at all times during operations and closure. A monitoring program to confirm this will be required. | | | | | Condition #5 | | |
| MEMPR-84 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 3. If LGO is not processed, all tailings are planned to be disposed in the impoundment. The contingency evaluation for the TSF in the event LGO is not processed suggests that there is some risk to water quality in the TSF pond from the pump down of the water to the open pit and exposure of Cleaner tailings, but that this water could be pumped to the open pit and assumedly treated. MEM is unclear why cleaner tailings would have to be exposed to oxidizing conditions under any closure scenario and believes this is an unnecessary risk that must be mitigated by the proponent. | If the LGO is not processed then 2.5 years of deposition of rougher tailings over the previously deposited cleaner tailings within the TSF pond will not occur. The indicated risk to water quality in the TSF if the LGO is not processed would occur if the cleaner tailings are exposed when the pump down of tailings pond water to the open pit occurs. The purpose of the pumpdown is to speed up the recovery of the TSF water quality. The trade off would be any potential oxidation that could occur between the period of pump-down and refilling. The alternative is to treat the TSF surplus water until it meets discharge criteria. | | | | | Condition #5 | | |
| MEMPR-85 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 5. The source term developed for loadings from the tailings beach to the tailings impoundment appears reasonable. RRR2 suggests that water would be of acceptable quality to discharge from the TSF at year 3. If water quality were not suitable for discharge, water would be treated prior to discharge or interim diversion ditches would be constructed over the covered tailings beach. MEM considers the treatment of TSF water during the closure phase a likelihood and the 3 year period to clean discharge at closure optimistic. MEM requests that the proponent commit to treating TSF water at closure if it is not suitable for discharge rather than the less certain efficacy of constructing diversion ditches over the covered tailings beaches. | PBM must comply with permitted discharge water quality objectives. If the water quality in the TSF is predicted to be not suitable for discharge when the TSF pond is infilled in Year 3 PBM must implement adaptive management measures, approved by MEM, in at least 6 months prior. Options for adaptive management include water treatment and diversion ditches over the covered tailings beaches. An addtional contingency measure is storage of additional water in the TSF. | | | | | Condition #17 | | |
| MEMPR-86 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 6. Producing consistently non-PAG construction sands is a key requirement for the Morrison project. The proponent's commitment to develop a QA/QC testing program and management criteria to guide tailings sand placement is appropriate. MEM wishes to further clarify that at Mines Act permitting stage, detailed monitoring plans and triggers for management actions will need to be clearly formulated to ensure that PAG sands are not generated or inappropriately placed. (Mines Act Permitting Requirement). | PBM must develop a QA/QC testing program and management criteria to guide tailings sand placement. | | | | | PBM will develop a QA/QC testing program and management criteria to guide tailings sand placement. | | |
| MEMPR-87 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 8. MEM believes that the disposal of some PAG waste in the TSF is a necessity during operations (i.e. primary mitigation strategy) and not a contingency plan (see comments dealing with mine backfill below). Thus, additional information will be required at permitting that details plans for how and where PAG waste rock will be placed in the TSF. | For permitting PBM must prepare plans detailing triggers, where and how PAG waste rock will be placed in the TSF. | | | | | For permitting PBM will prepare plans detailing triggers, where and how PAG waste rock will be placed in the TSF. | | |
| MEMPR-88 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 10. The water balance for the TSF has assumed that the tailings will be placed at a density of 1.3 t/m3. This fact, combined with the much larger surface area to be reclaimed at closure of the TSF, may make trafficability by equipment challenging during reclamation and require careful working only during the winter months when tailings are sufficiently frozen. This could potentially affect the time-to-acceptable water quality in the TSF as described above, and is another reason why a clear commitment to treat TSF water is needed. It is not clear from review of the RRR2 if the estimated time frame for reclamation of the TSF was based on a restricted seasonal activity period. Further details on how reclamation of the tailings impoundment will be undertaken will be required. (Mines Act Permitting Requirement). | PBM must develop, at the Mines Act Permitting Stage, a detailed TSF reclamation plan. | | | | | PBM will develop a detailed TSF reclamation plan for permitting. | | |
| MEMPR-89 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 12. At the Mines Act Permitting stage, detailed plans and geochemical threshold criteria (including NPR, soluble metals and solid phase metals) for sediments will be required. The EA commitment language should be modified to reflect that this plan will be submitted for permitting (i.e. take out the word conceptual). (Refinement to Commitment, Mines Act Permitting Requirement) | PBM must prepare, at the Mines Act Permitting stage, detailed plans and geochemical threshold criteria (including NPR, soluble metals and solid phase metals) for sediments. | | | | | PBM will prepare, at the Mines Act Permitting stage, detailed plans and geochemical threshold criteria (including NPR, soluble metals and solid phase metals) for sediments. | | |
| MEMPR-90 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 13. MEM believes that the new water balance information represents a significant improvement over previous iterations and is acceptable for assessing project effects at the EA stage. The uncertainties in the assumptions underpinning the water balance have been considered in the analysis and expressed in the results. The proponent has committed to continuously updating the water balance during operations as more site specific data become available. A commitment from the Proponent to perform annual updates to the water balance should be a permit requirement. (Mines Act Permitting Requirement) | PBM must, during operations and closure, perform annual updates to the water balance. | | | | | Condition #17 | | |
| MEMPR-91 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 15. For permitting, MEM will require that detailed plans for water treatment and discharge be included in the application. It is noted that a different location for a water treatment facility during operations will be needed from the closure location identified in RRR2. As well, detailed plans for sludge storage may be needed for the operational phase, depending on the operational storage location chosen. As noted above, estimates of the treated water quality and quantity will also need to be included. (Recommended Commitment, Mines Act Permitting Requirement) | PBM must prepare, at the Mines Act Permitting Stage, detailed plans for the water treatment plant, discharge pipeline, difusser and sludge storage if required during the operational phase. Estimates of treated water quality and quantity must be included. | | | | An updated assessment of placement of waste rock in the open pit or in the TSF is presented in the 3rd Party Review Response Report. | Carry forward to Permitting | | |
| MEMPR-92 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 19. As noted in MEM/Lorax comments dealing with mine backfill (see below), to further minimize the risks and liabilities associated with the Morrison project, MEM will require that there be sufficient storage room on an annual basis for backfilling all PAG, non-PAG and LGO to the open pit. This will require that any surplus wastes be stored subaquesously in the tailings facility. MEM will require that the waste materials with the highest potential for ARD be preferentially hauled to the impoundment during operations (i.e high PAG). (Recommended Commitment) | The open pit will not be sufficiently developed (i.e. pit level below lake level) in at least the first 5 years of mining to ensure that waste rock can be placed in the open pit below lake level and this requirement will dictate that all waste rock will likely need to be placed in the TSF during that period. PBM plam is that the reconciliation be delayed in order to maximize the use of the open pit to store waste rock on closure. PBM have a concern that if a smaller volume of waste rock is available for backfill into the open pit, then the closure option of wetland and small pond would not be achievable and that a lareger contaminated closure lake would be the result. | | | | An updated assessment of placement of waste rock in the open pit or in the TSF is presented in the 3rd Party Review Response Report. | Carry forward to Permitting | | |
| MEMPR-93 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 20. A separate non-PAG waste rock dump is now proposed north of the pit. Reclamation plans for any surplus materials in this dump have not been included but will be required for permitting. (Mines Act Permitting Requirement) | PBM must develop, at the Mines Act Permitting Stage, a detailed non-PAG waste dump reclamation plan. | | | | | Carry forward to Permitting | | |
| MEMPR-94 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 21. A single large PAG waste facility is located immediately northwest of the pit with separate areas for LGO, high PAG and low PAG. It is unclear how these areas will be designed and managed so that LGO and high PAG waste can be removed from these facilities during operations. Additional design information will be required at permitting. (Mines Act Permitting Requirement) | PBM must prepare, at the Mines Act Permitting Stage, detailed plans for the design and management of the PAG waste facility so that LGO and high-PAG waste can be removed from these facilities during operations. | | | | | Carry forward to Permitting | | |
| MEMPR-95 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 22. Additional details on LGO and waste rock segregation will be required at permitting, including the development of standard operating procedures. A higher frequency of analysis may be needed in non-PAG components as described previously. A monitoring program for material characterization after disposal in the dumps will be required (i.e. this is important to understanding the geochemical performance of the natural fine fraction and confirming pre-mining assessments). Mineralogical examinations on all waste materials will also be required during operations. (Mines Act Permitting Requirement) | PBM must prepare, at the Mines Act Permitting Stage, detailed plans for LGO and waste rock segregation including standard operating procedures. Plans will include a monitoring program for characterization after deposition in the dumps and mineralogical examinations on all waste materials during operations. | | | | | Carry forward to Permitting | | |
| MEMPR-96 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 23. The commitment to have ground water wells for monitoring downstream of the LGO facility is important. Detailed monitoring plans that include locations, parameters and frequencies will be required for Mines Act Permitting. (Mines Act Permitting Requirement) | PBM must develop, at the Mines Act Permitting Stage, a detailed monitroing plan for groundwater downstream of the LGO including ground well locations, parameters and frequency. | | | | | Carry forward to Permitting | | |
| MEMPR-97 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 24. The RRR2 does not describe how the Proponent will decide, 8-9 years in advance of possibly milling the LGO, to "not process" or "process" the LGO stockpile, and move and flood waste rock to the TSF instead. Metal prices will be the major factor in the proponent's decision. MEM considers this proposed plan to be impractical since the time frame described could certainly span a downcycle in metal pricing. There remains a very significant risk that metal prices could eventually fall to values unsupportive of LGO millng following a decision to eventually mill in Year 10. To manage this risk, MEM feels strongly that the proponent must commit to managing mine backfill storage on an annual basis. If the total volume of non-PAG waste rock, PAG waste rock and LGO in any given year will surpass the available backfill storage in the open pit for that year, then the surplus volume of materials will be required to be placed in the TSF that year and flooded. (Recommended Commitment) | Refer to MEMPR-92 | | | | An updated assessment of placement of waste rock in the open pit or in the TSF is presented in the 3rd Party Review Response Report. | Carry forward to Permitting | | |

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| MEMPR-98 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 25. At Mines Act permitting stage, the proponent will be required to provide annualized inventories of LGO and waste rock volumes and available storage area for pit backfill, and identify the required volumes and materials to be deposited into the TSF for flooding. High PAG waste rock should be prioritized for storage in the TSF wherever possible. These modifications will have the added benefits of reducing costs through eliminating double handling requirements for mine waste and lowering reclamation security for the proportion of PAG mine waste that has already been backfilled and proactively flooding. (Recommended Commitment and Mines Act Permitting Requirement) | Refer to MEMPR-92 | | | | see above | Carry forward to Permitting | | |
| MEMPR-99 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 27. For permitting, MEM requires further information on how mine wastes and water will be managed in the open pit at the same time during backfilling. Provision of pit fill curves for water and waste must be provided, along with an explanation of how water will be managed in the pit when the till cover is being placed. (Mines Act Permitting Requirement) | For permitting PBM must prepare pit fill curves for water and waste place in the open pit along with an explanation of how water will be managed in the pit when the till cover is being placed. | | | | | Carry forward to Permitting | | |
| MEMPR-100 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 29. The ability to control the pore water pH during backfilling is expected to be highly challenging and a more detailed plan as to how this will be accomplished will be required at Mines Act permitting. In addition, a monitoring plan to assess the backfill porewater chemistry during the active closure phase will be required in order to demonstrate successful pH amendment within the backfill. (Mines Act Permitting Requirement) | PBM must prepare, at the Mines Act Permitting Stage, detailed plans for controlling the open pit pore water pH during backfilling. Plans will include a monitoring plan to assess the backfill porewater chemistry during the active closure phase. | | | | | Carry forward to Permitting | | |
| MEMPR-101 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 30. Page 45 of the RRR2 states that only 50% of the waste rock will require liming. MEM agrees that not all waste rock will experience acid weathering prior to backfilling but questions how the proponent will decide which wastes need to be limed and the application rate. For Mines Act permitting, the proponent will be required to submit details on how lime slurry will be applied during backfill and a methodology for assessing application rates for lime slurry. (Recommended Commitment) | PBM must prepare, at the Mines Act Permitting Stage, detailed plans for controlling the open pit pore water pH during backfilling. Plans will include a monitoring plan to assess the backfill porewater chemistry during the active closure phase. | | | | | Carry forward to Permitting | | |
| MEMPR-102 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 31. MEM notes that the commitment to apply lime slurry to backfilled PAG waste should also apply to any backfilled PAG LGO to the open pit. (Recommended Commitment) | PBM must prepare, at the Mines Act Permitting Stage, detailed plans for controlling the open pit pore water pH during backfilling. Plans will include a monitoring plan to assess the backfill porewater chemistry during the active closure phase. | | | | | Carry forward to Permitting | | |
| MEMPR-103 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 33. Revised estimates of porewater concentrations in the TSF were developed using lock-cycle test water results (Expected Case) and EDCM water quality predictions for water at pH 8.0 (Upper Bound). A review of the estimated concentrations for each case suggests that the estimates appear reasonable and likely conservative. The Expected Case Cu (32 µg/L), Cd (0.88 µg/L) and Zn (220 µg/L) are likely conservative estimates for actual porewaters. Porewater concentrations are difficult to estimate in advance of actual tailings production and the Proponent will need to commit to monitoring of the TSF impoundment including determination of porewater chemistry. (Recommended Commitment and Mines Act Permitting Requirement) | PBM must monitor the TSF impoundment including determination of tailings porewater chemistry. | | | | | PBM will monitor the TSF impoundment including determination of tailings porewater chemistry. | | |
| MEMPR-104 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 35. A number of Adaptive Management components have been identified for operation and closure of the TSF and include:<br>- Raising the TSF dam to accommodate surplus water or waste rock and/or LGO;<br>- Install sulphide separation circuit to ensure production of non-PAG Rougher tailings.<br>As stated previously, MEM is of the strong opinion that operational management of waste rock through storage in the TSF on an annual basis needs to be the mining base case. As such, the contingency plan of raising the dam is a likelihood rather than a contingency measure. MEM supports the contingency plan for inclusion of a sulphide removal circuit. Details of the program that will trigger the decision to install the sulphide removal circuit needs to be outlined for permitting. (Mines Act Permitting Requirement) | Refer to MEMPR-92 | | | | | Carry forward to Permitting | | |
| MEMPR-105 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 42. As with any modeling, there are uncertainties with flow and chemistry assumptions. MEM will require that a comprehensive monitoring program be developed for mining operations that will support refinements of uncertainties and revised water quality modeling. Every 5 years during mining operations, revised water quality predictions will be required as well as updates of management strategies and detailed liability cost estimates. (Mines Act Permitting Requirement) | PBM must develop a comprehensive monitoring plan for mining operations that will support refinement of uncertainties and revised water quality modelling. Every 5 years during mining operations revised water quality predictions will be required as well as updates of managment stategies and detailed liability cost estimates. | | | | | Carry forward to Permitting | | |
| MEMPR-106 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 44. The proposed end-dumping of PAG waste rock into the pit is a concern as this will not ensure PAG wastes are backfilled below the ultimate level of flooding in the pit lake. This would result in significant quantities of additional PAG waste material remaining on the pit walls at closure. This would provide a long term source of acidity and metal loadings which has not been accounted for in the proposed plan and effects assessment. Controlled hauling and direct placement of waste rock (i.e. not end dumping) is required to be the method of placement for all backfill into the open pit. (Recommended Commitment) | PBM commits that high-PAG waste rock and LGO will be hauled and direct placed in the open pit. Low-PAG wate rock and LGO may be end dumped into the open pit however they will be dozed or otherwise handled to ensure to ensure they are backfilled below the ultimate level of flooding. | | | | | Condition #8 | | |
| MEMPR-107 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 46. The proponent should be aware that at the Mines Act permitting stage, MEM will include in its assessment of closure costs, long-term annual operating costs (including power, reagents, personnel etc.) of the water treatment system and long-term monitoring. Given that these environmental liabilities are created at the very initiation of mining, MEM will incorporate these items up-front into the financial security requirements for the site. This combined with the unrealistic backfill costs, demonstrates that the actual closure costs and the anticipated financial security requirements are not fully understood by the proponent and have been grossly underestimated. A financial security of the magnitude anticipated by MEM for the Morrison project may not have been fully considered in the proponent's economic feasibility assessment. MEM questions whether the current proposed plan for backfill at closure is any more financially feasible than storing all PAG waste in the TSF during operations. | see below | | | | | Carry forward to Permitting | | |
| | | | | | | | MEM believes this is a fundamental question that should be answered as part of the Environmental Assessment, and that all parties should have confidence that the project can be designed, constructed, operated and closed in accordance with the proposed plan. MEM recommends further work to evaluate and compare the full life cycle costs of backfill to the TSF during operations versus backfill to the open pit at closure, before concluding the EA. (Additional EA Information Requirement.) | PBM believes that the reclamation and closure costs are reasonably estimated for the EA. PBM must, at the Mines Act Permitting Stage , evaluate and compare the full life cycle costs of placing waste rock in the TSF during operations versus backfill to the open pit at closure | | | | | Carry forward to Permitting | | |
| MEMPR-108 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 47. Given that the proposed reclamation and closure cost estimates presented in RRR2 are grossly underestimated and that MEM's requirements for posting a financial security will include up-front costing for long-term treatment and monitoring, the full life cycle costs of this plan (including financial security requirements) should be more fully compared to other options (see comment 46 above). Accordingly, the proponent will need to complete a full disclosure cost comparison of the proposed closure option, using more realistic backfilling costs, and an alternative mine waste strategy of placement of as much PAG material as possible in the TSF during operations. Details of per unit costs and assumptions behind the individual costs for each option need to be included. MEM requires this comparison to fully evaluate the environmental liabilities of the project. (Mines Act Permitting Requirement) | PBM believes that the reclamation and closure costs are reasonably estimated for the EA. PBM must, at the Mines Act Permitting Stage , evaluate and compare the full life cycle costs of placing waste rock in the TSF during operations versus backfill to the open pit at closure | | | | | Carry forward to Permitting | | |
| MEMPR-109 | MEMPR/Lorax | 11-Aug-11 | | | | RRR Rev.2 | 49. MEM considers HDS lime treatment to be proven technology that is capable of providing effective and reliable means of treating Morrison TSF and open pit water to protect the environment. However, there are significant long-term environmental risks and liabilities associated with perpetual water treatment including:<br>• the long-term (essentially permanent) presence of contaminated drainage on the mine site,<br>• the permanent removal of land areas from future productive use,<br>• the effectiveness of collection systems and treatment processes,<br>• the ability of collection and treatment systems to perform under extreme climatic conditions,<br>• the generation of large amounts of secondary wastes (i.e. sludge) that must be managed, and<br>• high costs and onerous management requirements.<br>Successful management will require strong and on-going proponent commitment, long-term operator vigilance, an adaptive management approach, effective long-term monitoring, regular and proactive maintenance and contingencies to manage risk over time. Detailed plans for Mines Act permitting must be consistent with this approach. (Mines Act Permitting Requirement) | PBM must prepare, at the Mines Act Permitting Stage, detailed plans for the water treatment plant, discharge pipeline, difusser and sludge storage if required during the operational phase. Estimates of treated water quality and quantity must be included. | | | | | Carry forward to Permitting | | |

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| MOE-000 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | 7.7.2, Table 7.7-3, Table 7.7-4; Appendix I Appendix AG | I; Addendum | An explanation of the depths chosen to estimate hydraulic conductivity in the faults and fractures should be provided. | The testing intervals and depth varied depending on the quality of the rock observed in the drill core. Original data from Knight Piesold is available in the Addendum Appendix I. Additional testing was completed in the open pit and is presented in Addendum Appendix AG. | Response satisfactory. | | | The hydrogeology assessment has been further quantified in the 3rd Party Review Response Report. | | | |
| MOE-001 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | 7.7.2 Table 7.7-3 Table 7.7-4 Appendix I Appendix AG | I Addendum | What pumping tests have been done to explore the hydraulic connectivity or boundary conditions between the mine site and Morrison Lake and to develop hydraulic properties such as storativity and specific yield. | Original data from Knight Piesold is available in the Addendum Appendix I. Additional testing was completed in the waste rock and is presented in Addendum Appendix AG. For the Feasibility Design Falling head,Shelby Tube, Slug and Proctor Compacted test were used to assess overburden conductivity. Packer, Packer -CHT, Packer-FHT, Packer-DT, Packer Permeability, Slug Test-RHT, Slug-FHT, Lugeon and Falling Head Tests were used to assess the permeability of bedrock. PBM commits to carrying out pumping tests and additional hydraulic conductivity testing in the detail design stage. | Unresolved. Further discussion required regarding potential for deferral to permitting phase. | An updated assessment of the hydrogeological connection between Morrison Lake and the open pit is provided in Section 6.3 of RRR Rev.2. PBM must carry out site investigations and pump well tests in the bedrock between Morrison Lake and the open pit. If zones of high conductivity are encountered such that high flows from Morrison Lake to the open pit could signficantly adversely effect Morrison Lake Water levels or Morrison River flows or cause a significant surplus water balance that would "upset" the "zero discharge" water management plan, then the zones must be grouted to reduce flows towards the predicted flows. | | The hydrogeology assessment has been further quantified in the 3rd Party Review Response Report. | | | |
| MOE-002 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | App. 24, 25; Appendix 4; App. AG, AX, | Vol VIII, IX; Vol IV; Addendum | Explain the work done to characterize the bedrock in the project area. What faults were measured and where? | Bedrock and structure were studied by PBM (and by previous property owners Noranda) during years of exploration work and resource drilling. Bedrock was also characterized during geotechnical and groundwater monitoring studies completed by Knight Piesold, Klohn Crippen Berger and Rescan. Finally, bedrock information was also taken from published geological reports, including the regional compilation map by MacIntryre 2001 (BC GSB OF 2001-3). Direct observation and study of faults in the open pit area was made during resource drilling, geotechnical and environmental studies. The most recent work included packer testing of faults in the 2010 drilling program (EAC Addendum Appendix AG). No direct observation of faults was made either by PBM and its consultants nor by government geologists in the area of the Tailings Storage Facility due to the heavy blanket of glacial till in the area. | Response addresses comment. However, further discussion required regarding permitting-phase commitments. | An updated assessment of the hydrogeological connection between Morrison Lake and the open pit is provided in Section 6.3 of RRR Rev.2. PBM must carry out site investigations and pump well tests in the bedrock between Morrison Lake and the open pit. If zones of high conductivity are encountered such that high flows from Morrison Lake to the open pit could signficantly adversely effect Morrison Lake Water levels or Morrison River flows or cause a significant surplus water balance that would "upset" the "zero discharge" water management plan, then the zones must be | | The hydrogeology assessment has been further quantified in the 3rd Party Review Response Report. | | | |
| MOE-003 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | App. 24, 25; Appendix 4; App. AG, AX, | Vol VIII, IX; Vol IV; Addendum | Explain the work done to characterize the bedrock in the project area. How do these faults interact with the upper unconsolidated layer? | Bedrock characterization is based on local and regional geology, and core logging of geotechnical and groundwater monitoring well drill holes. Terrain and underlying faults are blanketed by glacial till. | Response addresses comment. However, further discussion required regarding permitting-phase commitments. | PBM must carry out site investigations and pump well tests in the bedrock between Morrison Lake and the open pit. If zones of high conductivity are encountered such that high flows from Morrison Lake to the open pit could signficantly adversely effect Morrison Lake Water levels or Morrison River flows or cause a significant surplus water balance | | The hydrogeology assessment has been further quantified in the 3rd Party Review Response Report. | | | |
| MOE-004 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | Appendix AX, Pg 61 | Addendum | Explain the work done to characterize the bedrock in the project area - Has the fracture zone thickness been measured? The average thickness of 20 meters seems high and there should be an explanation provided on how this was determined through physical measurements, etc. | The bedrock permeability decreases with depth. The upper 20m of bedrock, based on field hydraulic conductivity testing, has a permeability of 8.7 X10-7 m/s and has been characterized as fractured rock. The permeability rock decreases to less than 1.3x10-7 m/s. | Response addresses comment. However, further discussion required regarding permitting-phase commitments. | See above | | | | | |
| MOE-005 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | Appendix AX, Table 4.16 | Addendum | Explain the work done to characterize the bedrock in the project area. - Why were the faults at the tailing pond area not studied, e.g., no hydraulic conductivity measurements were done in the bedrock in the tailing pond area? | Hydraulic conductivity of bedrock (and overburden) in the tailings pond area were measured during several seasons of field studies (please read Proponent response to comment MOE-12 below for more details). Additionally, terrain and faults in this area are heavily blanketed by glacial till and no direct observations of faults, which were marked 'inferred' on the regional bedrock geology map they were taken from (MacIntryre, BC GSB OF 2001-3), were recorded by government geologists. | Response addresses comment. However, further discussion required regarding permitting-phase commitments. | See above | | | | | |
| MOE-006 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | Appendix AX, Table 4.16 | Addendum | Explain the work done to characterize the bedrock in the project area. - In appendix AX, the deep zone of fractured rock at 35-50 m was assigned a hydraulic conductivity value of 3x10-7 m/s. Was this determined through a physical test? | Hydraulic conductivity (k) testing was done by KCBL in 2007 & KP in 2006. Packer tests were completed in the glacial tills, the shallow fractured bedrock & the deeper, more competent bedrock. Results of the testing are described in detail in the KP report entitled "Geotechnical Site Investigation Report (No. VA101-102/7-1), issued July06 & KCBL report "2007 Geotechnical Site Investigation", issued May08. Also, KCBL reviewed & incorporated falling head test results conducted by Rescan in monitoring wells MW07-1 to MW07-8, installed Oct & Nov, 2007. Results of all k testing are summarized by depth in Appendix AX, Table 4.16. For the fractured bedrock zone encountered at depths generally between 10-40m below ground surface, test results indicate k-values ranging from 1.5x10-7m/s to 5.1x10-6m/s with a geometric mean of 8.7x10 -7m/s. K-values decreased with depth: bedrock tested between approximately 40-50m has a range of 7.0x10-8m/s to 1.8x10-6m/s & a geometric mean of 3.1x10-7m/s. Tests conducted at depths greater than 50m below ground surface indicate k ranges from less than 6.6x10 -8m/s to 2.4x10 -7m/s. | Response addresses comment. However, further discussion required regarding permitting-phase commitments. | An updated assessment of the hydrogeological connection between Morrison Lake and the open pit is provided in Section 6.3 of RRR Rev.2. PBM must carry out site investigations and pump well tests in the bedrock between Morrison Lake and the open pit. If zones of high conductivity are encountered such that high flows from Morrison Lake to the open pit could signficantly adversely effect Morrison Lake Water levels or Morrison River flows or cause a significant surplus water balance that would "upset" the "zero | | | | | |
| | | | | | | | | | | The open pit will be developed over 19 years in a number of stages: Phase I and II will be developed to 576 masl, a depth of ~156 m below Morrison Lake (~732 masl); Phases III and IV will be developed to 480 masl, a depth of ~252 m below Morrison Lake:<br><br>• Phase I will be mined Year 1 to Year 7.<br>• Phase II will be mined Year 4 to Year 11.<br>• Phase III, an expansion of the Phase I pit will be mined Year 8 to Year 17 and<br>• Phase IV, an expansion of the Phase II pit will be mined Year 12 | | | | | |

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| MOE-007 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | Appendix 25 | IX | Explain the work done to characterize the bedrock in the project area. - The proposed pit elevation is 500m and the deepest piezometer is at 687 m but it appears that there has been no characterization work done for the bottom layer of the pit which is important when determining predicted inflows to the pit. | The proposed pit bottom is 480 masl. Groundwater seepage rates are estimated for pit lake elevations 492 m, 516 m, 588 m, 648 m, 708 m, and 732 masl. Groundwater inflow modeling was based on the very conservative assumption that the dewatering wells would draw down the groundwater table in the pit wall to the base of the pit - as such they represent an upper bound potential condition. In general, the hydraulic conductivity decreases with depth and the analysis is not that sensitive to the deeper bedrock values. PBM commits to carrying out additional characterization work in the detail design stage. | Response addresses comment. However, further discussion required regarding permitting-phase commitments. | See above | | | PBM will carry out additional characterization work in the detail design stage. | | |
| MOE-008 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | Appendix 10 | V | Where are the drawings mentioned in the appendices? | There are numerous drawings throughout the EAC Application. However assuming the request pertains to drawings associated with Appendix AX these drawings are contained in EAC Application, Volume 5, Appendix 10. | Response satisfactory. | | | | | | |
| MOE-009 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | Appendix 9 | V | Where are figures VIII 2 and 3 (p. 101) in Appendix AX? | See EAC Application, Volume V, Appendix 9, Appendix VIII | Response satisfactory. | | | | | | |
| MOE-010 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | Appendix 25 Appendix I | IX Addendum | How is the issue of transversely isotropic addressed? | The overburden and the bedrock formations together with the fault zones are assumed to be homogeneous and isotropic within the individual zones and layers in the baseline groundwater model. Transversely isotropic faults were included in the model. | Unresolved; further discussion required. Carry forward. | The overburden and the bedrock formations together with the fault zones are assumed to be homogeneous and isotropic within the individual zones and layers in the baseline groundwater model. Transversely isotropic faults were included in the model. | | The hydrogeology assessment has been further quantified in the 3rd Party Review Response Report. | | | |
| MOE-012 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix 25 | IX | • It appears that there is are 2 additional faults noted on Figure 4.1 of Appendix AX that weren't included in the groundwater model or subsequent figures showing the local geology. In the old Appendix 25 Figure 2.1-1 doesn't include this fault. One of these faults underlies the tailing pond, could connect with other faults and play a role in contaminant transport. There is another fault to the west of the tailing pond that was also missed. What was the rationale for not including these faults in the model? | Geology of the project area is based upon the 1:100,000-scale regional geologic compilation map (MacIntyre 2001, BC GSB Open File 2001-3). This map compiles mapping efforts from many geologists over decades. In the vicinity of the Project site, terrain is heavily blanketed by till and other glacial deposits making direct observation of bedrock difficult. The fault on the map under the footprint of the TSF (Fig 7-1) is dashed, indicating its presence is inferred and thus not based on direct observation. Even if a fault does exist in this location, the orientation and age of the fault are important factors for assessing its ability to act as a conduit for groundwater flow. Old (e.g. Jurassic-age or 210-140 million years ago) faults are much less likely to be viable conduits for flow than young (e.g. Recent-age) faults. Finally, it is important to understand that the dominant controlling factors for seepage through the TSF foundations are the hydraulic conductivities of the tailings and the underlying glacial till, both of which have been measured. | Unresolved; further discussion required. Carry forward. | Section 6.2.2 RRR Rev.2 addresses the influence of faults on the hydrogeology of the TSF area and Section 6.3.3.2 addresses the influence of faults on the open pit/Morrison Lake area. | | The hydrogeology assessment has been further quantified in the 3rd Party Review Response Report. | | | |
| MOE-013 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix 25 | IX | The potentiometric map (manually done) is different from the potentiometric map produced by the model. The modelled potentiometric surface "misses" local areas of high groundwater tables by Booker Lake and to the west and north of the tailing pond. This obviously is due to a lack of data and the way the model works. | The MODFLOW 2000 pre-conditioned conjugate gradient (PCG2) solver is used for all the flow simulations, and it has proved to be an efficient iterative method for solving difficult modelling problems (BGC 2009; Cho 2009). The baseline model is run at steady state with the parameters described in the above sections and calibrated with the PEST (a popular parameter estimation program) in MODFLOW package and manual adjustment of the flow and aquifer parameters within the reasonable ranges of the tested and estimated data. | Response satisfactory. | | | | | | |
| MOE-014 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix 25 | IX | What role do the major faults play in the groundwater flow and direction – the model doesn't appear to have taken these into account and is primarily looking at the unconsolidated materials? What is the interaction between the unconsolidated and bedrock formations in relation to contaminant transport? Some discussion on this is warranted. | The MODFLOW model was prepared considering faults. Discussion of the inclusion and effect is provided in EAC Application, Volume IX, Appendix 25. Additionally model calibration and sensitivity analysis are documented. No major faults have been identified in the TSF area that would provide preferential flow paths. | Unresolved; further discussion required. Carry forward. | Section 6.2.2 RRR Rev.2 addresses the influence of faults on the hydrogeology of the TSF area and Section 6.3.3.2 addresses the influence of faults on the open pit/Morrison Lake area. | | The hydrogeology assessment has been further quantified in the 3rd Party Review Response Report. | | | |
| MOE-015 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix AB; 2.1 " TSF Impoundment Water Quality" | Addendum; RRR | Mike Wei's review commented on a high nitrate value but the same results do not appear in the new reports? Maybe I'm missing something? | In a review of the Nov 30, 2009 letter to Chelton van Geloven of MOE, that comprise Mike Wei's comments, PBM found no reference to nitrates. Appendix AB, Lake Effects addresses water quality predictions that are revised for the TSF from the initial application. These water quality predictions are further updated in the RRR | Response satisfactory. | | | | | | |
| MOE-016 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | 7.7.2 Table 7.7-3; Append I & AG; 2.2.2 | I; Addendum; RRR | The hydraulic conductivity values for the till may vary. For instance the hydraulic conductivity values for the till closer to the lake may be higher than the till to the east. Has this been looked at and factored into the model? | The till materials across the site are of the same origin. The hydraulic conductivity of the till in a variety of locations was assessed. The glacial till present in the dam and impoundment footprint is a moderately plastic clay till. A triaxial test carried out on a sample indicated a hydraulic conductivity of 1x10 -10 m/s. However a more conservative hydraulic conductivity of 1x10 -8 m/s used in the EAC model. Therefore the predicted TSF seepage is conservative (high). | Unresolved. Response is inadequate and does not address the pit area. Further discussion required. | Additional assessment is provided in RRR Rev.2: Section 6.2.1 for the TSF area and Secction 6.3.1 for the open pit area. | | 3rd Party Review Response Report. | | | |
| MOE-017 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | 7.6.3; 2.1.4 | I; RRR | The BCWQG for drinking water should not be used as MOE no longer maintains these values. For instance, the guideline value for arsenic used in the report is 0.025 ppm which is outdated. The Canadian Drinking Water Quality Guidelines should be used as these are kept current and what the province uses with respect to drinking water, e.g. the guideline for arsenic is 0.010 ppm. | Reference to BCWQG was the requirement of the Terms of Reference. However a Table comparing TSF water quality at closure to a suite of guidelines is presented in the RRR. The water quality meets all drinking water guidelines with the exeption of sulphate, which is largely an aesthetic/ taste guideline. | Response satisfactory. | | | | | | |
| MOE-018 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | Appendix AB; 4.0 "Morrison Lake Effects" | Addendum; RRR | The background groundwater quality has some metal and other constituents that exceed existing guideline values. Will one of the effects of the project be to mobilize these metals and transport them to surface water bodies in the area? What will be the effect of mixing the tailing pond effluent with the background groundwater? | RRR, Table 3.1 shows a comparison of all water quality results with turbidity values >50 NTU discarded and the analysis redone using only samples with turbidity concentrations <50 NTU. The new baseline groundwater quality, without the high turbidity samples, is significantly of "better quality" than the EAC Application groundwater quality and is more consistent with the expected groundwater quality; i.e. very low in metal concentrations. The effects of seepage entering streams and Morrison Lake are updated on this basis in the RRR. | Unresolved; further discussion required. Carry forward. | A comparison of all water quality results with turbidity values >50 NTU discarded and the analysis redone using only samples with turbidity concentrations <50 NTU. The new baseline groundwater quality, without the high turbidity samples, is significantly of "better quality" than the EAC Application groundwater quality and is more consistent with the expected groundwater quality; i.e. very low in metal concentrations. The effects of seepage entering streams and Morrison Lake are updated on this basis in the RRR Rev.2. The modelling incorporates mixing of seepage water and baseline groundwater. | | | Noted | | |
| MOE-019 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | | | The reasons for the wide range of results from a single well and between wells in the same areas were not provided. In addition some of the monitoring wells show fairly consistent higher concentrations (e.g. MW07-08). | see above | Unresolved; further discussion required. Carry forward. | A comparison of all water quality results with turbidity values >50 NTU discarded and the analysis redone using only samples with turbidity concentrations <50 NTU. The new baseline groundwater quality, without the high turbidity samples, is significantly of "better quality" than the EAC Application groundwater quality and is more consistent with the expected groundwater quality; i.e. very low in metal concentrations. The effects of seepage entering streams and Morrison Lake are updated on this basis in the RRR Rev.2 | | | Noted | | |

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| MOE-020 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | 3.4 "Mine Area Baseline Groundwater Quality", Table 3.1 | RRR | Turbidity results were very high for 34 samples, e.g. turbidity was >50 NTU, which comprise almost 50% of the samples reported. Appendix AY (p.4-1) states that these high values are background concentrations but I don't agree. These results are likely due to incomplete development of the well or poor sampling practices. The water quality results for these 34 wells are questionable due to the high turbidity results and should be redone. Samples should be collected using a low purge rate (< 1L/s) to try to collect a more representative sample. All water quality results with turbidity values >50 NTU should be discarded and the analysis redone using only samples with turbidity concentrations <50 NTU. | Acknowledged. RRR, Table 3.1 shows a comparison of all water quality results with turbidity values >50 NTU discarded and the analysis redone using only samples with turbidity concentrations <50 NTU. The new baseline groundwater quality, without the high turbidity samples, is significantly of "better quality" than the EAC Application groundwater quality and is more consistent with the expected groundwater quality; i.e. very low in metal concentrations. Additional samples were collected in October 2010. For permitting and prior to construction, as part of the EMS, PBM commits to collecting additional samples to assess groundwater quality. | Unresolved; further discussion required. Carry forward. | A comparison of all water quality results with turbidity values >50 NTU discarded and the analysis redone using only samples with turbidity concentrations <50 NTU. The new baseline groundwater quality, without the high turbidity samples, is significantly of "better quality" than the EAC Application groundwater quality and is more consistent with the expected groundwater quality; i.e. very low in metal concentrations. The effects of seepage entering streams and Morrison Lake are updated on this basis in the RRR Rev.2 | | | Carry forward to Permitting | | |
| MOE-021 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | Appendix AY, Pg. 2-2 | Addendum | It doesn't appear that an adequate characterization of the bedrock types has been done. In Figure 2.1-1, it indicates that there are 9 different bedrock types in the project area. However, water quality results were only provided for 3 of the bedrock types – Ashman, Saddle Hill and FPB. An explanation should be provided why the other types of bedrock formations were not characterized through water quality sampling. | Groundwater quality data is available for other formations. The database has not been compiled by rock type. The groundwater quality characterization was based on a spatial distribution of monitoring wells. | Unresolved; further discussion required. Carry forward. | Groundwater quality data is available for other formations. The database has not been compiled by rock type. The groundwater quality characterization was based on a spatial distribution of monitoring wells. | | | Noted | | |
| MOE-022 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | Appendix AB; 2.1 "TSF Impundment Water Quality"; 4.0 "Morrison Lake Effects" | Addendum; RRR | In appendix AY, it states that the high metal concentrations are going to be dealt with during development, operation and closure but no explanation has been provided as to what this means. Maybe this has been explained in another report? | PBM commits that exceedances of groundwater quality will be taken into consideration when managing and displacing groundwater during mine development, operation, and closure, especially near Morrison Lake. Appendix AB, Lake Effects updates the water quality predictions from those available when Appendix AY was written. Water quality predictions are revised for the TSF and Appendix AB further deals with the groundwater quality including effects on lakes and streams. These water quality predictions are further updated in the RRR. | Unresolved. Further discussion required and may result in a certificate commitment. | The updated water quality predictions for seepage analysis incorporates groundwater quality data and "screens-out" high turbidity samples. The updated Morrison Lake water quality predictions are presented in Section 10.10 (Expected Case) and 10.11 (Upper Bound) of the RRR Rev.2. | | 3rd Party Review Response Report - Addendum. | | | |
| MOE-023 | MOE, Vicki Carmichael | 21-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 5.7 | | | No information was provided in the report on the time that was spent on developing the monitoring wells. | Acknowledged. It is unclear what what issue is being raised with this point. However the reports submitted provide information regarding well development and records of the samples collected. Additional samples were collected in October 2010. For permitting and prior to construction, as part of the EMS, PBM commits to collecting additional samples to assess groundwater quality. | Response addresses comment. However, further discussion required adequacy of information. | | | | For permitting and prior to construction, as part of the EMS, PBM will collect additional samples to assess groundwater quality. | | |
| MOE-024 | MOE, Vicki Carmichael | 21-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | | | How will seepage through the dam be dealt with on mine closure? Will there be ongoing pumping after the mine closes? Who will be responsible? | Seepage from the TSF will also be collected in the seepage ponds and pumped back to the TSF pond until seepage meets discharge water quality criteria. Care and maintenance of the Site including the on-going pumping after mine closure will be provided by Pacific Booker Minerals personnel. | Further discussion required. Carry forward. | Seepage from the TSF will also be collected in the seepage ponds and pumped back to the TSF pond until seepage meets discharge water quality criteria. Care and maintenance of the Site including the on-going pumping after mine closure will be provided by Pacific Booker Minerals personnel. | | | EMP | | |
| MOE-025 | MOE, Greg Tamblyn | 28-Sep-10 | Construction and Operational EMPs | 9.1 | 4.19.7.2 Environmental Management Plans | I | Comment: "PBM will develop conceptual monitoring programs before submitting the EA application" - conceptual plans were not submitted before the EA Application, but are contained within the application and the addendum. (G. Tamblyn, Application). | Acknowledged. For permitting and prior to construction PBM commits updating the Environmental Management System and providing it to the MOE. | Resolved. Certificate commitment required. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-026 | MOE, Greg Tamblyn | 28-Sep-10 | Atmosphere and Climate | 5.1 | 7.2.2 Baseline Conditions | I | Comment: The snow survey data is vital for accurate water balance and modeling. Was the data collected in 2008 used for the water balance? Are there any other nearby snowcourses to allow you to correlate data collected at the Morrison Site (G. Tamblyn, Application). | The TSF and overall mine contact water is managed on an annual basis, which makes the water balance relatively insensitive to the proportion of snow versus precipitation. PBM commits to collect snowpack data during operations to provide a more robust basis water management and for closure planning. | Unresolved. Further discussions regarding water balance required. Certificate commitment may be required. | On-site snow data has been collected by PBM for winter 2010/2011 and is provided in RRR Rev.2 Appendix I. The TSF and overall mine contact water is managed on an annual basis, which makes the water balance relatively insensitive to the proportion of snow versus precipitation. PBM commits to collect snowpack data during operations to provide additional data to calibrate to regional data. | | | PBM will collect snowpack data during operations to provide a more robust basis water management and for closure planning. | | |
| MOE-027 | MOE, Greg Tamblyn | 28-Sep-10 | Atmosphere and Climate | 5.1 | 7.2.2.4 Baseline Conditions, pg 7-10; Appendix AP | I; Addendum Vol XI; EAC VIII, Appendix 20, pg 3-1 | Comment: A hourly average windspeed of <1m/s (calm conditions) 66% of the time is unusual and suspect. (G. Tamblyn, Application). Action: Submit anemometer calibration records to MOE. (G. Tamblyn, Application). | PBM has provided installation, calibration and data in support of Application. The higher than expected frequency of calms was addressed in the EAC Application and the maintenance and QA/QC records do not indicate there was a problem with the wind sensor (see EAC Vol VIII, Appendix 20 pg 3-1). Additionally PBM has acquired and provided Babine North Forest Service Fire Weather Station data for comparison purposes. | See below. | | | | | | |
| MOE-027a | MOE, Greg Tamblyn | 3-Dec-10 | Atmosphere and Climate | | | | Comment: Appendix AP does not contain calibration records for the anemometer and as such, we must assume that the anemometer was not calibrated, which raises serious concerns about the wind data and the subsequent modelling results. | | Unresolved; further discussion required. Carry forward. | In addition to the aforementioned submissions PBM submitted a Wind Data Analysis Report Dec 6, 2010. Correlation between PBM's and Babine North Forest Service weather statsion is presented. Additionally a calibration certificate from November 16, 2009, that includes both before and after service condition, is provided. | | | | | |
| MOE-028 | MOE, Greg Tamblyn | 28-Sep-10 | Air Quality | 5.2 | 7.3.4 Baseline Conditions; EAC Vol VIII, App. 18, Table 3.2-1 | I | Comment: It appears that dustfall detection limits change from <0.10 to 0.12, though the text indicates that the detection limit is <0.12 (G. Tamblyn, Application) | EAC Vol VIII Appendix 18, Table 3.2-1 notes that the detection limit is 0.10 mg/dm2/day; however, EAC Vol I, Section 7.3, Table 7.3-1 notes the detection limit is 0.12 mg/dm2/day. PBM acknowledges the apparent typographical error in Vol I. | Resolved. | | | | | | |
| MOE-029 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | 7.4 Water Quality | I | Comment: Study methods are mentioned in Appendices 26 and 27, but the study design (e.g. BACI) and the rationale for frequency of sampling is not mentioned. Historic / pilot study data was not used to assist determining required sample sizes for the subsequent water quality monitoring programs. Water quality results are compared to "30-day mean" guidelines, which ensures interpretation of results is conservative, which is a good thing in an impact assessment. However, the 30-day mean guidelines are meant to be compared to the mean values from 5 water samples taken within a 30 day period. Unfortunately, no "5 in 30" day sampling was conducted so that water quality at key times of year cannot be properly characterized. (G. Tamblyn, Application). | Baseline sampling of 5 times per month per site is not common practice. It appears these quoted guidelines are as identified in the DRAFT "Water and Air Resource Protection Guidelines Mine Proponents and Operators" Baseline Monitoring May 2009. PBM commits to ensuring that required guidelines, for example an approved version of the Water and Air Resource Protection Guideline, are adhered to for future sampling. | Unresolved; further discussion required. Carry forward. | For permitting and prior to construction, PBM commit to consulting with MoE to identify key water quality stations that may require the 5 day sample collection and an appropriate time for sampling. | | | PBM will ensure that required guidelines are adhered to for future sampling. For permitting and prior to construction, PBM will consulte with MoE to identify key water quality stations that may require the 5 day sample collection and an appropriate time for sampling. | | |
| MOE-029-a | MOE, Greg Tamblyn | 3-Dec-10 | Hydrology and Surface Water Quality and Quantity | | | | Comment: Sampling water quality 5 times in 30 days during either or both spring freshet and low flows is common practice at proposed mines in the Skeena Region. Results from this type of frequent sampling provide better characterization of water quality variabilty during key times of year. | | Unresolved; further discussion required. Carry forward. | For permitting and prior to construction, PBM commit to consulting with MoE to identify key water quality stations that may require the 5 day sample collection and an appropriate time for sampling. | | | Carry forward to Permitting | | |

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| MOE-030 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | 7.4 Water Quality | I | Comment: Although table 7.4-2 provides minimums, maximums and medians for some parameters at the stream sites, water quality data for all years combined was not summarized well. A single baseline report or an EA chapter thoroughly covering 2004-2009 data would have made the review much simpler. (G. Tamblyn, Application). | Acknowledged. | Unresolved; further discussion required. Carry forward. | Acknowledged. | | | | | |
| MOE-031 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | 7.4 Water Quality | I | Comment: Duplicates were taken as part of the QA/QC protocols for water quality sampling, which is standard protocol. However, it is not clear if duplicates were included in summary statistics in any part of the Application. Duplicates are solely for QA/QC purposes and only one of the samples in each duplicate pair should be used when calculating statistics. Including duplicates can bias the data. (G. Tamblyn, Application). | PBM collected additional data in 2009 and 2010 and commits to continuing to collect baseline data prior to construction PBM commits to preparing a consolidated Surface Water Quality database incorporating available data. Proper sampling, QA/QC and analytical procedures will be used. | Response not satisfactory. Were duplicates included in summary statistics? | Duplicates were not used for baseline water quality data for RRR Rev.2 water quality predictions. | | | | | |
| MOE-032 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | 7.4 Water Quality | I | Comment: It is unfortunate that so many samples in Jan 2008 appear to have been contaminated as this is the only January sample available for some of the sites during the baseline study. Water quality samples were collected in the winter of 2004-05, but method detection limits, in some cases are much higher than in 2008. PBM should consider discarding the January 2008 data. (G. Tamblyn, Application). Action: Additional water quality sampling will be required at some stream sites to fill in gaps prior to permitting (G. Tamblyn, permitting). | PBM collected additional data in 2009 and 2010 and commits to continuing to collect baseline data prior to construction PBM commits to preparing a consolidated Surface Water Quality database incorporating available data. Proper sampling, QA/QC and analytical procedures will be used. | Unresolved. Further discussions required. Carry forward to next tracking table. | PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. Appendix I RRR Rev.2 documents overall data collection. PBM commits to preparing a consolidated Surface Water Quality database incorporating available data. Appropriate sampling, QA/QC and analytical procedures will be used. | | | | | |
| MOE-032a | MOE, Greg Tamblyn | 3-Dec-10 | Hydrology and Surface Water Quality and Quantity | | | | Comment: In a high-valued lake such as Morrison Lake located immediately adjacent to the proposed mine, seasonal data at multiple depths is required to properly characterize the lake temporally and spatially and to predict possible effects. Lack of data for Morrison Lake remains a significant data gap that was not addressed in the Review Response Report. Action: Determine vertical profiles for physical water quality parameters and collect water quality data at multiple depths at the sites and sites in Morrison lake during winter. This combined with the other seasonal data, and a clearer understanding of the hydrogeology and groundwater quality, should provide the minimum data required to predict water qaulity in the lake and thus conduct an effects assessment. | | Unresolved; further discussion required. Carry forward. | PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. Appendix I RRR Rev.2 documents overall data collection. | | | | | |
| MOE-033 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | 7.4 Water Quality | I | Comment: Some streams have natural water quality that exceed existing B.C. water quality guidelines for aquatic life. | Acknowledged. | No further response required. | | | | | | |
| MOE-034 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | 7.4 Water Quality | I | Action: The Ministry of Environment will require PBM to look into establishing site specific Water Quality Objectives for streams that are subject to seepage discharges on the mine site (e.g. Streams 7, 8, 10) along with Morrison Creek. In some cases, particularly streams 8 and 10, additional baseline data will be required to determine if water quality objectives are necessary. Water Quality Objectives are numerical limits for chemical, physical or biological characteristics of a water body that have been set to protect the most sensitive designated water use at a specific site (e.g. aquatic life, drinking water, recreation, etc). Objectives are generally set when the natural water quality at a site exceeds BC Water Quality Guidelines (Guidelines are general and apply to the entire province) for one or more parameters of concern. They are based on knowledge of the baseline water quality, designated water uses, and waste discharges and predicted impacts. (Comment continued in next cell below). | PBM commits, as required by MOE, to preparing a proposed water quality objective for discharges from the mine site for permitting. | Response satisfactory. Proponent commitment required for EAC. | | | | | | |
| MOE-035 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | | | Objectives become targets for ambient water quality –i.e. downstream of an initial dilution zone - but are not legal limits. Permit limits, however, are legal concentrations that must be met. Setting Water Quality Objectives can be a time consuming and expensive process depending on the local situation and the methods needed to develop the objectives. However, water quality objectives will help ensure that water quality monitoring programs have achievable targets for those parameters which naturally exceed guidelines. Water Quality objectives should be established according to approved Ministry of Environment methods and principles: Methods for Deriving Site Specific Water Quality Objectives in BC and Yukon and Principles for Preparing Water Quality Objectives in BC (G. Tamblyn, Application). | See above. | See above. Response satisfactory. Proponent commitment required for EAC. | | | | | | |
| MOE-036 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | 7.4.2 Stream Water Quality Data | I | Comment (also relevant to section 7.4.3.1): The BC 30 day guideline for cyanide relates to weak acid dissociable cyanide (WAD). However, in this report, total cyanide levels are compared to this guideline. As WAD cyanide was not measured, it is uncertain whether the 30-day guideline was exceeded at any point in time. Also, care must be taken in comparing single samples with 30-day average guidelines. Action: In future water quality sampling in both streams and creeks, both weak acid dissociated and strong acid dissociated cyanide will need to be measured, and some samples should be taken in the bright sunlight. (G. Tamblyn, Application). | PBM commits to future water quality sampling as stipulated. | Response satisfactory. Proponent commitment required for EAC. | | | | PBM will conduct water quality sampling as stipulated. | | |
| MOE-037 (1) | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | 7.4.3 Lake and Pond Sites | I | Comment: As stated during screening, the water quality sampling program for Morrison Lake is inadequate to characterize the water quality both spatially and temporally. This is a significant information gap in the application. In 2006, it appears that surface water samples were collected once (in late August) at the 5 lake sites. In 2008, samples were taken at the same sites at both the surface and near bottom in late July (though the deep station samples appear to have been contaminated, thus artificially inflating concentrations of numerous parameters). Other recent mining projects in the region have been expected to conduct monthly sampling for a year at three vertical depths (surface, thermocline and bottom), which has been reduced to quarterly sampling should monthly variability be low. Quarterly sampling is a minimum sampling frequency. (Cont. on next cell below) | Additional sampling of Morrison lake was completed in 2010. PBM also commits to undertaking the indicated sampling prior to construction. Further during operations and post closure, prior to discharge in Year 45 when the open pit is full, PBM will undertake quarterly sampling for monitoring and reporting during operations and post closure. Further, as discharge is not planned until the open pit refills with water, over 40 years of baseline data will be available as input for the detailed design of the discharge pipeline and water treatment plant. | See below. | | | | | | |
| MOE-037 (2) | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | 7.4.3 Lake and Pond Sites | I | Although DO and temperature profile sampling was conducted once at each of the Morrison Lake sites, specific conductance and pH profiles would also be useful in characterizing baseline conditions. Predicting water quality in the lake based one set summer samples requires significant assumptions and leads to a very large uncertainty, which is not reflected in the water quality predictions for the lake. According to Appendix AB, PBM committed to collecting seasonal thermal profiles in the water column in the summer of 2010 near the proposed effluent diffuser location to add to the depth profiles for oxygen and temperature. I did not see a clear indication of what sites were reference sites for the lake sampling program – I am assuming Lake E is the single reference site. (G. Tamblyn, Application, inadequate information). Action: Although water quality variability among sites in Morrison Lake was low for many metals in 2008, seasonal sampling of water quality at the lake sites for a full suite of parameters is required to complete baseline sampling. (Cont. on next cell below) | See above. | Unresolved; further discussion required. Carry forward. | PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. Appendix I RRR Rev.2 documents overall data collection. | | | Condition #22 | | |
| MOE-038 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | 7.4.3 Lake and Pond Sites | I | Action continued: Currently, no understanding exists of the seasonal variability in the lake water quality. Some parameters varied significantly between the one-time 2006 and 2008 samples. Additionally, data for the deep station sites needs to be confirmed as it appears that samples for these sites were contaminated in 2008 – which is the only data available. (G. Tamblyn, Application and Permitting). | See above. | Unresolved; further discussion required. Carry forward. | PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. Appendix I RRR Rev.2 documents overall data collection. | | | Condition #22 | | |
| MOE-038a | MOE, Greg Tamblyn | 3-Dec-10 | Aquatic Biology and Fisheries | | | | Comment: In a high-valued lake such as Morrison Lake located immediately adjacent to the proposed mine, seasonal data at multiple depths is required to properly characterize the lake temporally and spatially and to predict possible effects. Lack of data for Morrison Lake remains a significant data gap that was not addressed in the Review Response Report. Action: Determine vertical profiles for physical water quality parameters and collect water quality data at multiple depths at the sites and sites in Morrison lake during winter. This combined with the other seasonal data, and a clearer understanding of the hydrogeology and groundwater quality, should provide the minimum data required to predict water qaulity in the lake and thus conduct an effects assessment. | | Unresolved; further discussion required. Carry forward. | PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. Appendix I RRR Rev.2 documents overall data collection. | | | Condition #22 | | |

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| MOE-039 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | 7.4.3 Lake and Pond Sites | I | Comment: NO baseline sampling was conducted for Nakinilerak Lake. This is a significant information gap in the application. (G. Tamblyn, Application). Action: Although the risks to this lake are much lower than to Morrison Lake, baseline water quality, sediment and fish tissue sampling is required prior to mine construction as a discharge from the tailings storage facility will enter this lake and unforeseen accidents or effects may occur (G. Tamblyn, Permitting) | PBM commits to collecting Nakinilerak Lake Baseline data prior to construction. In the Fall of 2010 PBM initiated a field work program to commence collection of data. | Unresolved. Sampling program is under discussion. Carry forward. | PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. Appendix I RRR Rev.2 documents overall data collection. PBM commits to collecting Nakinilerak Lake Baseline data prior to construction. In the Fall of 2010 PBM initiated a field work program to commence collection of data. | | PBM has collecgted baseline data from Nakinilerak Lake. | Nakinilerak Lake Baseline completed in Septemper 2011 | | |
| MOE-039a | MOE, Greg Tamblyn | 3-Dec-10 | Aquatic Biology and Fisheries | | | | Comment: MOE-EPD strongly advises that PBM submit all aquatic monitoring programs for review prior to conducting further sampling to help ensure that standards are followed and the program will meet the rigour required by regulatory reviewers. | | Information / clarification point. Discussions ongoing. | | | | | | |
| MOE-040 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | 7.8 Sediment Quality; EAC Vol IX, App 26, Section 2.1.3; Vol IX, App 27, Section 2.1.3 | I | Comment: It is unclear what size class of sediment was analyzed. Ministry of Environment requires sampling on the <63um fraction of sediment as it this particle size is ingestible by detritivores (G. Tamblyn, Application). | EAC Vol IX, App 26, Section 2.1.3 states that whole sediment samples were collected according to RIC (1998) standards and analyzed for moisture, nutrients, TOC and total metals, etc and compared to CCME and BC sediment quality guidelines. For future sediment sampling the <63 um fraction will be used for metals analysis | Unresolved. Carry forward; may result in a certificate commitment. | | | | For future sediment sampling the <63 um fraction will be used for metals analysis | | |
| MOE-041 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | 7.8 Sediment Quality; EAC Vol IX, App 26, Section 3.6.4 | I | Comment: Were duplicate samples independent samples or split samples from a homogenized mixture of field sub-samples? (G. Tamblyn, Application). | Lake sediment QA/QC procedures are stated in EAC Vol IX, App 26, Section 3.6.4 and EAC Vol IX, App 27, Section 3.6.4. PBM believes that the duplicates were independent samples. | Resolved. | | | | | | |
| MOE-042 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | 7.8 Sediment Quality | I | Comment: Were duplicate sample results used to calculate summary statistics? (G. Tamblyn, Application). | PBM will ensure an future duplicate samples for QA/QC are not used in future statistical analysis. | Response not satisfactory. Carry forward for further discussion. | Lake sediment QA/QC procedures are stated in EAC Vol IX, App 26, Section 3.6.4 and EAC Vol IX, App 27, Section 3.6.4. PBM believes that the duplicates were independent samples. | | | | | |
| MOE-043 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 7.8 Sediment Quality | I | Comment: Prior to the development of an Aquatic Effects Monitoring Program, the 2006 and 2008 data for Morrison could be tested statistically to determine if the data can be combined into a "baseline" data (i.e. 6 samples from each of 5 lake sites as opposed to 3 samples from each of five lake sites in 2006 and 2008). This larger sample size may allow better before/after comparisons. (G. Tamblyn, Permitting). | Prior to the development of an Aquatic Effects Monitoring program, for permitting and prior to construction, as part of the EMS, PBM commits to testing statistically to determine if the data can be combined as suggested. The 2010 data will also be inspected for that purpose. | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-044 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | 7.8.2 Lake and Pond Sites | I | Comment: Table 7.8-4 is based on average sediment concentrations – this should be noted in the table (G. Tamblyn, Application). | Acknowledged | Resolved. | | | | | | |
| MOE-045 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 7.9 Aquatic Resources | I | Comment: Interpretation of biological data is difficult without seeing habitat assessments (G. Tamblyn, Application). Action: Habitat data will be required to be collected and presented in Aquatic Effects Monitoring Programs, and the influence on the results will need to be discussed (G. Tamblyn, Permitting) | For permitting and prior to construction, as part of the EMS, PBM commits to collecting habitat data and presenting it in Aquatic Effect Monitoring Plan as stipulated. | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-046 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 7.9.3 Periphyton | I | 7.9.3 and Appendix 27 - 2.1.4.1 Comment: Periphyton results are questionable for the following reasons: A) aliquots for biomass (chl a) and ID were taken from the same sample – it is very difficult to properly homogenize periphyton sampling to allow a proper split sample. The samples should be taken separately. B) The methods are not well explained and leave many questions including how rocks were chosen, how areas to be scraped were delineated, and whether samples were composited. C) the number of replicates appears to be low – 2006/2007 could have been used to conduct a power analysis to determine the adequate sample size in 2008. D) There is no information related to habitat data for the various sites. If reference sites are not similar to exposure sites, variability between sites may be due to habitat differences. Furthermore, methods used in 2006/2007 and 2008 do not appear to be consistent (i.e. – use of razor in 2006/2007 and a toothbrush in 2008). The BC Field Sampling Manual does not seem to have been followed. (G. Tamblyn, Application). | See below | Response not satisfactory. Carry forward to tracking table 2. | Appendix I RRR Rev.2 documents overall data collection. For permitting and prior to construction, as part of the EMS, PBM commits to negotiating the periphyton sampling techniques and number of replicates prior to the initiation of an Aquatic Effects Monitoring Program. | | | Noted | | |
| MOE-047 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 7.9.3 Periphyton | I | Action: Periphyton sampling techniques and number of replicates will need to be negotiated prior to the initiation of an Aquatic Effects Monitoring Program. (G. Tamblyn, Permitting). | For permitting and prior to construction, as part of the EMS, PBM commits to negotiating the periphyton sampling techniques and number of replicates prior to the initiation of an Aquatic Effects Monitoring Program. | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-048 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 7.9.3 Periphyton | I | 7.9.3 and Appendices 26 s3.3.1 and 27 s3.3.1 Comment: There is significant interannual variability among periphyton samples – both for species found at sites, and for biomass. For example, the stream 1 site has 100% Chrysophytes in 2006 and 2007, but 98% in Cyanophytes in 2008. As stated in the report, Oscillatoria overwhelmingly dominates a number of sites in 2008. Are there thoughts to why this might be, aside from sampling in late August versus July as stated in the text - different weather (2006 – dry year), sampling after storm events, different samplers, presence of macrophytes etc ? As there is little interpretation of this data, or linking periphyton data to water quality, flow or physical habitat data, it is difficult to tell. These links may be important when interpreting future Aquatic Effects Monitoring Program Data. The concerns regarding periphyton sampling techniques aside, these results are an example of the value of collecting multiple years of baseline data to characterize variability (G. Tamblyn, Application). | For permitting and prior to construction, as part of the EMS, PBM commits to discussing variability of future sampling in order to improve interpretation of future Aquatic Effects Monitoring Program Data. | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-049 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 7.9.4 Benthic Invertebrates | I | Comment: Stream 9 has a lake not far upstream of the sampling site and the sediments are generally finer. It is arguable whether this is an appropriate reference stream. Selecting reference streams will require discussion with MOE during the development of an Aquatic Effects Monitoring Program (G. Tamblyn, Application and Permitting). | For permitting and prior to construction, as part of the EMS, PBM commits to discussion of selection of reference steams with MOE during the development of an Aquatic Effects Monitoring Program | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-050 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | 7.9.4 Benthic Invertebrates | I | Comment: Nice to see a comparison of 2008 to 2007/06 data (G. Tamblyn, Application). See additional comments under Appendix 27 below. | Acknowledged | No further response required. | | | | | | |

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| MOE-051 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 7.9.6 Phytoplankton | I | Comment: Biomass of phytoplankton decreases from northern sites to southern sites (as does the density of benthic invertebrates and zooplankton – though a weaker trend) Why might this be occurring? Biomass is also significantly higher in 2008 than 2006 – apart from potential differences in sampling dates, what environmental or chemical factors may have contributed to this difference? The number of taxa in Morrison Lake is important; combining all the lake / pond data together clouds any discussion or conclusions. (G. Tamblyn, Application). Action: A standardized sorting / counting technique will need to be determined for the Aquatic Effects Monitoring Program (G. Tamblyn, Permitting). | For permitting and prior to construction, as part of the EMS, PBM commits to adopting a standardized sorting /counting technique for the Aquatic Effects Monitoring Program. Neither the trends nor the influences can be positively determined without considerably more samples and statistical analysis. This level of analysis is normally beyond the scope of baseline studies. | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-052 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | 7.9.6 Phytoplankton | I | Comment: Given the dominance of 3 species in 2008 and the absence of one of these three in 2006, does this indicate anything about the current state of the lake aquatic ecosystem? (G. Tamblyn, Application) | No conclusions can be reached without considerably more samples and statistical analysis, specifically analysis of covariance (ANCOVA) between species and physical/ chemical data. This level of analysis is normally beyond the scope of baseline studies. As more data is collected PBM will make it available for statisitical analysis. | Response satisfactory for EA phase. Certificate commitment required. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-053 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | 7.9.7 Benthic Invertebrates | I | Comments: It is interesting that in 2008, Copepods made up a larger percentage moving northward in Morrison Lake, while molluscs showed the opposite trend. These trends were not seen in 2006. Ostracods made up a much lower percentage of the community in 2008 than 2006. (G. Tamblyn, Application). | As above. It has not been statistically determined that this is a trend. It may just be a sampling anomaly, or reflect patchiness in the benthic community; same for plankton. This level of analysis is normally beyond the scope of baseline studies. | See below. | | | | | | |
| MOE-053a | MOE, Greg Tamblyn | 3-Dec-10 | | | | | Comment: The proponent responses for the above three comments call into question the adequacy of the aquatic ecosystem baseline monitoring program. An objective of a baseline monitoring program in a BACI designed study should be collect sufficient information prior to project development to enable statistical comparisons with data collected once the mine is constructed and begins operation so that a biologically significant effect can be detected if one is present. Action: Propose additional baseline data collection to ensure that the variability in aquatic communities can be more thoroughly understood. | | Response not satisfactory. Carry forward. | Appendix I RRR Rev.2 documents overall data collection. For permitting and prior to construction, as part of the EMS, PBM commit to consulting with MoE to establish the periphyton sampling techniques and number of replicates prior to the initiation of an Aquatic Effects Monitoring Program. | | | Carry forward to Permitting | | |
| MOE-054 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | 7.10.5 Morrison Lake and Reference Site | I | Comment: Summary table 7.10-10 is good. However, it is unclear why other metals were not included. Raw data for metal levels in fish tissue is missing and could not be found in Appendix 28 (Fisheries Baseline Report) or Appendix AE. (G. Tamblyn, Application) | Appendix AE - a full list of the tissue metals tested for is presented in Appendix 4.3-2. Testing of Nakinilerak Lake fish tissues is ongoing for the October 2010 samples. | Resolved. | | | | | | |
| MOE-054a | MOE, Greg Tamblyn | 3-Dec-10 | Aquatic Biology and Fisheries | | | | Acknowledged - Appendix AE does include the raw data requested in MOE-054. | | Resolved. | | | | | | |
| MOE-055 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 7.12 Wetlands | I | Comment: No baseline data exists for the wetlands in the Stream 10 system. (G. Tamblyn, Application). Action: Prior to mine operation, baseline information (water quality and sediment data) will be required in the wetland closest to the proposed TSF in the Stream 10 watershed. (G. Tamblyn, Permitting). | For permitting, prior to mine operation, PBM commits to acquiring additional water quality and sediment data in the wetland closest to the proposed TSF in the Stream 10 watershed prior to mine operation. Note that additional data from Stream was already collected in 2010. | Response satisfactory for EA phase. Certificate commitment required. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-056 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 7.12.3 Results and Discussion | I | 7.12.3.4 Comment: Total cyanide exceeds the BC 30 day guideline for weak acid dissociable cyanide (WAD). As WAD cyanide was not measured and 5 samples were not collected over 30 days, it is uncertain whether the 30-day guideline was formally exceeded. (G. Tamblyn, Application) Action: In future water quality sampling in streams, wetlands and lakes, both weak acid dissociated and strong acid dissociated cyanide will need to be measured, and some samples should be taken in the bright sunlight - this will help determine if photolysis of iron-cyanide complexes has produced free cyanide at levels which may be unacceptable. (G. Tamblyn, Application). | PBM commits to ensuring indicated guidelines are adhered to for future sampling. | Response satisfactory for EA phase. Certificate commitment required. Details to be addressed prior to permitting. | | | | PBM will ensure indicated guidelines are adhered to for future sampling. | | |
| MOE-057 | MOE, Greg Tamblyn | 28-Sep-10 | Air Quality | 6.2 | 8.2.5 Potential Residual Effects | I I | 8.2.5/8.2.6 Comment: It is questionable that CO2 from the project will be consumed by carbon sinks as is stated because carbon levels are currently exceeding the capacity of natural sinks. The claimed short-term reversibility of impacts due to greenhouse gas emissions from this project is questionable unless PBM purchases carbon offsets. This is because release of carbon to the atmosphere at the beginning of the project will contribute to a positive feedback loop (i.e. marine ice melting, leading to loss of albedo, contributing to the increased absorption of heat to the ocean which accelerates the release of natural sources of greenhouse gases). In addition, ocean acidification due to the conversion of CO2 to carbonic acid is predicted to result in an irreversible loss of biodiversity and possible collapse of the oceanic food chain. The above scenario would also mean the duration of effects as summarized in Table 8.2.5 is far-future as opposed to short- and medium-term. Furthermore, the calculation of greenhouse gases does not appear to include gases produced by trucking ore to port. (G. Tamblyn, Application). | Much lower than average mine CO2 emissions resulting from low strip ratio, use of hydro power, bussing of personnel being efficient than numerous personal vehicles and compact mine site design (eg WRD and Plant very near pit) that endeavours to minimize haul distances. PBM is considering a number of initiatives that may reduce CO2 emissions: LNG as fuel for ore haul trucks and vehicle fuel on site; participation in BC bulk haul program to increase the tonnage per truck thus reducing the number of concentrate trucks and reducing emissions for concentrate haul to port by more than 20%. PBM commits to participating in BC Bulk haul program subject to finanical viability being verified and reduced emissions being achieved. PBM further commits to further investigating the use of LNG for both on site and concentrate haul trucks. | Further discussion required and may result in a certificate commitment. | Much lower than average mine CO2 emissions resulting from low strip ratio, use of hydro power, bussing of personnel being efficient than numerous personal vehicles and compact mine site design (eg WRD and Plant very near pit) that endeavours to minimize haul distances. PBM is considering a number of initiatives that may reduce CO2 emissions: LNG as fuel for ore haul trucks and vehicle fuel on site; participation in BC bulk haul program to increase the tonnage per truck thus reducing the number of concentrate trucks and reducing emissions for concentrate haul to port by more than 20%. PBM commits to participating in BC Bulk haul program subject to finanical viability being verified and reduced emissions being achieved. PBM further commits to further investigating the use of LNG for both on site and concentrate haul trucks. | | | Condition #27 | | |
| MOE-058 | MOE, Greg Tamblyn | 28-Sep-10 | Monitoring | 9.4 | 8.4 Surface Water Quality | I I | Comment: I strongly disagree with the statement "Sufficient baseline information is available to monitor for potential future effects to source water quality and there are no critical data gaps identified for this assessment." It is questionable whether sufficient baseline data has been collected for some waterways (e.g. streams 8, 9 (reference stream), 10, Morrison Lake, Nakinilerak Lake) in order to statistically or even subjectively determine biologically and environmentally significant changes in the receiving environment should the project be developed. (G. Tamblyn, Application) Action: Data gaps in baseline programs will need to be identified and filled prior to mine permitting and operation (G. Tamblyn, Permitting). | PBM collected additional data in 2009 and 2010 and commits to continuing to collect baseline data prior to construction PBM commits to preparing a consolidated Surface Water Quality database incorporating available data. Proper sampling, QA/QC and analytical procedures will be used. | Unresolved; further discussion required. Carry forward. | PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. Appendix I RRR Rev.2 documents overall data collection. PBM commits to continuing to collect baseline data prior to construction PBM commits to preparing a consolidated Surface Water Quality database incorporating available data. Proper sampling, QA/QC and analytical procedures will be used. | | | Condition #22 | | |
| MOE-058a | MOE, Greg Tamblyn | 3-Dec-10 | Monitoring | | | | Comment: Though sampling may still be underway, MOE-EPD has not had an opportunity to review the sampling programs and determine whether the information being collected will be adequate. Furthermore, the data collected in 2010 was not revealed or used in the Review Response Report. Action: Submit sampling programs for review. | | Unresolved; further discussion required. Carry forward. | PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. Appendix I RRR Rev.2 documents overall data collection. PBM commits to continuing to collect baseline data | | | Condition #22 | | |
| MOE-059 | MOE, Greg Tamblyn | 28-Sep-10 | Cumulative Effects | 8 | Table 5.2-4 | I | Comment: Cumulative effects for Babine Lake have not been included here, though are discussed subjectively in Appendix AB. (G. Tamblyn, Application). | Acknowledged. Morrison Creek and Lake are included within the water quality, aquatic resources, and fisheries assessments, but are NOT considered VECs based on their standalone value. Babine Lake has been included within the cumulative effects assessment. | Resolved. | | | | | | |

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| MOE-060 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 3.1.4.1 | I | Action: Prior to draining Booker Lake and Ore pond, PBM will need to discuss the need for an authorization with the Ministry of Environment (G. Tamblyn, Permitting). | PBM commits to discussing the need for authorization to draining Booker Lake and Ore Pond with MOE during permitting. | Response satisfactory for EA phase. Certificate commitment required. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-061 | MOE, Greg Tamblyn | 28-Sep-10 | Assessment of Project Effects, Mitigation Measures and Significance of Residual Project Effects | 6 | Chapter 8; Appendix AB | I I; Addendum | Comment: Several effects assessment tables need to be updated given the updated information in some of the addendum appendices including Appendix AB. (G. Tamblyn, Application) | The updated effects assessments are generally less significant. On this basis, and considering conservative inputs used in the EAC, the original tables present conservative assessment of effects. | Unresolved; further discussion required. Carry forward. | RRR Rev.2 provides effects assessment tables in Sections 10. Additionally updated effects assessments tables with a signficance rating are provided in Appendix IV RRR Rev.2. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-062 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | 8.4 ; 8.9 | I I | Table 8.4-3 Comment: Surface runoff and siltation: I am unsure as to why magnitude and probability of occurrence are low in this table and moderate in Table 8.9-2 – Aquatic resources. I happen to agree more with the aquatic resources assessment (G. Tamblyn, Application) | Per Table 8.4-3, during operations, for the mine site the magnitude and probability of surface runoff-generated siltation are both medium. After Closure, for the mine site, the magnitude and probability are negligible and low. | No further response required. | | | | | | |
| MOE-063 | MOE, Greg Tamblyn | 28-Sep-10 | Assessment of Project Effects, Mitigation Measures and Significance of Residual Project Effects | 6 | Chapter 8 | I I | Comment: It is worrisome that the effects assessment for key aspects of the mine – ML/ARD / Discharge of effluent – have low confidence in the predictions. This leads me to believe that precautionary measures need to be used with this project as the actual effects could be quite different than those predicted. I am assuming that the updated predictions completed in Appendix AB have the same low confidence (G. Tamblyn, Application). | Based on the current available information the confidence level in the predictions made for this effects assessment is high for most effects. The methodology defaulted a low confidence for some items and this is now addressed by additional work. Irrespective PBM believes the low confidence is balanced against conservative inputs. | No further response required. | | | | | | |
| MOE-063a | MOE, Greg Tamblyn | | Assessment of Project Effects, Mitigation Measures and Significance of Residual Project Effects | | | | Previously submitted reviewer comments have expressed concerns over various aspects of the project; water qaultiy predictions being one major aspect of those concerns. Further comments are provided throughout this table as well as the companion RRR response letter. Overall, the general evaluation of the project based on the informtion submitted and reviewed to date, is that signifanct adverse effects could occur over the long term as a result of the mining development. | | No further response required. | | | | | | |
| MOE-064 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Table 8.8.2 | I I | Table 8.8-2 Comment: As with water quality in MSC 7, 8 and 10, sediment quality may be degraded due to degraded groundwater quality sourced from the TSF seepage. This needs to be covered in this table. (G. Tamblyn, Application). | Per Section 8.8.4.3 "Discharge and Spill Contaminant Loading" the TSF seepage is considered in preparation of Table 8.8-2. The TSF groundwater loadings are not large enough to degrade the sediments measurably. | Unresolved; further discussion required. Carry forward. | Per Section 8.8.4.3 "Discharge and Spill Contaminant Loading" the TSF seepage is considered in preparation of Table 8.8-2. The TSF groundwater loadings are not large enough to degrade the sediments significantly. RRR Rev.2 Section 10.2 documents the effects of seepage on streams. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-065 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 6.6 | Chapter 8 | I I | Comment: The possibility of siltation (sediment quantity rather than quality issue) seems to be underestimated. For example, adding water from clean diversion channels will increase flows in Stream 6, possibly causing a new channel to be cut. This event does not appear to be captured in the effects assessment. (G. Tamblyn) | Clean water diversion channels will be designed and constructed to control erosion (gradients, liners and riprap). Additional flows from the clean water diversions are within the seasonal variability in flows within the receiving stream channels. | Resolved. | | | | | | |
| MOE-066 | MOE, Greg Tamblyn | 28-Sep-10 | Habitat Mitigation and Compensation Plan | 9.2 | 8.9.4 Identification and Description of Potential Effects | I I | Comment: Habitat loss due to reduced flow in Stream 7 is not mentioned as a potential effect, but is mentioned in the fisheries section.(G. Tamblyn, Application) | Acknowledged. The degree of dewatering & habitat loss will be considerably less than originally planned. Residual loss is addressed in the fish habitat compensation plan. | No further response required. | | | | | | |
| MOE-067 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | Table 8.9-2 | I I | Table 8.9-2 Comment: Some of this table needs to be updated given the predictions presented in Appendix AB. See comments above under 8.4.6 (G. Tamblyn, Application). | The updated effects assessments are generally less significant. On this basis, and considering conservative inputs used in the EAC, the original tables present conservative assessment of effects. | Unresolved; further discussion required. Carry forward. | RRR Rev.2 provides effects assessment tables in Section 10. Additionally updated effects assessments tables with a signficance rating are provided in Appendix IV RRR Rev.2. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-068 | MOE, Greg Tamblyn | 28-Sep-10 | Geology and ML-ARD | 6.3 | Chapter 8 | I I | Comment: It is worrisome that the effects assessment for key aspects of the mine – ML/ARD / Discharge of effluent – have low confidence in the predictions. This leads me to believe that precautionary measures need to be used with this project as the actual effects could be quite different than those predicted (G. Tamblyn, Application). | Based on the current available information the confidence level in the predictions made for this effects assessment is high for most effects. The methodology defaulted a low confidence for some items and this is now addressed by additional work. PBM reocgnizes that ML/ARD prediction is not an exact science and, therefore, conservative water quality parameters have been used to compensate for any uncertainty. | Unresolved; further discussion required. Carry forward. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. Section 8 of the RRR Rev.2 updates the geochemistry predictions and geochemistry controls that will be used to ensure a higher confidence level in the predictions. RRR Rev.2 provides effects assessment tables in Sections 10. Additionally updated effects assessments tables with a signficance rating are provided in Appendix IV RRR Rev.2. | | | Noted | | |
| MOE-069 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | 8.10.4 Identification and Description of Potential Effects; 2.1 "TSF Impoundment Water Quality" | I I; RRR | Table 8.10-11 Comment: While this fish effects assessment is much more comprehensive than the other assessments, the effects of the TSF seepage on fish, particularly in streams 7 and 8, does not seem to have been considered. Fish in relation to the revised TSF seepage predictions in Appendix AB also do not seem to be included (G. Tamblyn, Application). | TSF seepage effects have been revised along with a revised estimate of potential tailings pore water chemistry in the RRR. The efffects are are assessed as not being significant. Nonetheless, site specific water quality objectives will be required that are protective of the receiving environments in the streams. PBM commits to developing proposed water quality objectives during the permitting stage. | Response satisfactory for EA phase. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-070 | MOE, Greg Tamblyn | 28-Sep-10 | Cumulative Effects | 8 | 11.1.2 Methodology Overview | I I I | Comment: The temporal boundary seems short. The time frame of 10 years after the end of project life does not include the point at which ARD and water treatment is expected. The timeline could be hundreds of years. (G. Tamblyn, Application). | Aknowledged. However the temporal boundary addresses the time period when the site is subjected to the most significant physical alteration. | Unresolved. Requires further discussion. Carry forward. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. Section 8 of the RRR Rev.2 updates the geochemistry predictions and geochemistry controls that will be used to ensure a higher confidence level in the predictions. The temporal boundary is quantified for effects of loads on Morrison lake in Section 10.2.4.3 of RRR Rev.2. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-071 | MOE, Greg Tamblyn | 28-Sep-10 | Cumulative Effects | 8 | 11.4.6 Interactions with Other Developments and Activities | I I I | Table 11.4-2 Comment: Using the numbers for mean annual flow and probable concentration, the mean annual loadings appear to be underestimated. For example, rather than a contribution of 0.8kg/year of copper from Bell Mine, the annual loading should be 4.3 kg.(G. Tamblyn, Application). | Acknowledged | Requires further discussion. | Acknowledged | | | Noted | | |
| MOE-072 | MOE, Greg Tamblyn | 28-Sep-10 | Cumulative Effects | 8 | 11.7.7 Predicted Residual Cumulative Effects | I I I | Table 11.7-2 Comment: Frequency for discharge should be continuous due to both seepage and the proposed discharge of treated effluent. The analogous table for water quality shows continuous for frequency for discharge. (G. Tamblyn, Application). | Acknowledge the error in Table 11.7-2 however the text in this section correctly references the discharge as continuous once it starts. | Requires further discussion. | Acknowledge the error in Table 11.7-2 however the text in this section correctly references the discharge as continuous once it starts. | | | Noted | | |

| Issue No. | Commenter & Agency | Date | Issue Theme | Section in TOR | EAC Chapter or Supporting Document | EAC Volume | Additional information or clarification required in Application | Proponent Response | Status of Issue as of 01-24-2011 | Additional Proponent Response | Additional Working Group Comments | Additional Proponent Response | Final PBM Response | Key Project Component Number | Status of Issues as of May 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MOE-073 | MOE, Greg Tamblyn | 28-Sep-10 | Cumulative Effects | 8 | 11.8.7 Predicted Residual Cumulative Effects | I I I | Comment: It could be argued that sublethal effects (due to contaminant loading) have a continuous frequency as seepage and discharge from the mine will be continuous in nature once the mine starts to operate and treat its effluent after closure. (G. Tamblyn, Application). | Lethal effects on lake trout, rainbow trout, and pacific salmon VECs were assessed as continuous in frequency because they are regularly harvested for consumption on an annual basis. Lethal effects on Dolly Varden and other fish species VECs were assessed as sporadic in frequency because they are not generally harvested. All fish species VECs for sublethal effects and fish habitat VEC effects were assessed as sporadic in frequency because these events are not planned and do not occur on any interval pattern. | Unresolved; further discussion required. Carry forward. | Lethal effects on lake trout, rainbow trout, and pacific salmon VECs were assessed as continuous in frequency because they are regularly harvested for consumption on an annual basis. Lethal effects on Dolly Varden and other fish species VECs were assessed as sporadic in frequency because they are not generally harvested. All fish species VECs for sublethal effects and fish habitat VEC effects were assessed as sporadic in frequency because these events are not planned and do not occur on any interval pattern. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-074 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 13.3.6 Activities to Avoid, Control, and Mitigate | I I I | Comment: Will extra pumps be kept on site in case of an unexpected pump failure (G. Tamblyn, Application). Comment: Can the thickness of the tailings pipe be determined so that steps can be taken to avoid a pipe failure? (G. Tamblyn, Application). | An extra pump is to be kept on site. The tailings pipeline will has been sized and wall thickness determined however this will be confirmed in detailed design. Note that the tailings pipeline will be installed in a ditch that will drain to a suitably sized settling pond that will capture any tailings in the event of pipe failure. | Resolved. | | | | | | |
| MOE-075 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 13.4.6 Activities to Avoid, Control, and Mitigate | I I I | Comment: Transmission line: minimize cutting of riparian zones. It is unclear if a road will be built under the transmission line to access the line for maintenance. Action: If so, install culverts or create hardened fords to minimize impacts – particularly on fish streams or in areas of fine sediments.(G. Tamblyn, Application and Construction). | A continuous road will not be built the entire length of the transmission line. Rather the transmission line right of way will be accessed via forest service roads roads that provide access between streams. As scuh, no stream crossings are planned for a road along the transmission right of way. | Resolved. | | | | | | |
| MOE-076 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 13.4.9 Reporting | I I I | Action: Reporting will also need to indicate any mitigative actions required to address any water quality issues. (G. Tamblyn, Application). | Acknowledged. For permitting and prior to construction PBM commits updating the Environmental Management System and providing it to the MOE. | Response satisfactory. Certificate commitment required. | | | | Carry forward to Permitting | | |
| MOE-077 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 13.4.10 Responsibilities | I I I | Action: PBM has committed to having an environmental monitor on site during construction. This monitor should be an independent 3rd party with the power to stop the construction activity if deemed necessary to protect water quality or aquatic habitat. (G. Tamblyn, Application) | PBM commits to using an independent 3rd party environmental monitor during construction. | Response satisfactory. Certificate commitment required. | | | | Condition #28 | | |
| MOE-078 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 13.5.8 Key Performance Indicators | I I I | Comment / Action: Fish tissue sampling will be also required in a reference lake (i.e. Tochcha Lake).(G. Tamblyn, Permitting) | PBM commits to fish tisuse sampling in a reference lake for permitting. | Response satisfactory. Certificate commitment required. | | | | Condition #24 | | |
| MOE-079 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 13.7 Erosion and Sediment Control Management Plan | I I I | Action: A detailed sediment and erosion control plan will need to be submitted prior to construction (G. Tamblyn, Permitting) | The EAC Application includes an environmental management plan that inlcudes measures to manage erosion and sediment control. For permitting and prior to construction, as part of the EMS, PBM commits to provide MEMPR a detailed plan for erosion and sediment control to provide guidance and direction for operational management. Best management practices will be used to minimize both erosion and siltation. | Resolved. | | | | | | |
| MOE-079a | MOE, Greg Tamblyn | 3-Dec-10 | | | | | Action: Submit a copy of the detailed plan for erosion and sediment control to MOE-EPD when it is developed as this will inform the MoE authorization for construction purposes. | | Certificate commitment required. Details to be addressed prior to permitting. | | | | Carry forward to Permitting | | |
| MOE-080 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | 13.7.5 Activities to Avoid, Control, and Mitigate | I I I | Comment: The report mentions sediment traps and velocity baffles will be used to minimize erosion in clean water diversion ditches.(G. Tamblyn, Application). Action: List the other design features of the ditches that will be used to minimize erosion – e.g. gradients, riprap, etc. G. Tamblyn, Application) | Gradients, riprap and other features to minimize erosiion are definitely part of the design. Best management practices will be used to minimize both erosion and siltation. | Resolved. | | | | | | |
| MOE-081 | MOE, Greg Tamblyn | 28-Sep-10 | Monitoring | 9.4 | 13.7.7 Key Performance Indicators | I I I | Action: Consider adding turbidity levels / total suspended sediment levels in key streams as KPIs. (G. Tamblyn, Permitting) | PBM commits to adding turbidity levels / total suspended sediment levels in key streams as KPIs. | Resolved - details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-082 | MOE, Greg Tamblyn | 28-Sep-10 | Monitoring | 9.4 | 14.6.2 Scope and Objectives | I I I | Comment: The Ministry of Environment will require monitoring of fish tissue for a suite of metals, not just mercury, as part of the AEMP (G. Tamblyn, Permitting). | PBM commits to monitoring of fish tissue for a suite of metals, not just mercury, as part of the Aquatic Effect Monitoring Program | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-083 | MOE, Greg Tamblyn | 28-Sep-10 | Monitoring | 9.4 | 14.6.3 Monitoring Activities | I I I | Comment: The Ministry of Environment will require water quality sampling much more frequently than is proposed in Table 14.6-1 and may require sampling of other ecological assemblages in addition to benthic invertebrates (e.g. periphyton, plankton etc). For lake sites, water quality sampling will vary from monthly to quarterly and will begin prior to construction to build the baseline data set that currently contains significant gaps. Stream sites will be monitored monthly to quarterly depending on the existing baseline dataset. The monitoring program may also contain "triggers" which will initiate more detailed sampling. If an adequate baseline data set exists currently, power analyses can be conducted for key parameters to determine appropriate sample sizes. (G. Tamblyn, Permitting). Action: A draft Aquatic Effects Monitoring Program must be submitted to the Ministry of Environment for review and the program will be finalized prior to construction of the mine and prior to the issuance of any Environmental Management Act permits. (G. Tamblyn, Permitting). | PBM has submitted an Aquatic Effects Monitoring Plan in Volume III Chapter 14.6. PBM commits to updating this plan to meet permitting requirements. | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-084 | MOE, Greg Tamblyn | 28-Sep-10 | Monitoring | 9.4 | 14.6.3 Monitoring Activities | I I I | Comment: Ministry of Environment (MOE) is requesting that only the <63um subfraction of sediment be sampled – partly to standardize tests and partly to look at concentrations of contaminants in the most biologically available fraction of the sediment. (G. Tamblyn, Permitting). Comment: The appropriateness of existing benthic invertebrate reference sites (Stream 1 and 9) will need to be evaluated. MOE has concerns that the habitat of reference sites differs significantly from most the exposure sites, which could cloud interpretation of results in the AEMP (G. Tamblyn, Permitting). Comment: MOE would like to discuss the sampling design of the benthic invertebrate program (RCA vs BACI) prior to the development of the AEMP (G. Tamblyn, Permitting). | For future sampling PBM will specify the <63 um fraction for metals analysis and will commit to discussing the benthic reference site(s) with MOE and the study design regarding reference/control and before/after//control/impact stations and timing. | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-085 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | Appendix 23 – Water Quality and Water Balance Model | V I I I | Some or many of the following comments may not be relevant given the updated water quality modeling presented in Appendix AB. | Acknowledged | No further response required. | | | | | | |
| MOE-086 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | Appendix 23 – Water Quality and Water Balance Model | V I I I; RRR | 7.2 Comment: pH values shown in this section range from 7 to 8.5. It is unclear why the pHs are different. The predicted pH of 7 in Table 7.2-2 matches the assigned pH loading as shown in Table 7.2-1, but is much lower than the values (8-8.5) shown as inputs in Table 7.1-3 | Not relevant given the updated water quality modeling presented in RRR. | No further response required. | | | | | | |
| MOE-087 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | Appendix 23 – Water Quality and Water Balance Model | V I I I; RRR | Figure 7.2-4 / Figure 9.2-4 Comment: I am unsure where the BC MOE guideline of 890 mg/L for Nitrate as shown in this figure came from. The old guideline was 200 mg/L. The new guideline (updated Sept. 2009 – updated after this Application was written) is 31.3 mg/L (maximum) and the guideline for average concentrations is now 3.0 mg/L. (G. Tamblyn, Application). | Acknowledged. The guideline of 3.0 mg/L is used in Appendix AB and the updated water quality modeling presented in RRR. | No further response required. | | | | | | |
| MOE-088 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | Appendix 23 – Water Quality and Water Balance Model | V I I I; RRR | Figure 7.2-5 Comment: The guideline for ammonia is dependent on pH and temperature. At a pH of 8.2 (Table 7.1-3) and temperature of 6 degrees C, the guideline is 3.86. The guideline value shown on this graph is for a lower pH than is predicted for the TSF supernatant. However, in this case, it is not terribly important due to the low concentrations of ammonia. (G. Tamblyn, Application). | Acknowledged. The guideline of 1.85 mg/L is used in Appendix AB and the updated water quality modeling presented in RRR. | No further response required. | | | | | | |
| MOE-089 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | Appendix 23 – Water Quality and Water Balance Model | V I I I | Table 7.2-2. Comment: It may be more appropriate to compare modeled concentrations to the BC guidelines for chronic exposure (averages) as opposed to maximums as the calculated values appear to be averages and that water quality will be present in the stream for months. (G. Tamblyn, Application). | Acknowledged | No further response required. | | | | | | |

| Issue No. | Commenter & Agency | Date | Issue Theme | Section in TOR | EAC Chapter or Supporting Document | EAC Volume | Additional information or clarification required in Application | Proponent Response | Status of Issue as of 01-24-2011 | Additional Proponent Response | Additional Working Group Comments | Additional Proponent Response | Final PBM Response | Key Project Component Number | Status of Issues as of May 2012 |
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| MOE-090 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | Appendix 23 – Water Quality and Water Balance Model | V I I I; RRR | Comment: There is a new max. dissolved iron guideline = 350 ug/L; the aquatic life guideline for total Lithium is 0.870 mg/L , Total Titanium = 2; the guideline for ammonia as shown (0.681 mg/L) is not related to the predicted pH of 7 in this table. While these values don't make a difference to any conclusions, these errors should be fixed in future reports (G. Tamblyn, Application). | Acknowledged. The current guidelines are used in the updated water quality modeling in the RRR. | No further response required. | | | | | | |
| MOE-091 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | Appendix 23 – Water Quality and Water Balance Model | V I I I; RRR | Table 9.1-3 Comment: This table is missing (G. Tamblyn, Application). | Acknowledged. Waste Rock and Pit Wall Quality Table 9.1-1 and 9.1-2 on pages 9-2 and and 9-3. Table 9.1-2 on page 9-3 should be labeled continuation of Table 9.1-1. On Pg 9-5 reference to Table 9.1-3 should be to Table 9.1-2 on Page 9-5. A table of pit wall runoff quality and loadings is provided in the updated water quality modeling in the RRR. | Resolved. | | | | | | |
| MOE-092 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | Appendix 23 – Water Quality and Water Balance Model | V I I I | 11.1 Comment: Water quality data from stream 7 was required to model the effects of TSF seepage on water quality in stream 10. The baseline program should have been designed to collect adequate data for stream 10 to conduct this prediction. As it stands, the use of other stream data adds additional uncertainty to the prediction. (G. Tamblyn, Application) | Additional data has been collected in 2010. PBM commits that additional data from Stream 10 will be collected when flows are observed, prior to construction. | Unresolved; further discussion required. Carry forward. | Appendix I RRR Rev.2 documents overall data collection. Note that PBM collected additional data in 2009, 2010 and 2011. PBM also commits to continuing to collect baseline data for Stream 10 during 2011 per the Nakinilerak Baseline Plan as submitted. | | PBM has collecgted baseline data from Nakinilerak Lake and Stream 10 in September 2011. | | | |
| MOE-093 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 26 – Aquatics Baseline Report, 2006/2007 | I X | Comment: Many comments for Appendix 27 (below) apply also to this appendix. | See below | No further response required. | | | | | | |
| MOE-094 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 26 – Aquatics Baseline Report, 2006/2007 | I X | Figure 3.3-4: Comment: Diversity and evenness are highly correlated in this figure – likely because evenness is integrated into the diversity index and species richness and evenness are themselves highly correlated with standard counting practices used for periphyton (Stevenson and Smol, 2003) and benthic invertebrates. (G. Tamblyn, Application). | Acknowledged | No further response required. | | | | | | |
| MOE-095 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 26 – Aquatics Baseline Report, 2006/2007 | I X; RRR | Figure 3.4-10. Comment: The text below the figures incorrectly states that no BC aquatic life guidelines exist for ammonia. In subsequent work in this application, the guideline for ammonia is used (G. Tamblyn, Application). | Acknowledged. The current guidelines are used in the updated water quality modeling in the RRR. | Resolved. | | | | | | |
| MOE-096 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | Comment: Water and sediment quality values below detection limit were replaced with values equivalent to ½ the detection limit in order to calculate summary statistics. Action: The proponent needs to explain the biases this leads to in the results (G. Tamblyn, Application). | The bias should be less than if the values were either ommitted, or treated as zero. By using 0.5 times the detection limit, the estimate may be too high or too low, but the variance (between estimate and true value) will generally be less than would otherwise be the case. | Resolved. | | | | | | |
| MOE-097 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X; RRR | Table 2.1-2: Comment: The following water quality parameters have detection limits <5X the water quality guidelines including total phosphorus, total cyanide, cadmium, copper, mercury and silver. Table 2.1-3: Detection limits for arsenic, cadmium, nickel, selenium and silver are either equivalent, very close or <5X the guideline values. Discussion of results for these parameters should reflect detection limits and limits of quantitation. (G. Tamblyn, Application). | PBM has included discussion of results for the indicated parameters to reflect detection limits and limits of quantitation in the RRR. | Resolved. | | | | | | |
| MOE-098 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | In addition, inadequate baseline data exists for stream 10 and upper stream 7, and stream 8. In Appendix AB, data from Stream 7 has been used in predictions for water quality in streams 8 and 10. (G. Tamblyn, Application). | PBM collected additional data in 2009 and 2010 and commits to continuing to collect baseline data prior to construction PBM commits to preparing a consolidated Surface Water Quality database incorporating available data. Proper sampling, QA/QC and analytical procedures will be used. | Response not satisfactory. Requires further discussion and may result in a certificate commitment. | Appendix I RRR Rev.2 documents overall data collection. Note that PBM collected additional data in 2009, 2010 and 2011. The updated effects on the receiving stream uses all data collected up to January 2011 and is presented in Table 10.7, 10.8 and 10.9 for streams, 7, 8 and 10, respectively. PBM also commits to continuing to collect baseline data for Streams 7 & 8 as well as Stream 10 during 2011 per the Nakinilerak Baseline Plan as previously submitted. | | Additional baseline was collected in 2011. | | | |
| MOE-098a | MOE, Greg Tamblyn | 3-Dec-10 | Aquatic Biology and Fisheries | | | | Commetn: No new data was seen in the Review Response Report and it does not appear that any new data was used in the updated water quality predictions for streams 8 and 10. Action: If available, use water quality information from streams 8 and 10 as the basis from which to predict water quality for these streams. | | Response not satisfactory. Requires further discussion and may result in a certificate commitment. | Appendix I RRR Rev.2 documents overall data collection. Note that PBM collected additional data in 2009, 2010 and 2011. The updated effects on the recieving stream uses all data collected up to January 2011 and is presented in Table 10.7, 10.8 and 10.9 for streams, 7, 8 and 10, respectively. PBM also commits to continuing to collect baseline data for Streams 7 & 8 as well as Stream 10 during 2011 per the Nakinilerak Baseline Plan as previously submitted. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-099 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 2.1.2.2 and 2.2.7. Comment: QA/QC includes many more things than blanks and replicates - see the BC Field Sampling Manual (WLAP 2003).(G. Tamblyn Application) | Acknowledged | No further response required. | | | | | | |
| MOE-100 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 2.1.4.2 Benthic Invertebrates: Comment: Collecting 5 replicates, each consisting of 3 pooled grab samples (i.e. 3 field sub-samples), is a relatively common practice with Hess samples during the first year of a study in the absence of a pilot study. Was the data from 2007 used to conduct a power analysis to determine appropriate replicate sample size and was a "power regression equation" used to determine the appropriate number of field sub-samples (Env. Can. 2002)(G. Tamblyn, Application). | PBM cannot confirm that a power analyses or regression equation was used. The sampling for the baseline inventory was a relatively limited program to establish main species and approximate numbers. In preparation for and completion of EEM studies, PBM will commission benthic sampling programs to meet DFO/MOE requirements. | No further response required. | | | | | | |
| MOE-101 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | Comment/Action: The calculation of additional metrics to those calculated will need to be negotiated prior to the development of an Aquatic Effects Monitoring Program, including consideration of those metrics deemed to be most effective indicators of stream condition (i.e. monotonic responses across a gradient of impact) in the Morice and Lakes timber supply areas including: # Ephemoptera and Plecoptera taxa, # Intolerant Taxa, # Clinger taxa, total taxa richness, Relative Abundance of Predators, Relative Abundance of Dipterans, Relative Abundance of non-insects, and Relative Abundance of Sediment Intolerant individuals.(Croft, 2004).(G. Tamblyn, Permitting). | The metrics of interest are readily determined from the data sets and background information provided by taxonomic laboratories. PBM commits to negotiating additional metrics with MOE for the development of Aquatic Effects Monitoring Program for permitting. | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-102 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | Comment: Description of sorting protocols would have been valuable to ensure future taxonomic sorting is consistent.(G. Tamblyn, Application) | Sorting protocols for the laboratory used in the EAC studies will be obtained as possible. Future taxonomic sorting techniques will be fully described in monitoring reports. Addendum, Appendix AE, Section 2, Methods includes a description of sorting protocol. | Response not satisfactory. Requires further discussion. | | | | PBM will consult with MoE to establish appropriate sorting protocols for future sampling. | | |
| MOE-103 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 2.5.2.2 and 2.2.5.3 / Appendix AB Comment: It is not clear how many replicates were taken at each site for both benthic inverts and zooplankton. It also does not appear that results from 2006 were used to determine appropriate number of replicates for the 2008 sampling (G. Tamblyn, Application). | 2.2.7 Quality Assurance and Quality Control Triplicate samples for phytoplankton were collected at each lake station, and three replicates (composites) were taken for sediment, zooplankton and benthos sampling. Additionally, at 10% of the sites, one sediment sample was split for QA/QC purposes to ensure that sample homogenization was thorough. | Resolved. | | | | | | |
| MOE-104 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X; RRR | 3.1.1 Comment: What hardness values are used to determine hardness related guidelines and how were these selected? Hardnesses used to calculate guidelines are more clearly defined in Appendix AB. (G. Tamblyn, Application) | Receiving environment hardnesses are used to calculate guidelines. The hardnesses used to calculate guidelines are documented in the RRR. | Resolved. | | | | | | |
| MOE-105 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | Comment: The text indicates that "No Guidelines Exist for TSS" (p 3-1). Total Suspended Solids does have guidelines for aquatic life. They are based on induced suspended sediment loads and are related to baseline or reference conditions. | Acknowledged. | No further response required. | | | | | | |

| Issue No. | Commenter & Agency | Date | Issue Theme | Section in TOR | EAC Chapter or Supporting Document | EAC Volume | Additional information or clarification required in Application | Proponent Response | Status of Issue as of 01-24-2011 | Additional Proponent Response | Additional Working Group Comments | Additional Proponent Response | Final PBM Response | Key Project Component Number | Status of Issues as of May 2012 |
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| MOE-106 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | Table 3.1-1 Comment: This table is helpful in providing a snapshot of parameters that exceed guidelines. (G. Tamblyn, Application). | Acknowledged | No further response required. | | | | | | |
| MOE-107 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 3.2 Comment: This section incorporates data from past years more effectively than the water quality section.(G. Tamblyn, Application). | Acknowledged | No further response required. | | | | | | |
| MOE-108 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | Comment: The validity of stream 9 as a reference stream (for sediments and benthic invertebrates) is questionable due to the difference in sediment size compared with many of the receiving environment streams and the lake headed nature of this system. The results might be more comparable – at least for sediment – if sediment analysis were standardized to <63um, which is what MOE is requesting with new baseline programs. (G. Tamblyn, Application). | There are sections within Stream 9 with similar sediment characteristics to Stream 7 and both have large ponds in their headwaters, as does Stream 6 and (existing) Stream 5. However, if Stream 9 does prove unsuitable with further inspection, another more suitable stream will be found as a reference/ control system. For future sampling PBM will specify the <63 um fraction for sediment analysis. | Unresolved; further discussion required. Carry forward. | | | | For future sampling PBM will specify the <63 um fraction for sediment analysis. | | |
| MOE-109 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 3.2.2 Comment: As with water quality samples, averages calculated using values below detection limit need to be identified and the assumptions and biases discussed (G. Tamblyn, Application). | Acknowledged. Assumptions and biases will be discussed in future baseline reports. | No further response required. | | | | | | |
| MOE-110 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 3.3.2 Comment: Interestingly, benthic invertebrate community compositions are similar between 2007 and 2008 despite the apparent dramatic differences in periphyton communities (G. Tamblyn, Application) | Benthic communities are more sedentary and less migratory than plankton, such that spatial and temporal differences in species distribution or density occur more frequently in the plankton community. | No further response required. | | | | | | |
| MOE-112 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 3.4 Comment: The graphs in this section, complete with detection limits and guidelines assist greatly in the interpretation of the data.(G. Tamblyn, Application). | Acknowledged | No further response required. | | | | | | |
| MOE-113 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 3.4.1 Comment: Text in this section and the note at the bottom of Figure 3.4-3 indicates there is no BCWQ guideline for total phosphorus. This is incorrect. The aquatic life guideline for lakes in which salmonids are the predominant fish species is 5 to 15 ug/L at spring overturn or the mean epiliminetic growing season. See Table 3 of the BC Approved Water Quality Guidelines (MOE 2006). All Morrison Lake samples in 2006 and 2008 exceed 5 ug/L (G. Tamblyn) | Neither Section 3.4.1 and Figure 3.4-3 refer to phosphorous. PBM acknowledges that aquatic life guidelines for lakes in which salmonids are the predominant fish species is 5 to 15 ug/L at spring overturn or the mean epiliminetic growing season. | No further response required. | | | | | | |
| MOE-114 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X; RRR | Comment: Figure 3.4-5 The nitrate BCWQG for aquatic life has been revised recently and is now 3.0 mg/L (30-day average) and 31.3 mg/L (maximum).The lake samples are well below these values. | Acknowledged. The guideline of 3.0 mg/L is used in Appendix AB and the updated water quality modeling presented in RRR. | Resolved. | | | | | | |
| MOE-115 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | Comment: Total cyanide exceeds the BC 30-day average guideline for weak acid dissociable cyanide (WAD). As WAD cyanide was not measured, it is uncertain whether the 30-day guideline was exceeded at any point in time. Also, care must be taken in comparing single samples with 30-day average guidelines. Action: For future water quality sampling programs in streams, wetlands and lakes, both weak acid dissociated and strong acid dissociated cyanide will need to be measured, and some samples should be taken in the bright sunlight - this will help determine if photolysis of iron-cyanide complexes has produced free cyanide at levels which may be unacceptable. | PBM commits to future water quality sampling as stipulated where cyanide analysis is required. | No further response required. | | | | | | |
| MOE-116 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 3.4.2 – Comment: The report states that Cd (0.000031 mg/L) does not exceed the B.C. water quality guideline for aquatic life at Morrison A. In fact, it does. At a hardness of 30mg/L, the guideline is actually 0.000012 mg/L, which is lower than the mdl of 0.00002. All sites may in fact exceed the guideline, but we can't tell because of the detection limit (G. Tamblyn, Application). | Acknowledged | No further response required. | | | | | | |
| MOE-117 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | Comment: The guideline for dissolved iron is 350ug/L. (G. Tamblyn, Application) | Acknowledged | No further response required. | | | | | | |
| MOE-118 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 3.4.3 Comment: Good work collecting a blank from the Go-Flo apparatus. As pointed out, this blank shows contamination. It is interesting that most of the deep stations had higher metal values and that the Go-Flo did not get rinsed sufficiently while sampling to decontaminate it. Given this, the results of the deep stations should be disregarded, or at least interpreted with caution. Additionally, because of this contamination, samples should have been taken the following year. Better yet, as mentioned in 7.4 above, lake samples should have been taken at least seasonally, if not monthly. In addition, it is apparent that the Go-Flo needs to be decontaminated prior to starting a round of sampling as part of the QA/QC program – see comment above in this section. In addition, the Go-Flo should have been mentioned as a sampling tool in the methods section. (G. Tamblyn, Application). | Acknowledged. These comments will be considered in future sampling. | No further response required. | | | | | | |
| MOE-119 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | Comment: A number of metals were highest at Morrison E – deep – more so than the other deep sites. Was this site sampled first and hence may have the highest level of contamination? (G. Tamblyn, Application). | Samples were taken at the five sites again in 2010 and comparisons will be made. | Unresolved; further discussion required. Carry forward. | Appendix I RRR Rev.2 documents overall data collection. PBM collected additional data in 2009, 2010 and 2011. Basic statistical interpretations of Morrison Lake water chemistry were prepared. Data gathered through January 2011 was used in preparing RRR Rev.2. | | | Noted | | |
| MOE-120 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 3.6 Comment: The standard error bars on the graphs assist with the interpretation of the data. | Acknowledged | No further response required. | | | | | | |
| MOE-121 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 3.6.2 Comment: 1) Inconsistencies exist between appendices regarding cyanide concentrations. The ranges reported for cyanide concentrations in 2006 sediment samples is reported as 1.9-5.5 mg/kg in Appendix 27 vs. 2.4 to 7.3 mg/kg in Appendix 26. 2) According to Figure3.6.3 in Appendix 26, the reported values are mean values, not individual values. This is not made clear. 3) Furthermore, care should be taken when calculating means with values below detection limit – both reported mean values of 1.9 (App. 26) and 2.4 mg/kg (App. 27) are below detection limit, so in reality, the only thing that can be said (with this small sample size and without special statistical software), is that the lower limits are below detection limits. (G. Tamblyn, Application). | Acknowledged | No further response required. | | | | | | |
| MOE-122 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | 3.7.1.2. Comment: It is not clear how densities were calculated given that so many values shown in Appendix 3.7.1 are "<" some number. | Acknowledged | No further response required. | | | | | | |
| MOE-123 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | Comment: The difference in genus richness between years was attributed solely to counting taxa differently. However, even if the taxa observed during the initial screening of samples are removed from the genus richess count, there are still significantly more genera in 2008 vs. 2006 (i.e. LakeE mean of 22 genera vs. 8 in 2006).(G. Tamblyn, Application) | Acknowledged | No further response required. | | | | | | |
| MOE-124 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | Appendix 27 – Aquatics Baseline Report, 2008 | I X | Appendix 3.1-4. Comment: relative percent difference values look good, though the duplicates for Stream 1 on Aug 17, 2008 show high relative percent differences for 6 parameters which is unusual. (G. Tamblyn, Application). | Acknowledged | No further response required. | | | | | | |
| MOE-125 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 5.6 | Appendix 22; App J. 2005 McElhanney Baseline Water Quality | Addendum | Comment: Some streams have several years of information. The report contains no map and there is no cross-referencing of this information to the main Application, making the information contained in this Appendix difficult to interpret. The pre-2004 results in this Appendix have not been captured in the main Application. However, given the limited sampling conducted pre-2004 and issues with high detection limits and QA/QC, the value of this information is limited anyway (G. Tamblyn, Application). | The 2005 report preceeded and was a source for the EAC Application so does not contain cross-referencing to the EAC Application. Within the EAC Application, particularly Appendix 22, this data is referenced and maps are provided. | No further response required. | | | | | | |
| MOE-126 | MOE, Greg Tamblyn | 28-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | App AA. Conceptual Design for a High Density Sludge Water Treatment Plant (SGS 2010) | Addendum; RRR | Comment: What hardness was used to calculate the guidelines? (G. Tamblyn, Application) | Receiving environment hardnesses are used to calculate guidelines. The hardnesses used to calculate guidelines are documented in the RRR. | Resolved. | | | | | | |

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| MOE-127 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | Comment: Much of the water quality modeling was redone in this appendix. However, the effects assessment summary tables originally found in Chapter 8 of the assessment were not updated. (G. Tamblyn, Application). | The updated effects assessments are generally less significant. On this basis, and considering conservative inputs used in the EAC, the original tables present conservative assessment of effects. | Response not satisfactory. Effects assessment must be updated. | The revised effects assessment are presented in Section 10 of RRR Rev.2. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-128 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | Table 1.1 Comment: Thanks – this is helpful (G. Tamblyn, Application). | Acknowledged | No further response required. | | | | | | |
| MOE-129 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | 3.2.2 Comment: The use of the 30-day mean values for the guidelines is appropriate and is an improvement over the former predictions in Appendix 23. (G. Tamblyn, Application). | Acknowledged | No further response required. | | | | | | |
| MOE-130 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrology and Surface Water Quality and Quantity | 6.6 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | 3.2.2 Comment: The use of ½ the detection limit in calculations for values below detection limit is clearly stated. This may either over-estimate or under-estimate predicted concentrations. The use of the detection limit (rather than ½ the detection limit) to represent water quality for modeling purposes would have been even more conservative and precautionary. Alternatively, the use of percentiles (e.g. 75th or 90th percentiles) as opposed to means would have both eliminated biases associated with substituting numbers for concentrations < detection limits and allowed water quality predictions to be more conservative. Having said this, the problem of inadequate baseline data for streams 8 and 10 still exists. (G. Tamblyn, Application). | The bias should be less than if the values were either ommitted, or treated as zero. By using 0.5 times the detection limit, the estimate may be too high or too low, but the variance (between estimate and true value) will generally be less than would otherwise be the case. Samples from streams 8 & 10 in 2009 and 2010 are available. PBM collected additional data in 2009 and 2010 and commits to continuing to collect baseline data prior to construction PBM commits to preparing a consolidated Surface Water Quality database incorporating available data. Appropriate sampling, QA/QC and analytical procedures will be used. | Response not satisfactory. Requires further discussion and may result in a certificate commitment. | The detection limit for cadmium for sample collected in January 2011 was reduced to 5 nanograms. This data was incorporated and used in preparing RRR Rev.2. PBM also commits to continuing to collect baseline data for Streams 7 & 8 as well as Stream 10 during 2011 per the Nakinilerak Baseline Plan as previously submitted. | | | Nakinilerak Lake Baseline completed in Septemper 2011 | | |
| MOE-130a | MOE, Greg Tamblyn | 3-Dec-10 | Hydrology and Surface Water Quality and Quantity | | | | Comment: No new data was seen in the Review Response Report and it does not appear that any new data was used in the updated water quality predictions for streams 8 and 10. Action: If available, use water quality information from streams 8 and 10 as the basis from which to predict water quality for these streams. | | Unresolved; further discussion required. Carry forward. | Appendix I RRR Rev.2 documents overall data collection. PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. The updated effects assessment uses data collected up to January 2011 | | | Noted | | |
| MOE-131 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010) | Addendum; RRR | Comment: Groundwater water quality modeling of the seepages from the TSF was conducted using dissolved metals. When comparing the predicted dissolved metals concentrations with water quality guidelines based on total metals (dissolved guidelines available only for Al and Fe), potential effects may be underestimated and hence modeling may not be "worst case" (G. Tamblyn, Application). | Groundwater seepage is expected to be primarily dissolved concentrations. This is updated in the RRR. | Resolved. | | | | | | |
| MOE-132 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010) | Addendum; RRR | Table 3.2: Comment: Section 1.4 states that "Where there is a choice between a maximum value or a 30-day mean value, the 30 day mean value is used." [for water quality guidelines]. However in some cases, even where average guidelines exist, maximum guidelines are listed in this table. In addition, some listed guidelines are incorrect – e.g. the 30-day average ammonia guideline at 10oC and pH 7.5 (as outlined in section 1.4) – is 1.85 mg/L, not 3.33; nitrate is 3.0 mg/L (new) , not 40 mg/L, titanium is 2 mg/L, not 0.1 and zinc is0.0075 mg/L. Note also that the guideline for dissolved iron is 0.350 mg/L. However, based on the model results, none of these adjustments makes any difference to the conclusions. In other areas of this appendix, the guidelines for the above parameters are listed correctly (G. Tamblyn, Application) | Acknowledged. MOE input is considered in the RRR. | No further response required. | | | | | | |
| MOE-133 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | Table 3.3 Comment: Many of the incorrect values in table 3.2 have been corrected for this table. The lithium value should be 0.870 mg/l rather than 0.014 mg/L. (G. Tamblyn, Application). | Acknowledged | No further response required. | | | | | | |
| MOE-134 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010); 2.1 "TSF Impundment Water Quality" | Addendum; RRR | Comment: According to Table 3.3, predicted tailings porewater concentrations of ammonia, nitrite and nitrate all exceed both natural baseline groundwater quality values and the BC water quality guidelines. Sulphate and fluoride exceed guidelines, but are within natural ranges for groundwater quality. (G. Tamblyn, Application). | Acknowledged. Pore water quality predictions are updated in RRR. | Resolved. | | | | | | |
| MOE-135 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010); 2.1 "TSF Impoundment Water Quality" | Addendum; RRR | Table 3.4 Comment: The groundwater contribution (from the TSF seepage) is shown in L/s in this table. The actual values in the table match the groundwater contributions listed in m3/hr on page 25 (e.g. Table 3.4 – 19.7 L/s on page 25, it says 19.7 m3/hr). It is unclear which unit has been used in the water quality modeling .(i.e.,results shown in Table 3.7). The use of 19.7 L/s means more groundwater will be flowing into the MSC 7 than the use of 19.7 m3/hr. Perhaps the units of L/s is just a typo (G. Tamblyn, Application). Action: Clarify what units were used and if predictions need to be recalculated (G. Tamblyn, Application). | L/s units are correct. M3/hr values are incorrect and revised numbers are 26 m3/hr, 65 m3/hr and 17 m3/hr for MCS-7, MCS-8 AND MCS-10 respectively. Prediction was correctly based on L/s. Revised predictions will be submitted along with the revised TSF pore water quality in the RRR. | Resolved. | | | | | | |
| MOE-136 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | Table 3.5 Comment: The numbers from this table (originally from Table 7.1-1 of Appendix 23) do not match the water quality summary table in the Application for any of the streams (Table 7.4-2). It is not clear if the natural runoff values are means (if they are, an estimate of precision or data variability should also be indicated) and if they are from upper or lower creek 7. An option would have been to use a high percentile such as the 75th or 90th percentiles to represent natural water quality to help capture water quality conditions when the creek is most susceptible to effects as opposed to means for the "natural runoff". This method would also eliminate biases due to using ½ detection limits when calculating means. (G. Tamblyn, Application). | Assuming the comment is referring to Volume 1 Table 7.4-2. The chemistry of natural runoff is based on data obtained during the baseline monitoring program for the Project (Rescan 2008a, 2008b, 2009a). Per Appendix 23 Pg 7-2 the "Natural water quality used in the model is based on average concentrations of chemical constituents from all samples for stream MCS-7". The bias should be less than if the values were either ommitted, or treated as zero. By using 0.5 times the detection limit, the estimate may be too high or too low, but the variance (between estimate and true value) will generally be less than would otherwise be the case. | No further response required. | | | | | | |
| MOE-137 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | Table 3.7 Comment: the BC WQG guideline for Hg is 0.00002, not 0.00001 (in the text in section 3.2.2. the correct guideline is used) (G. Tamblyn, Application) | Acknowledged | No further response required. | | | | | | |
| MOE-138 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010); 2.1 "TSF Impoundment Water Quality"; 2.5 "Seepage Effects on Receiving Environment" | Addendum; RRR | Comment: It is unclear if the final numbers used to model water quality in the creeks and shown in Table 3.7 are based on the "base case" or the "upper bound". It appears that seepage rates used were base case and not "upper bound" (Section 3.2.3). For the worst case scenario, the upper bound would need to be used. (G. Tamblyn, Application). Action: Clarify whether base case or upper bound values were used in predicting water quality in MSC7, 8 and 10. (G. Tamblyn, Application). Action: Clarify to which reaches or points in streams 7, 8 and 10, the water quality predictions in Table 3.7 apply and if the water quality concentrations in these reaches are maximums or averages. | Updated TSF water quality predictions and seepage effects assessment are provided in RRR. | Unresolved; further discussion required. Carry forward. | RRR Rev.2 Section 10 documents the effects of seepage on streams. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-138a | MOE, Greg Tamblyn | 3-Dec-10 | Hydrogeology and Groundwater Quality and Quantity | | | | Comment: There is no information in the RRR related to which reaches or points in the streams the water quality predictions relate to. Action: Describe the sections of the streams the predictions apply to. | | Unresolved; further discussion required. Carry forward. | RRR Rev.2 Section 10 documents the effects of seepage on streams. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-139 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010); 2.1 "TSF Impoundment Water Quality"; 2.5 "Seepage Effects on Receiving Environment" | Addendum; RRR | 3.2.7 Comment: According to Table 3.7, in addition to Cd, nitrite exceeds guidelines for MCS7 & 8 and MCS 10 (low flow only) and Hg exceeds its guideline at MCS 8 (low flow) – in the text this is explained as an artifact of a high detection limit and the use of ½ the detection limit in the calculations. Perhaps the use of percentiles may have avoided this issue. At any rate, based on this modeling, exceedances are not large, and the risks to the streams are likely to be minimal. Unfortunately, the fact that MSC 7 data was used for streams 8 and 10, the use of dissolved metals, and the use of annual means rather than data for the season when the streams are at highest risk –likely low flows - may underestimate predicted final surface water quality conditions (G. Tamblyn, Application). | Acknowledged. Updated TSF water quality predictions and seepage effects assessment are provided in RRR. | Unresolved; further discussion required. Carry forward. | RRR Rev.2 Section 10 documents the effects of seepage on streams. | | 3rd Party Review Response Report-Addendum | | | |

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| MOE-140 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | 3.3 Comment: Section 8.4.4.4 of the original application indicates that the pit will intercept 90% of the seepage from the waste rock dump (i.e. 10% of seepage will end up in the lake), while Section 5.1.3 of Appendix 23 indicates all precipitation onto the waste rock dump will end up in the open pit. This addendum indicates that "the total water flow (214m3/hr) will be collected, treated and discharged to Morrison Lake," which seems to say that 100% of the seepage from the waste rock dump will drain into the pit. Action: What is the level of certainty related to the prediction that no seepage will enter Morrison Lake? (G. Tamblyn, Application). | The 0.63 m3/hr seepage that will reach Morrison Lake is from the LGO not the WRD. The runoff from the WRD will be captured in the open pit as the WRD is fully within the open pit catchment. During operations runoff from the LGO will be captured and pumped to the TSF. Post closure the LGO will have been processed and the stockpile area reclaimed so runoff is non-contact and discharged. In the event that the LGO is not milled and a cover is not adequate to limit seepage, PBM commits that the material will be placed in the open pit and flooded. | Unresolved; further discussion required. Carry forward. | The initial management plan for LGO seepage is presented in the EAC Addendum - Appendix AB, Section 3.4. Additionally, during operations, PBM must place the Low Grade Ore (LGO) stockpile on a low permeability glacial till liner and must collect seepage water from the stockpile for recycle. PBM must install groundwater monitoring wells between the Low Grade Ore stockpile and Morrison Lake and if water quality exceeds predicted water quality, a pump-back system must be implemented. On closure, PBM must place all potentially acid generating waste rock and low grade ore back into the open pit, where it must be submerged. The prediction of water flows and water quality for the open pit area is presented in Sections 7 and 8 of RRR Rev.2. | | | Condition #14 | | |
| MOE-141 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | 4.2.1 Comment: The limited depth profile information for the lake (EAC Appendix 27, Appendix 3.5-1) indicates that for station Lake D, the thermocline was approximately 7.5 m. Furthermore, historic reports mentioned in section 6.6 of Appendix AB indicate that the thermocline is between 4 and 7 m (Bustard 2005) and 6.2 m (Shortreed et al. 2001). The assumption used for discharge predictions - that the thermocline is at a depth of 15m - is not supported by any data. (G. Tamblyn, Application). Action: Please comment on whether considering the thermocline to be at 15 m rather than 7 m affects the water quality predictions. (G. Tamblyn, Application). | Acknowledged. A depth of 15m was used for conservative purposes until the thermocline depth over the proposed diffuser site was determined. The lower depth effectively reduced the volume of the hypolimnion into which the treated effluent will be released after mine closure and pit lake refilling (about mine-year 45). | Resolved. | | | | | | |
| MOE-142 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010) | Addendum; RRR | 4.3 Comment: It is appropriate to use the receiving environment (Morrison Lake) hardness to calculate hardness-based guidelines. Table 5.2 indicates that the average hardness in Morrison Lake is 29.2 mg/L, almost half of the 50 mg/L value used in this section. This hardness value should be used for all the hardness-based guidelines. (G. Tamblyn, Application). | Receiving environment hardnesses are used to calculate guidelines. The hardnesses used to calculate guidelines are documented in the RRR. | No further response required. | | | | | | |
| MOE-143 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | 5.2 Comment: Significant efforts were made to model resulting water quality and the predicted effects of the effluent discharge. However, the water quality predictions shown in this chapter are concerning for the following reasons: (a) They are based on limited water quality information for the lake (i.e. summer only). As no water quality sampling was conducted in the winter, there are some significant assumptions needed for this calculation; (b)As discussed in section 3.4.3 of Appendix 27, the Go-Flow apparatus used to collect the deep samples from the lake sites appeared to have been contaminated, thus contaminating the samples. Seeing as these values were used for the lake water quality predictions, the water quality predictions may actually be worse than they should be (i.e. water quality will actually be better than predicted); (c) There are discrepancies related to the diameter of the dilution zone between different parts of section 5 and sections 6 and 7 – see comments below; (continued in cell below). | See below | Unresolved; further discussion required. Carry forward. | Morrison Lake steady state water quality is provided in RRR Rev.2 Section 10.2.4 for the Expected Case and an Upper Bound Case. | | Updated water quality predictions are presented in 3rd Party Review Response Report - Addendum 1. | | | |
| MOE-144 | MOE, Greg Tamblyn | 28-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AB. Lake Effects Assessment (KCB 2010); 4.0 "Morrison Lake Effects" | Addendum; RRR | (d) In some cases, (e.g. copper and aluminum), predicted concentrations following dilution will be lower than the average baseline concentrations in the lake; (e) Equilibrium concentrations after 15 years are not shown. Conceivably, "background" water quality in the lake may increasingly get worse due to cumulative contaminant loading from the diffuser until an equilibrium is reached (G. Tamblyn, Application). Action: Determine what lake water quality be like after 15 years when equilibrium is reached as mentioned on page 72. (G. Tamblyn, Application). | Morrison Lake steady state water quality is provided in RRR. | Unresolved; further discussion required. Carry forward. | Morrison Lake steady state water quality is provided in RRR Rev.2 Section 10.2.4 for the Expected Case and an Upper Bound Case. | | Updated water quality predictions are presented in 3rd Party Review Response Report - Addendum 1. | | | |
| MOE-145 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010); 4.0 "Morrison Lake Effects" | Addendum | Table 5.2 Comment: The table shows hardness of Morrison Lake to be 29.2 mg/L. Based on this hardness, Cd should be 0.000011 mg/L, Pb = 0.004, Mn 0.73. The mercury guideline is actually one order of magnitude lower than shown. The Al guideline is 0.05 mg/L. These revised guidelines do not make a difference, except for Cd and Al. | Acknowledged. Receiving environment hardnesses are used to calculate guidelines. The hardnesses used to calculate guidelines are documented in the RRR. | Resolved. | | | | | | |
| MOE-146 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010); 4.0 "Morrison Lake Effects" | Addendum | Comment: This table is somewhat misleading because it does not clearly explain that the 40X dilution "concentrations" are based on water with zero levels of all water quality constituents (i.e. deionized water). It is not until the following page, p. 70, that this is explained. (G. Tamblyn, Application). | Acknowledged. Within the RRR, the dilution factors by distance from the diffuser are re-calculated using the updated water quality modeling results for seepage and final effluent concentrations. | Resolved. | | | | | | |
| MOE-147 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010); 4.0 "Morrison Lake Effects" | Addendum | Table 5.3 Comment: This table is incomplete. 40 and 100 X dilution values for all parameters in actual lake water should have been included. For example Al may be an issue: the predicted final treated concentration is <3mg/L and the assumption for modeling is to use 3 mg/L. 40X dilution concentration in CLEAN (i.e. distilled) water is 0.075 mg/L which is higher than the BC WQG of 0.05 mg/L (0.1 mg/L is the CCME guideline). Average Morrison Lake water quality is 0.0422 – just under the guideline. (G. Tamblyn, Application). | Acknowledged. Within the RRR, the dilution factors by distance from the diffuser are re-calculated using the updated water quality modeling results for seepage and final effluent concentrations. | Resolved. | | | | | | |
| MOE-148 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | 6.2.1 Comment. The highest values of metals and nutrients in sediments tend to be at stations A and E. This may be important to keep in mind when interpreting results from an aquatic environmental monitoring program – or it may be the result of contamination from the Go-Flow sampler. (G. Tamblyn, Application). | Acknowledged | No further response required. | | | | | | |
| MOE-149 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010); 4.0 "Morrison Lake Effects" | Addendum; RRR | 7.1 Comment. The 100:1 dilution zone is within a 5.5 m radius from the diffuser (p. 67); there did not appear to be calculations for the distance at which concentrations would be below guidelines. Thus, the statement "all effluent constituent meet the BC Water Quality Guidelines within 20 m horizontally from the diffuser" does not appear to be supported by the modeling completed in section 5 because a 20 meter radius (40m diameter) is not used in the modeling. (G. Tamblyn, Application). | Within the RRR, the dilution factors by distance from the diffuser are re-calculated using the updated water quality modeling results for seepage and final effluent concentrations. | Resolved. | | | | | | |
| MOE-150 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010); 4.0 "Morrison Lake Effects" | Addendum; RRR | 7.2 Comment: There is some inconsistency regarding which water quality parameters are of concern related to the effluent discharge. Nitrates and aluminum are not included here, but they were listed in section 7.1.1. Copper and arsenic are not included in Table 5.3, but are listed in section 7.2. It is unclear what the predicted concentrations of these constituents are following dilution of the effluent. (G. Tamblyn, Application). | Within the RRR, the parameters and dilution factors are clarified in the effects assessment using revised water quality data and plume modeling. | Resolved. | | | | | | |
| MOE-151 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010); 4.0 "Morrison Lake Effects" | Addendum; RRR | 7.2 Comment: One of the reasons for conservative water quality guidelines (up to 10X lower than the lowest observed effect level) is to account for unknown synergistic effects from multiple contaminants. Indicating that a contaminant is above a guideline, but this is OK because of the safety factor built into the guideline, does not consider the effects of other contaminants in the water (G. Tamblyn, Application). | Acknowledged. Within the RRR, the dilution factors by distance from the diffuser are re-calculated using the updated water quality modeling results for seepage and final effluent concentrations. | Resolved. | | | | | | |
| MOE-152 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AA; 2.5;4.0 | Addendum; RRR | 7.2.2 Comment: Final effluent concentration of cadmium is noted here as <0.0005 mg/L which matches with Table 5 in Appendix AA. However, section 2.3.3 in Appendix AA indicates that final effluent concentration is expected to be 0.001 mg/L. This higher concentration will result in a higher prediction of water quality. Based on the assumption of 20X dilution within "10m of the diffuser", the cadmium concentration would be 0.00005 mg/L. (G. Tamblyn, Application). | The concentration of <0.0005 mg/L is correct. In the event that the concentration of cadmium in Morrison Lake will exceed the permitted water quality guidelines a polishing treatment using ion exchange or activated silica gel may be able to further remove cadmium. Therefore when the post closure detailed design of the water treatment plant occurs, using actual data from operations and post closure, the requirement for installation of additional treatment to remove cadmium or other contaminants will be addressed in consultation with permitting agencies. | Response satisfactory for EA phase. Certificate commitment required. Details to be addressed at permitting. | Final effluent quality and dilution in Morirson Lakeare updated in RRR Rev.2 Section 10.2.4. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-153 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010); 4.0 "Morrison Lake Effects" | Addendum; RRR | 7.4 Comment: 40:1 dilution zone is said to be 20 m horizontally here and 2.2 m horizontally on page 67. There are multiple conflicting dilution zones mentioned now: 2.2 m diameter or 10 m = 40:1 dilution; 5.5 m diameter and 10m – 100:1 dilution; and 20m radius (40 m diameter) for all parameters to be below guidelines (in Section 9.3, this is said to be the 20:1 dilution zone) (G. Tamblyn, Application). Action: Please clarify the predicted effluent concentration at various distances from the diffuser. (G. Tamblyn, Application). | Refer to revised effluent concentrations in the RRR. | Resolved. | | | | | | |

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| MOE-154 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010); 4.0 "Morrison Lake Effects" | Addendum; RRR | 7.2.3 Comment: It is unclear how copper concentrations will be diluted to 0.00075 mg/L within 10 m of the diffuser when the average concentration of Cu in the lake is higher than this – 0.0011 mg/L. (G. Tamblyn, Application). | Acknowledged. Refer to revised effluent concentrations in the RRR. | Resolved. | | | | | | |
| MOE-155 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010); 2.5 "Seepage Effects on Receiving Environment" | Addendum; RRR | 8.1 Comment: The statement "The TSF seepage is predicted to have no measureable effect on the water quality in the receiving streams' is based on a large number of assumptions – see comments under Table 3.7 and section 3.2.7 above. (G. Tamblyn, Application). | Refer to revised TSF seepage water quality effects assessment for streams is provided in RRR. | Unresolved; further discussion required. Carry forward. | RRR Rev.2 Section 10.2.2 documents the effects of seepage on streams. | | Updated water quality predictions are presented in 3rd Party Review Response Report - Addendum 1. | | | |
| MOE-156 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AB. Lake Effects Assessment (KCB 2010); 4.0 "Morrison Lake Effects" | Addendum; RRR | 9.3 Comment: Given the uncertainty in the water quality predictions for Morrison Lake due to lack of baseline data and the assumptions made, it cannot be assumed at this point that water quality guidelines will be met in Morrison Creek. In fact, according to Table 7.4-3 of the original application, baseline concentrations Al, Cu, Cd, and Fe exceed either 30-day mean (needs to be confirmed with 5 in 30 day testing) or maximum guidelines in some samples for Morrison Creek. (G. Tamblyn, Application) | Revised TSF seepage water quality is used in the updated effects assessment on Morrison Lake, which is provided in RRR. The water quality entering Morrison Creek is expected to be equivalent to the Morrison Lake steady state water quality. | Unresolved; further discussion required. Carry forward. | Revised TSF seepage water quality is used in the updated effects assessment on Morrison Lake, which is provided in RRR Rev.2. The water quality entering Morrison Creek is expected to be equivalent to the Morrison Lake steady state water quality. | | Updated water quality predictions are presented in 3rd Party Review Response Report - Addendum 1. | | | |
| MOE-157 | MOE, Greg Tamblyn | 28-Sep-10 | Monitoring | 9.4 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | 13.4 Action: Additional seasonal sampling, at least near the proposed discharge, is required to verify that the data used for modeling water quality predictions in the lake in the area of the proposed diffuser are appropriate. (G. Tamblyn, Application). | PBM collected additional data in 2009 and 2010 and commits to continuing to collect baseline data prior to construction PBM commits to preparing a consolidated Surface Water Quality database incorporating available data. Proper sampling, QA/QC and analytical procedures will be used. | Unresolved; further discussion required. Carry forward. | Appendix I RRR Rev.2 documents overall data collection. PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. The updated effects assessment uses data collected up to January 2011 | | | Condition #22 | | |
| MOE-157a | MOE, Greg Tamblyn | 3-Dec-10 | Monitoring | | | | Comment: In a high-valued lake such as Morrison Lake located immediately adjacent to the proposed mine, seasonal data at multiple depths is required to properly characterize the lake temporally and spatially and to predict possible effects. Lack of data for Morrison Lake remains a significant data gap that was not addressed in the Review Response Report. Action: Determine vertical profiles for physical water quality parameters and collect water quality data at multiple depths at the sites and sites in Morrison lake during winter. This combined with the other seasonal data, and a clearer understanding of the hydrogeology and groundwater quality, should provide the minimum data required to predict water qaulity in the lake and thus conduct an effects assessment. | | Unresolved; further discussion required. Carry forward. | Appendix I RRR Rev.2 documents overall data collection. PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. The updated effects assessment uses data collected up to January 2011 | | Updated water quality predictions are presented in 3rd Party Review Response Report - Addendum 1. | | | |
| MOE-158 | MOE, Greg Tamblyn | 28-Sep-10 | Monitoring | 9.4 | App AB. Lake Effects Assessment (KCB 2010) | Addendum | S13.6, p. 144. Comment / Action: MOE will work with the proponent to identify necessary baseline data gaps that need to be filled to allow the establishment of a viable environmental effects monitoring program in Morrison and Nakinilerak lakes. This will include fish tissue sampling – s. 8.2.4. p. 125) (G. Tamblyn, Permitting). | Agreed | Resolved. | | | | | | |
| MOE-159 | MOE, Greg Tamblyn | 28-Sep-10 | Monitoring | | App AB. Lake Effects Assessment (KCB 2010) | Addendum | Review of June 23, 2010 letter from Klohn Crippen Berger to Mr. Erik Tornquist Morrison Copper/Gold Project EAC Application Screening Clarification | | No further response required. | | | | | | |
| MOE-160 | MOE, Greg Tamblyn | 28-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | App AB. Lake Effects Assessment (KCB 2010); 4.0 "Morrison Lake Effects" | Addendum; RRR | 2.4 Comment: The influence area of the diffuser plume is said to be 5.5 m here – again the actual diameter of area considered to be the initial dilution zone needs to be clarified. See comments under 7.2.2 and 7.4 above (G. Tamblyn, Application) | Within the RRR, the updated effects assessment clarifies the physical and chemical characteristics of the treated effluent plume using background water quality, updated lake data and final effluent figures. | Unresolved; further discussion required. Carry forward. | Revised updated effects assessment on Morrison Lake is provided in RRR Rev.2. Section 10.2.3 and 10.2.4. | | Updated water quality predictions are presented in 3rd Party Review Response Report - Addendum 1. | | | |
| MOE-161 | MOE, Greg Tamblyn | 28-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | App AB. Lake Effects Assessment (KCB 2010); 4.0 "Morrison Lake Effects" | Addendum; RRR | 3.2 Comment: The statement "After closure the quality of the TSF seepages is predicted to meet all applicable water quality criteria…" is different than that predicted in section 3.2.2 of Appendix AB, where it says that all parameters will meet guidelines except for cadmium 21-24 years (depending of section of chapter) after the TSF is full (closure +24 years to 27years). (G. Tamblyn, Application). | As above. | Unresolved; further discussion required. Carry forward. | Revised water quality predictions on closure are presented in Section 8.2 and 8.3 and updated effects assessment on streams and Morrison Lake is provided in RRR Rev.2, Section 10.2. | | Updated water quality predictions are presented in 3rd Party Review Response Report - Addendum 1. | | | |
| MOE-162 | MOE, Greg Tamblyn | 28-Sep-10 | Construction and Operational EMPs | 9.1 | App AC. Water Management Design (KCB 2010) | Addendum | Comment: Drawing D-3101 shows that a long clean water diversion above the proposed waste rock dump / low grade ore stockpile will divert water into stream 6. This added water will essentially increase the watershed area and flows in stream 6. Action: Will the existing stream channel be able to handle this increased flow in freshet and during storm events without widening or downcutting? If not, what steps will be taken to control erosion in stream 6 so that aquatic habitats and coho habitat in the lower reach and sockeye spawning areas at the mouth of the creek in Morrison Lake are not impacted by sediment carried downstream as the channel widens to accommodate the additional flows from the diversion ditch (G. Tamblyn, Application). | Drawing 3101 is a construction period drawing showing the diversion ditch incomplete and diverting water to only Stream 6. The waste rock dump diversion when completed by the end of construction and during operations will deliver diverted water to Streams 5 and 6 (see drawing D-3102). The diverted flow entering the stream will represent a small percentage of the stream flow. | Resolved. | | | | | | |
| MOE-163 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 5.8 | App AE. 2009 Fish & Fish Habitat & Aquatic Resources Report (Rescan) | Addendum | Section 2: Comment: Methods are missing for fish tissue collection. Action: Explain the methods used and what tissue was sampled - muscle, liver or whole body. Was the same tissue and techniques used for adult and juvenile fish? (G. Tamblyn, Application). | PBM understands that muscle was sampled and that within streams juveniles were sampled and within lakes adults. For Country Foods adult fish were sampled. Further tissue sampling was done in 2010 for Nakinilerak Lake. | No further response required. | | | | | | |
| MOE-164 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | App AE. 2009 Fish & Fish Habitat & Aquatic Resources Report (Rescan) | Addendum | Comment: Sorting methods for periphyton is important to include in the methods section. In fact, in other parts of the Application, differences in sorting techniques for aquatic assemblages between years is attributed to differences in results. It appears for the drift net sampling (according to section 2.4.1) that all benthic invertebrates in each sample were identified. (G. Tamblyn, Application). | For permitting and prior to construction, as part of the EMS, PBM commits to resolving periphyton sampling techniques and number of replicated with MOE prior to initiation of an Aquatic Effects Monitoring Program. | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-165 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | App AE. 2009 Fish & Fish Habitat & Aquatic Resources Report (Rescan) | Addendum | 2.1.4 Comment: The drift net sampling program is probably inadequate to properly characterize baseline conditions. Hatfield et al. (2007) (Sampling guidelines for small hydropower projects in BC) recommends sampling 5 replicates per year at three sites within the project stream. For stream 53400, three replicates were sampled at three sites once during the year. I understand that only three replicates were sampled due time limitations (G. Tamblyn, Application). | The reviewers reference to time limitations is believed to be assumed from the description of methods of sampling "access to these remote sites, especially the mid and upper reaches where considerable hiking was required, dictated taking the nets down during the same day. Therefore the sampling duration for each net was approximately three hours". For permitting and prior to construction, as part of the EMS, PBM commits to resolving adequate drift net sampling with MOE for Effects Monitoring Programs. | Requires further discussion. Carry forward. | The reviewers reference to time limitations is believed to be assumed from the description of methods of sampling "access to these remote sites, especially the mid and upper reaches where considerable hiking was required, dictated taking the nets down during the same day. Therefore the sampling duration for each net was approximately three hours". For permitting and prior to construction, as part of the EMS, PBM commits to resolving adequate drift net sampling with MOE for Effects Monitoring Programs. | | | Carry forward to Permitting | | |
| MOE-166 | MOE, Greg Tamblyn | 28-Sep-10 | Aquatic Biology and Fisheries | 6.8 | App AE. 2009 Fish & Fish Habitat & Aquatic Resources Report (Rescan) | Addendum | 3 Comment: The discussion of results is helpful. This section compares results to past sampling and provides a link to the literature that is often missing in the other parts of the Application related to aquatic life and water quality. (G. Tamblyn, Application). | Acknowledged, although the focus in the Addendum was on water quality for which numerous references were used regarding toxicities of different elements to aquatic life. | No further response required. | | | | | | |

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| MOE-167 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | App AE. 2009 Fish & Fish Habitat & Aquatic Resources Report (Rescan) | Addendum | 4.3 Comment: Detection limits for fish tissues would be helpful to see. How were values below detection limit incorporated into summary statistics? (G. Tamblyn, Application). Action: Provide lists of detection limit, methods for tissue collection, a description of how fish tissue data below detection limit was analyzed, and a brief description of taxonomic sorting protocols for both benthic invertebrates and periphyton. This information is very important during future comparisons to baseline data (G. Tamblyn, Application). | Further tissue sampling was done in 2010 for Nakinilerak Lake. For permitting and prior to construction, as part of the EMS, PBM commits to adopting a standardized methods, sorting / counting technique for the Effects Monitoring Program. | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-167a | MOE, Greg Tamblyn | 3-Dec-10 | Environmental Management System | | | | The requested information was not provided. Should this information not be available, the ability to design a comparable, consistent and powerful aquatic effects monitoring program following a before-after-control-impact design is questionable. Action: Provide the information requested in MOE-167. | | Response satisfactory for EA phase. Development of an Aquatic Effects Monitoring Program is required as part of the EMS and MOE permitting process. Details to be addressed at permitting. | | | | Carry forward to Permitting | | |
| MOE-168 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | App AE. 2009 Fish & Fish Habitat & Aquatic Resources Report (Rescan) | Addendum | Table 4.3-1: Comments: It is helpful to see that stats were run to compare metal levels between the two sites and that only Mn concentrations were significantly different. It would have been helpful to see the standard deviations, as in some cases, there appear to be a large ranges in concentrations of some metals among fish from a given site (G. Tamblyn, Application). | Future analysis will include data summaries with standard deviations shown. | No further response required. | | | | | | |
| MOE-169 | MOE, Greg Tamblyn | 28-Sep-10 | Environmental Management System | 9 | App AZ. EAC Application Screening Clarification (KCB) | Addendum | 5.1 Action: MOE would like to see a commitment to use an independent 3rd party environmental monitor during construction (G. Tamblyn). | PBM commits to using an independent 3rd party environmental monitor during construction. | No further response required. | | | | Condition #28 | | |
| MOE-170 | MOE, Greg Tamblyn | 28-Sep-10 | Assessment of Project Effects, Mitigation Measures and Significance of Residual Project Effects | 6 | App AZ. EAC Application Screening Clarification (KCB) | Addendum | Appendix B. Effects Assessment for Nak. Lake (excerpts from App. AC) Comment: Inconsistencies exist for the estimate of flows in stream 10. Section 3.2.6 of Appendix AC says "the low flows in all three streams will increase by 1.5 to 2 times present seepage rates." (Estimate is 9.5m3/hr or 2.64L/sec - Section 3.2.7). Section 3.2 of App AZ (p.9) indicates that Creek 10 will have a 22% (0.36m) reduction in wetted width. (G. Tamblyn, Application). | Appendix AC refers to the amounts of groundwater entering the creek flow before and after the TSF is operating, while Appendix AZ refers to the water volume in the creek, including groundwater contributions. There will be slightly more base flow at low water due to the increased groundwater contribution. However there will be a 22% reduction in wetted width overall, based on watershed area displaced. Once TSF surface water can be decanted to Stream 10 sometime in post-closure, flows will be restored to Stream 10. | Resolved. | | | | | | |
| MOE-170a | MOE, Greg Tamblyn | 3-Dec-10 | Assessment of Project Effects, Mitigation Measures and Significance of Residual Project Effects | | | | Good explanation. | | No further response required. | | | | | | |
| MOE-184 | MNRO, Chris Schell | 20-Oct-10 | Ecosystem and Vegetation | 6.11 | 8.15.5.1 Rare Ecosystems Pg 8-350 | | Recommendation: Provide more detail on the impacts and management of the impacts to these red listed ecosystems in the Vegetation and Ecosystems Management Plan. (13.9). See the comment for this section immediately below. | Vol II Chapter 15 includes effects on Ecosystems of interest (rare and sensitive ecosystems) The PEM map identified two red-listed ecosystems within the LSA (Section 7.15): the Saskatoon/slender wheatgrass (SBSmc2 81; Amelanchier alnifolia/Elymus trachycaulus) and the bluegrass-slender wheatgrass (SBSmc2 82; Poa secunda ssp. Secunda-Elymus trachycaulus) ecosystems. Approximately 0.8 ha of the Saskatoon/slender wheatgrass ecosystem will be affected: 0.1 ha will be permanently lost and 0.7 ha will be degraded within the MFA. As well, 3 ha of the bluegrass-slender wheatgrass ecosystem will be affected: 0.2 ha within the transmission line corridor, and the remaining portion within the MFA. These areas represent 0.1% and 0.2% of SBSmc2 81 and SBSmc2 82 within the RSA. PBM commits to providng a more detailed management plan for permitting. | See below | | | | EMP | | |
| MOE-185 | MNRO, Chris Schell | 20-Oct-10 | Ecosystem and Vegetation | 6.11 | 7.15.2.3; 8.15; 13.9.6.4 Listed Ecosystems | I;II;III | Comment: In the Bulkley Valley, the 2 dry grassland ecosystems (SBS mc2 81 and 82) have high value as spring deer habitat. This is not recognized in the Application, and project impacts on these values have not been subject to an effects assessment. Recommendation: The 2 dry grassland ecosystems need to be mapped and overlaps with project footprint verified. An effects assessment should be conducted on the impacts of creating access to these openings on deer. This would include identifying mitigation. | PBM commits to mapping, prior to construction, the 2 dry grassland ecosystems. PBM also commits that effects assessment and mitigation will be updated if the mapping indicates a signficant difference from the area used for the EAC effects assessment. | Response satisfactory. | | | | PBM will map, prior to construction, the 2 dry grassland ecosystems. | | |
| MOE-186 | MNRO, Chris Schell | 20-Oct-10 | Wetlands | 6.9 | 7.12; 8.12; 13.9.6.4 Wetlands | I; II; III | Comment: There is no project specific content in this section. Recommendation: Details of anticipated wetland impacts, mitigation and compensation plans should be presented here. | Volume 8.12 addresses project specific effects assessment with significance of residual effects summarized in Table 8.12-12. Although there are no comprehensive statutes exclusively for conserving BC wetlands with respect to private sector development activities. Mitigation and compensation are addressed in 13.9 Vegetation and Ecosystems Management Plan. Losses of wetlands totals 57 ha. The TSF will offer approximately 44 ha of beach area and 78 ha of shallow open water (<2 m deep) that could be vegetated with wetland plants to compensate for wetlands lost during the construction and operations phases of the Project (Figure 13.9-2). Planting these areas could result in the creation of approximately 72 ha of shallow open water, 40 ha of marsh, and 10 ha of swamp. | Further discussion required. Carry forward. | Refer to RRR Rev.2, Section 9. The revised closure and reclamation plan establishes viable wetlands closer to natural conditions 25 years sooner. Additionally the TSF water is dischargeable a few years after mine closure (as opposed to 75 years in the EAC Application). | | | Noted | | |
| MOE-187 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 13.9.6.8 | III | Recommendation: It is strongly recommended that PBM contact the Northwest Invasive Plant Council (www.nwipc.org/index.php) for status of invasive plants in the vicinity of the project site. This inter-agency council has extensive information and experience with invasive plants in northwestern BC. They can coordinate and conduct strategic survey and treatment plans, which they currently do for MoTI, MoFR, and several industrial clients, including mines. | Within Vol III, 13.9.6.8 PBM provides an invasive plant strategy including activities to undertake during construction, operations and closure that will be finalized as part of the EMS for permitting and before construction. PBM commits to contacting the NWIPC prior to permitting to acquire information about the status of invasive plants in the vicinity of the project. PBM will consider contracting NWIPC to coordinate and conduct strategic survey and treatment plans. | Response satisfactory. | | | | | | |
| MOE-188 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 13.9.7.1 | III | Comment: It appears that the construction of wetlands in the TSF would not be possible until after the TSF is filled and being reclaimed. This leaves 20+ years in which wetland function is not present during mine operation. In addition, the long term function of the TSF as a wetland is potentially unviable due to metal contamination. Recommendation: The application should attempt to quantify the risk of metal contamination so we can assess the viability of the compensation. Examples of other reclaimed TSF with similar tailings geologies should be presented. Additional compensation options should be presented in the event that the reclaimed TSF is found to be contaminating wildlife. | Although there are no comprehensive statutes exclusively for conserving BC wetlands with respect to private sector development activities, mitigation and compensation are addressed in 13.9 Vegetation and Ecosystems Management Plan. Losses of wetlands totals 57 ha. The TSF will offer approximately 44 ha of beach area and 78 ha of shallow open water (<2 m deep) that could be vegetated with wetland plants to compensate for wetlands lost during the construction and operations phases of the Project (Figure 13.9-2). Planting these areas could result in the creation of approximately 72 ha of shallow open water, 40 ha of marsh, and 10 ha of swamp. The risk of metal contamination is negligible. The tailings contain low concentration of metals and are similar to other copper porphyry mines (eg Bell, Granisle, Highmont and Trojan) where wetlands have been successfully developed. (continued below) | TSF closure plan has changed. Carry forward to tracking table 2. | Refer to RRR Rev.2, Section 9. The revised closure and reclamation plan establishes viable wetlands closer to natural conditions 25 years sooner. Additionally the TSF water is dischargeable a few years after mine closure (as opposed to ~75 years in the EAC Application). | | | Noted | | |
| MOE-188 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 13.9.7.1 | III | | While the construction of wetlands in the TSF is not possible until after the TSF is filled and reclaimed, the 20 years in which wetland function is not present represent a very short period of time considering the TSF will provide wetland funtion in perpetuity. The risk of metal contamination is considered and addressed in the closure planning. Post closure monitoring plans that will address metal contamination are presented in Vol III, 14.8.3. The risk of metal contamination is negligible. The tailings contain low concentration of metals and are similar to other copper porphyry mines (eg Bell, Granisle, Highmont and Trojan) where wetlands have been successfully developed. | TSF closure plan has changed. Carry forward to tracking table 2. | Refer to RRR Rev.2, Section 9. The revised closure and reclamation plan establishes viable wetlands closer to natural conditions 25 years sooner. Additionally the TSF water is dischargeable a few years after mine closure (as opposed to ~75 years in the EAC Application). | | | Noted | | |
| MOE-189 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 8.16.5.4 Disruption of Movements | II | Recommendation: Pg 8-392 The Wildlife Effects Monitoring program (14.9) or the Wildlife Management Plan (13.10) should include a detailed plan for where and how human activity will be prevented in these "key wildlife habitats and movement corridors". These areas should be mapped and mitigation measures outlined for each habitat type. This comment applied to all species, not just grizzly bear. | For permitting and prior to construction, as part of the EMS, PBM commits to providing a detailed plan for where and how human activity may be prevented. Considerations in the plan will be the land area that PBM can control as well as the legal rights of the public. | Requires further discussion and may result in a certificate commitment. | For permitting and prior to construction, as part of the EMS, PBM commits to providing a detailed plan for where and how human activity may be prevented. Considerations in the plan will be the land area that PBM can control as well as the legal rights of the public. | | | EMP | | |

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| MOE-190 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 8.16.5 Table 8-16-6 Physical Hazards – Mortality. | II; III | Comment: Compliance with speed limits is a critical aspect of preventing wildlife mortalities along the haul route. Random speed checks by evironmental department provide only very occasional monitoring. Recommendation: GPS units in trucks, or automated radar setup for more effective and full time compliance monitoring. This should be included in the Table of Commitments. | PBM commits to implementing instrumentation and/or automated methods of ensuring compliance with speed limits. Additionally PBM commits to implementing an effective system of non-compliance penalties. | Requires further discussion and may result in a certificate commitment. | PBM commits to implementing instrumentation and/or automated methods of ensuring its employees and contractors compliance with speed limits along the haul route. Additionally PBM commits to implementing an effective system of non-compliance penalties. | | | EMP | | |
| MOE-191 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 8.16.5 Table 8-16 Chemical Hazards and Attractants. | II; III | Comment: The Application states that invertebrates and wetlands will only be monitored if wildlife are observed “drinking eating or using water or vegetation” in the TSF. In order to effectively identify wildlife use, monitoring 24 hours a day, 365 days a year would be required. This is obviously impractical . In the event that metals levels in the TSF invertebrates and wetlands are found to approach monitoring criteria, what are the adaptive management measures that would be applied to minimize the risk of metal uptake to wildlife? Fencing the entire TSF? Recommendations: 1) Wetland and invertebrate monitoring should not be conditional on observed wildlife use. Rather, wildlife use of the TSF should be assumed, especially as the current plan includes creating wetland habitat in the TSF after closure. 2) Revise the Wildlife Effects Monitoring Program (14.9) to describe the adaptive management measures that would be applied to minimize the risk of metal uptake to wildlife | The risk of metal contamination is negligible. The tailings contain low concentration of metals and are similar to other copper porphyry mines (eg Bell, Granisle, Highmont and Trojan) where wetlands have been successfully developed. For permitting and prior to construction, as part of the EMS, PBM commits to: 1) update the wetland and invertebrate monitoring plan to occur independent of wildlife use of the TSF. 2) Revise the wildlife effects monitoring program to describe the adaptive management measures that would be applied to minimize the risk of metal uptake to wildlife. | Requires further discussion and may result in a certificate commitment. | The risk of metal contamination is negligible. The tailings contain low concentration of metals and are similar to other copper porphyry mines (eg Bell, Granisle, Highmont and Trojan) where wetlands have been successfully developed. Additionally as documented in RRR Rev.2 Cleaner and Rougher Tailings will be deposited separately with the lower quality Cleaner Tailings deposited within the pond are of the TSF and Rougher Tailings deposited to comprise the beaches and wetland areas. For permitting and prior to construction, as part of the EMS, PBM commits to: 1) update the wetland and invertebrate monitoring plan to occur independent of wildlife use of the TSF. 2) Revise the wildlife effects monitoring program to describe the adaptive management measures that would be applied to minimize the risk of metal uptake to wildlife. | | | EMP | | |
| MOE-192 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 8.16.5 Table 8.16-16 Combined Effects of the Project | II | Comment: Grizzly bear is a VEC for conservation and cultural reasons with potential impacts including direct and indirect mortality, and sensory disturbance. These impacts could result in changes in migration corridors and habitat use, potentially leading to population level effects. The Application characterized the extent of these impacts as “Uncertain” (pg 8-405). The project has no monitoring plan to track impacts on grizzly bear numbers and use of high quality habitats in the project area, and would therefore not be able to determine if impacts are occurring post construction, or how significant these impacts may be. Recommendation: A statistically robust monitoring plan should be designed to track project affects on grizzly bear habitat use in the project area. Use of the Morrison River is an obvious option to explore. Monitoring results should feed into an adaptive management plan that would require additional mitigation for unforeseen impacts. | For permitting and prior to construction, as part of the EMS, PBM commits to providing a monitoring plan to track affects to grizzly bear habitat within the MFA and will consider using the Morrison River as an option as well as an adaptive management plan to address additional mitigation for unforeseen impacts. | Requires further discussion and may result in a certificate commitment. | For permitting and prior to construction, as part of the EMS, PBM commits to providing a monitoring plan to track affects to grizzly bear habitat within the MFA and will consider using the Morrison River as an option as well as an adaptive management plan to address additional mitigation for unforeseen impacts. | | | EMP | | |
| MOE-193 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 8.16.6 Table 8.16-8 Physical Hazards – Mortality | II | Comment: “Avoid human activity near identified key wildlife habitats during sensitive wildlife periods (eg, calving).” Calving habitat is expected to be different than overwintering habitat. Has any calving habitat been identified? Recommendation: Along the lines of our comment above for section 8.16.5.4, specific measures should be contained in the Wildlife Management Plan (13.10) to flesh out this mitigation strategy so ESD can evaluate it. I.e.: what is does it mean in a practical sense to “Avoid human activity…”? Does this refer to timing windows? Specific type of activity? Forest cover removal? | For permitting and prior to construction, as part of the EMS, PBM commits to updating the Wildlife Management Plan to address the recommended points. | Requires further discussion and may result in a certificate commitment. | For permitting and prior to construction, as part of the EMS, PBM commits to updating the Wildlife Management Plan to address the recommended points. | | | EMP | | |
| MOE-194 | MNRO, Chris Schell | 20-Oct-10 | Wildlife and Wildlife Habitat | 5.1 | 8.16.7.3 Habitat loss or Alteration | II | Comment: The Application and the habitat mapping report in Appendix 37 admits that a high degree of uncertainty regarding the location of key mule deer overwintering habitat. As a result, there is insufficient information to perform an effects assessment on habitat impacts for this VEC. Recommendation: MoE recommends additional survey methods, including winter ground based, or aerial surveys. Given that mule deer can occupy heavily forested habitat during the winter, and can use much different habitat than moose, aerial surveys associated with the moose work, as recommended a the top of page 8-421, may not be affective. Accordingly, aerial surveys will likely require additional ground work to confirm habitat use. | PBM commits to a winter ground based and aerial survey for moose and mule deer during the 2010/11. PBM has agreed to support helicopter flights for LBN members to assess high moose use areas. A wildlife biologist retained by PBM may also be present for these flights. | This field work has taken place. Data/results/reports have not been submitted. | PBM completed, with LBN participation, a winter aerial survey for moose and mule deer during the 2010/11. Efforts to complete a ground survey with LBN were aborted due to weather and other circumstances. The consultants report is expected to be submitted in April 2011. | | | Noted | | |
| MOE-195 | MNRO, Chris Schell | 20-Oct-10 | Wildlife and Wildlife Habitat | 5.1 | 8.16.10.3 Western Toad Habitat Loss | II | Comment: The loss of breeding habitat is seen as an impact that has greater than “minor significance” for western toads in the LSA. Theloss of breeding pond with no nearby alternative effectively removes all the surrounding area as productive toad habitat, thus increasing the significance of the impact. Recommendation: Surveys should be conducted for additional breeding sites in the local project area. This will help place the impact in the landscape context, and perhaps guide wetland compensation. | Prior to construction PBM commits to conducting surveys for additional western toad breeding sites in the LSA. | Requires further discussion and may result in a certificate commitment. | Prior to construction PBM commits to conducting surveys for additional western toad breeding sites in the LSA. | | | Prior to construction PBM will conduct surveys for additional western toad breeding sites in the LSA. | | |
| MOE-196 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 13.9.6.8 | | Comment: This section relies heavily on generic language that could be applied to any project. Species and project specific strategy is largely absent from the application. Recommendation: It is strongly recommended that PBM contact the Northwest Invasive Plant Council (www.nwipc.org/index.php) for status of invasive plants in the vicinity of the project site, and along the proposed haul route. This inter-agency council has extensive information and experience with invasive plants in northwestern BC. They can coordinate and conduct strategic survey and treatment plans, which they currently do for MoTI, MoFR, and several industrial clients, including mines. | Within Vol III, 13.9.6.8 PBM provides an invasive plant strategy including activities to undertake during construction, operations and closure that will be finalized as part of the EMS for permitting and before construction. PBM commits to contacting the NWIPC prior to permitting to acquire information about the status of invasive plants in the vicinity of the project. PBM will consider contracting NWIPC to coordinate and conduct strategic survey and treatment plans. | Requires further discussion and may result in a certificate commitment. | Within Vol III, 13.9.6.8 PBM provides an invasive plant strategy including activities to undertake during construction, operations and closure that will be finalized as part of the EMS for permitting and before construction. PBM commits to contacting the NWIPC prior to permitting to acquire information about the status of invasive plants in the vicinity of the project. PBM will consider contracting NWIPC to coordinate and conduct strategic survey and treatment plans. | | | EMP | | |
| MOE-197 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 13.9.6.8 Preventing Invasive Plant Establishment | III | Comment: Is the proponent committing to “establishing vehicle wash stations upon entry to site” (first bullet, pg 13-70)? If so, will use be mandatory? Will this be an EA commitment? Recommendation: Invasive plants prevention program should be rewritten and include project specific strategies that are practical and workable for a producing mine operation. This document could then be referenced in a commitment table. | Within Vol III, 13.9.6.8 PBM provides an invasive plant strategy including activities to undertake during construction, operations and closure that will be finalized as part of the EMS for permitting and before construction. PBM commits to contacting the NWIPC prior to permitting to acquire information about the status of invasive plants in the vicinity of the project. PBM will consider contracting NWIPC to coordinate and conduct strategic survey and treatment plans. | Requires further discussion and may result in a certificate commitment. | Within Vol III, 13.9.6.8 PBM provides an invasive plant strategy including activities to undertake during construction, operations and closure that will be finalized as part of the EMS for permitting and before construction. PBM commits to contacting the NWIPC prior to permitting to acquire information about the status of invasive plants in the vicinity of the project. PBM will consider contracting NWIPC to coordinate and conduct strategic survey and treatment plans. | | | PBM will contact the NWIPC prior to permitting to acquire information about the status of invasive plants in the vicinity of the project. | | |

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| MOE-198 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 13.9.6.8 Establishing a Screening… | III | Comment: The Application stresses the importance of early detection systems, and ESD agrees. Recommendation: We request additional information on the screening program. Key points include: timing of inspections, frequency of inspections, qualifications of personnel conducting the inspections. | Within Vol III, 13.9.6.8 PBM provides an invasive plant strategy including activities to undertake during construction, operations and closure that will be finalized as part of the EMS for permitting and before construction. PBM commits to contacting the NWIPC prior to permitting to acquire information about the status of invasive plants in the vicinity of the project. PBM will consider contracting NWIPC to coordinate and conduct strategic survey and treatment plans. | Requires further discussion and may result in a certificate commitment. | Within Vol III, 13.9.6.8 PBM provides an invasive plant strategy including activities to undertake during construction, operations and closure that will be finalized as part of the EMS for permitting and before construction. PBM commits to contacting the NWIPC prior to permitting to acquire information about the status of invasive plants in the vicinity of the project. PBM will consider contracting NWIPC to coordinate and conduct strategic survey and treatment plans. | | | PBM will contact the NWIPC prior to permitting to acquire information about the status of invasive plants in the vicinity of the project. | | |
| MOE-199 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 13.9.6.8 Education and Training | III | Comment: Based on this section of the Application, my understanding is that invasive plant screening will be conducted by employees who have received some training, and who will have fact sheets made available to them. These employees will be expected to identify invasive species incidentally during their regular duties. This is not the most effective means of identifying invasive plants. Recommendation: Qualified, experienced personnel should conduct dedicated surveys for invasive plants. The extent and schedule for these surveys should be included in the EMP. The invasive plant EMP should be referenced in the Table of Commitments. | Within Vol III, 13.9.6.8 PBM provides an invasive plant strategy including activities to undertake during construction, operations and closure that will be finalized as part of the EMS for permitting and before construction. PBM commits to contacting the NWIPC prior to permitting to acquire information about the status of invasive plants in the vicinity of the project. PBM will consider contracting NWIPC to coordinate and conduct strategic survey and treatment plans. | Requires further discussion and may result in a certificate commitment. | Within Vol III, 13.9.6.8 PBM provides an invasive plant strategy including activities to undertake during construction, operations and closure that will be finalized as part of the EMS for permitting and before construction. PBM commits to contacting the NWIPC prior to permitting to acquire information about the status of invasive plants in the vicinity of the project. PBM will consider contracting NWIPC to coordinate and conduct strategic survey and treatment plans. | | | PBM will contact the NWIPC prior to permitting to acquire information about the status of invasive plants in the vicinity of the project. | | |
| MOE-200 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 13.10.10.3 | III | Recommendation: The power line should be designed such that bird electrocutions are impossible. This is standard design for modern transmission lines, it's in the best interest of the company and wildlife, and should be an EA certificate commitment. | Designs to make electrocutions 'impossible' are not, to PBM's knowledge, current industry best practices. PBM commits to a design minimizing bird electrocutions by deterring nest building or perching on power poles through design considerations as well as adopting a design consistent with the requirements of BC Hydro requirements that also implements solutions recommended by the Avian Power Line Interaction Committee (APLIC 2006). | Response satisfactory. | | | | PBM will minimize bird electrocutions by deterring nest building or perching on power poles through design considerations as well as adopting a design consistent with the requirements of BC Hydro requirements that also implements solutions recommended by the Avian Power Line Interaction Committee (APLIC 2006). | | |
| MOE-201 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 13.10.5.3 Key Wildlife Habitat Avoidance | III | Comment: Map 13.10-1 shows only high value moose habitat and riparian areas. This section refers to all key habitat including that amphibian breeding, cottonwood stands, moose calving (location not known) and winter habitat, deer habitat (not identified), and migration corridors. Much of this information is known, having been collected during the baseline work. Recommendation: All key wildlife habitats should be compiled and presented in the Wildlife Management Plan. This would then be used to plan development and design detailed, site specific avoidance and mitigation strategies, which should be part of the WMP. This plan should outline key mitigation strategies referenced in the Effects Assessment Tables, and will therefore comprise is a significant aspect of MOE – RSPD's review. | For permitting and prior to construction, as part of the EMS, PBM commits updating the Wildlife Management Plan to address the recommended points. | Requires further discussion and may result in a certificate commitment. | For permitting and prior to construction, as part of the EMS, PBM commits updating the Wildlife Management Plan to address the recommended points. | | | EMP | | |
| MOE-202 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 13.10.5.3 Wildlife Sensitive Period Avoidance | III | Comment: Top of page 13-90 states moose calving habitat may be identified during moose surveys outlined in Section 14.9. These surveys are scheduled for winter, and would not discover calving habitat. Calving habitat is impossible to predict using habitat models. Recommendation: Spring aerial surveys for moose cow-calf pairs would identify areas used for calving. This information should be used to inform the wildlife management plan | PBM commits to a winter and spring ground based and aerial survey for moose and mule deer during the 2010/11. PBM has agreed to support helicopter flights for LBN members to assess high moose use areas. A wildlife biologist retained by PBM may also be present for these flights. For permitting and prior to construction, as part of the EMS, PBM commits to updating the Wildlife Management Plan. | Response satisfactory. | PBM completed, with LBN participation, a winter aerial survey for moose and mule deer during the 2010/11. Efforts to complete a ground survey with LBN were aborted due to weather and other circumstances. The consultants report is expected to be submitted in April 2011. | | | | | |
| MOE-203 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 13.10.9.3 Wildlife Right of-Way and Reporting | III | Recommendation: The proponent should re-evaluate the workability and effectiveness of amphibians having the right-of-way over concentrate trucks and other mine traffic on the haul road. | A number of possible adaptive management responses have been identified. To minimize potential effects on western toads, roadside ditches in the mine site will be constructed and maintained to minimize standing water. Translocate toad tadpoles or egg masses from ditches (upon BC MOE approval) to a breeding pond. Install amphibians tunnels or cross-drain culverts to allow amphibians and small mammals passage. Additionally for permitting and prior to construction, as part of the EMS, PBM commits to re-evaluating the workability and effectiveness of amphibians having the right-of-way. | Response satisfactory. | | | | | | |
| MOE-204 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | 14.9.3.3 Field Sampling Design | III | Comment: Moose populations vary annually due to natural influences such as the severity of winter and snow pack. Recommendation: In order to capture some of this variation and provide a more effective and statistically powerful monitoring program, we recommend more than one year of monitoring pre construction. | PBM commits to a winter and spring ground based and aerial survey for moose and mule deer during the 2009/10. PBM has agreed to support helicopter flights for LBN members to assess high moose use areas. A wildlife biologist retained by PBM may also be present for these flights. | Response satisfactory. | PBM completed, with LBN participation, a winter aerial survey for moose and mule deer during the 2010/11. Efforts to complete a ground survey with LBN were aborted due to weather and other circumstances. The consultants report is expected to be submitted in April 2011. | | | | | |
| MOE-205 | MNRO, Chris Schell | 20-Oct-10 | Environmental Management System | 9 | Appendix 37 Section 3.4 | | Comment: Given the difficulties in accurately mapping mule deer overwintering habitat, and the resultant high degree of uncertainty of the result, this does not appear to be the appropriate tool to identify project impacts. Recommendation: Select a more effective means of gathering baseline information for mule deer. Then conduct an effects assessment using this information. | PBM commits to a winter and spring ground based and aerial survey for moose and mule deer during the 2010/11. PBM has agreed to support helicopter flights for LBN members to assess high moose use areas. A wildlife biologist retained by PBM may also be present for these flights. | Response satisfactory. | PBM completed, with LBN participation, a winter aerial survey for moose and mule deer during the 2010/11. Efforts to complete a ground survey with LBN were aborted due to weather and other circumstances. The consultants report is expected to be submitted in April 2011. | | | | | |
| MOE-206 (1) | MNRO, Chris Schell | 21-Oct-10 | Environmental Management System | 9 | | | The 10 and 28 year ages you referred to are for lake whitefish in northern lakes, near the Yukon border. In my experience LW around here rarely get over 10 years old. This is born out by Dave Bustards 2004 report where the oldest LW was 11 (captured in the 1940s), but most of the mature fish in the 2004 sampling were in the 4-6 year range, with the oldest 3 fish only 7 years old. In contrast, over half or the lake trout taken from Morrison Lake in 2004 were over 15 years old, with the oldest 6 fish more than 20 years old (oldest 38!).<br><br>In a general sense, I have no problem if Pacific Booker wishes to continue with lake whitefish for federal EEM purposes. It's an easy population to get a sample, and should provide some ability to measure impacts. There are several reasons lake trout life history predisposes them to accumulate metals faster than whitefish however. (comment continued below) | see below | See below | | | | | | |

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| MOE-206 (2) | MNRO, Chris Schell | 21-Oct-10 | Environmental Management System | 9 | | | They are piscivorous, therefore more prone to bioaccumulation, and during the summer when the lake is stratified, they are almost entirely confined to the hypolimnion, where the effluent is going to be discharged, and not mixed with the rest of the water column until fall turnover.<br><br>Finally, since they live 2-5 times longer on average than whitefish, they would accumulate metals longer and would therefore be one of the first in the lake to demonstrate sub-lethal population level effects (eg; reproductive failure) due to chronic, long term metals exposure. Strictly from a public health/country foods standpoint, however, some monitoring of the metals content of the populations that support angling is necessary. The recreational fishers using the lake will likely not feel safe eating the fish without such monitoring in place. While public health is not our mandate, impacts on recreational fisheries is very much MoE-RSPD's concern. (comment continued below) | see below | See below | | | | | | |
| MOE-206 (3) | MNRO, Chris Schell | 21-Oct-10 | Environmental Management System | 9 | | | If lake trout in Morrison Lake do experience elevated metals levels, and become subject to a public health warnings, this will have significant impacts on the recreational fishery. This is an impact that would be missed without monitoring in place.<br><br>Morrison Lake's lake trout population and its associated fishery are key issues for MoE-RSPD on this project. With a risk of water quality impacts, monitoring programs for this species must be in place in order to identify any adverse affects. | Vol III, 13.5 provides a Fish and Fish Habitat Management Plan. Data will be collected on fish size (length and weight), age (scale, fin ray, and otolith analysis), catch-per-unit effort (CPUE), external condition, and tissue metal analysis. Stream studies will concentrate on coho salmon (Oncorhynchus kisutch) and rainbow trout (Oncorhynchus mykiss) because they are the only fish species present in streams at the mine site. Lake studies will concentrate on lake trout (Salvelinus namaycush) that were found at all lake sampling sites. For permitting and prior to construction, as part of the EMS, PBM commits to updating the Fish and Fish Habitat Management Plan to address the recommended points. | Requires further discussion and may result in a certificate commitment. | PBM has updated the Fish and Fish Habitat Management Plan and submitted in March 2011. For permitting and prior to construction, as part of the EMS, PBM commits to updating the Fish and Fish Habitat Management Plan to address the recommended points. Data will be collected on fish size (length and weight), age (scale, fin ray, and otolith analysis), catch-per-unit effort (CPUE), external condition, and tissue metal analysis. Stream studies will concentrate on coho salmon (Oncorhynchus kisutch) and rainbow trout (Oncorhynchus mykiss) because they are the only fish species present in streams at the mine site. Lake studies will concentrate on lake trout (Salvelinus namaycush) that were found at all lake sampling sites. | | | EMP | | |
| MOE-207 | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | App A.2 Morrison Screening Evaluation Table 091027 | Addendum | Comment: Review of the supplemental information and comparison with the screening evaluation table, indicates that requested information and clarification has not been adequately provided for several key areas. Refer to MoE letter dated October 22, 2010. (C. Stewart) | The complete Screening Response Table (Short List) was submitted to EAO. | No further response required. | | | | | | |
| MOE-208 | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | App C. Feasibility Study Vo. 1 (Wardrop 2009) | Addendum | Page 4-22: Comment, Rock strength within the fault zones is rated as POOR, with a hydraulic conductivity of 10-5cm/sec compared with 10-7cm/sec for more competent bedrock. The strike of the west fault intersects with Morrison Lake, providing a direct conduit to the open pit; which may increase once mining removes material within and surrounding the fault zones. Water inflow to the pit from Morrison Lake may prove to be a significant water handling issue as well as having implications on pit stability. It is unclear whether or not the East Fault Zone intersects Morrison Lake. (Application, C. Stewart, Action; Further assessment regarding the hydraulic conductivities of the fault zones and connection with the open pit is required. Also refer to comment page 4-54 and App k comments below.) | After the Feasibility Study was published and in response to MOE queries PBM completed additional open pit site investigation and drilling in 2010. The results of this site investigation are documented in Appendix AG. Additonal information is also provided within Appendix H. PBM commits to further assessment of hydraulic conductivies during detailed design. Within the water managment plan EAC Vol III 13.3 if higher hydraulic conductivities are determined to exist alternate methods will be investigated, including grouting of fault/fractures around the pit area. Regarding the potential for seepage the maximum depth of Morrison Lake is ~10m in the immediate vicinity of the open pit and that the pit lake will be maintained below the elevation of Morrison Lake to ensure any seepage will be to the open pit. | Unresolved; further discussion required. Carry forward. | The potential for seepage between Morrison Lake and the open pit is addressed in Section 6.3 and 7.3 of RRR Rev.2. | | | Condition #15 | | |
| MOE-209 | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | App C. Feasibility Study Vo. 1 (Wardrop 2009) | Addendum | Page 4-27: Comment. Table 4.11 provides material balances per mining phase. The four phases will produce varying tonnages of overburden, waste and ore and within that, the breakdown of PAG and NPAG. In terms of the use of NPAG for construction or "mitigation", further refinement is required for each phase in regard to; a) the ability to segregate the available NPAG from the PAG, and b) the sequencing of NPAG generation such that it is available for its intended purpose at the time required. For example, there are discussions on using NPAG as basal material for the waste rock dump and low grade ore stockpiles. Is the material available to actually accomplish this? (Application, C. Stewart, Action: Refine the segregation and availability of NPAG material for each of the 4 mining phases and relate this to the relative usage of the material. Relate this to any water quality modeling which may have incorporated some mitigative effect of the use of NPAG). | PBM has committed to preferentially placing any segregated waste rock in natural drainage channels beneath the waste rock dump. However the prediction of ML/ARD is not based on this placement of segregatged waste rock in any way mitigating the ML/ARD. Therefore the waste rock management plan is not dependant on segregation. All waste rock is to be stored in a dump location within the catchment of the open pit so surface drainage and and seepage are collected in the open pit. Morrison open pit water quality is an analogue using Bell and Granisle Mines EDCM on the basis of acid rock drainage from the waste rock dump. | Unresolved; further discussion required. Carry forward. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. The preliminary plan for segregation of mine rock is presented in Section 5.2 of RRR Rev.2. | | | Condition #3 | | |
| MOE-210 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management Plan | 9 | App C. Feasibility Study Vo. 1 (Wardrop 2009); 2.6 "Water Management" | Addendum; RRR | Page 4-54, 4.9.1 Mine Water Management, Comment: A significant assumption is being made that "no major pumping will be required from the pits due to the low permeability of the country rock." This statement would appear to ignore the two major faults identified within the pit boundary, the west fault connection to Morrison Lake, the close proximity to Morrison Lake of the pit and the increased hydraulic conductivity of the fault zones and intensely altered country rock. (Application, C. Stewart, Action: Provide the specific rationale and supporting information for the stated conclusion, a sensitively analysis on various potential in-flow volumes, mitigation strategies to deal with these increased flows and the potential impacts to the mine operation, water handling and water quality for the various in-flow scenarios.) | The Comment reference includes a quotation from the Feasibility Study published in March 2009. The water management plan was updated in September 2009 EAC Application and most recently in Addendum Appendix AC May 2010. Specific pumping rates and pump sizes have been determined and are presented therein. Further documentation of the water management plan is provided in the RRR. | Partially resolved. Further information required with the new proposal. | Additional information is presented in RRR Rev.2 Section 7. | | | Condition #17 | | |
| MOE-211 | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | App D. Feasibility Study Vo. 3 (Wardrop 2009), App E. Feasibility Study Vo. 4 (Wardrop 2009, App F. Feasibility Study Vo. 5 (Wardrop 2009) | Addendum | Appendix D, E, F: Feasibility Cost Analysis: It would appear that major cost centre's not considered in the feasibility evaluation would include: • All costs associated with the installation of a cover over the waste rock dump; • All costs associated with the management of the low grade ore stockpile at closure; • All cost associated with the construction and operation of a mine water collection and treatment system, especially if required from the start of mine development. This would also include the cost of replacing an HDS plant every 20-25 yrs, sludge handling, lime and energy procurement, etc. (Application, C. Stewart, Action: Incorporate all of the above and other previously not included costs and incorporate into current feasibility evaluation; with particular emphasis on options development.) | These costs are substantially included, as estimated by KCB, with a contingency allowance that is adequate to cover any additional items. Revision of the Feasibility Study may occur but would also include increased metal prices and savings resulting from a detailed design. Note that the low grade ore stockpile will have been milled at closure so the costs are limited to reclamation of the footprint. Additionally note that the feasibility cost estimate includes a signfiicant contingency as allowance for other costs that may be in excess of the feasibility cost estimate. | Unresolved; further discussion required. Carry forward. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The financial security is expected to now exceed $100 million. PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. PBM has considered the effect of the financial security in the project financial viability. | | | PBM will resolve the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | | |
| MOE-212 | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | App H. 2009 Morrison Geology and Faults (PBM 2010); Appendix AG | Addendum | Parts 1 & 2: Pyrite Halo and Morrison Open Pit Wall Characterization: Previous comments provided by the author (C. Stewart) regarding the presence or absence of a pyrite halo and the sufficiency of pit-wall characterization stand. Although some further work was conducted by BPM, (diamond drill and ABA), the work was insufficient to complete the characterization of the pit wall materials. Both analogues (Bell and Granisle) have identified pyritic halos, and due to the similarities between all three deposits, there is insufficient evidence to determine that the Morrison deposit is different. (Cont. below) | In response to MOE previous queries PBM completed additional open pit site investigation and drilling in 2010. The results of this site investigation is documented in Appendix AG. Additonal information is also provided within Appendix H. | Unresolved; further discussion required. Carry forward. | In response to MOE previous queries PBM completed additional open pit site investigation and drilling in 2010. The results of this site investigation is documented in EAC Addendum -Appendix AG. Additonal information is also provided within Appendix H. A summary assessment of the data is also included in Appendix AB, Section 3.3.4. | | | Noted | | |

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| MOE-214 | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | App H. 2009 Morrison Geology and Faults (PBM 2010); Appendix AG | Addendum | Part 3, Hydraulic Conductivity of Fault: Lack of direct test work to determine the hydraulic conductivity of the East and West Fault zones in the open pit represents a significant data gap. As stated in Appendix H (page 15), "the hydraulic conductivity across the two faults through the Morrison deposit were estimated from values measured elsewhere on the property. No direct testing…was completed." Given the potential issues relative to pit inflow, the lack off real data regarding the fault hydraulic conductivity, is considered a major baseline gap in the database. Note that the surface expression of the East Fault Zone is up to 150m wide; (Appendix I), which represents a substantial width of elevated hydraulic conductivity (Figure 4.1) and potential for significant in-flow to the open pit. The cross sections indicate a width approaching 200m, (Figure 4.2, 4.3). Such a significant structure should have several tests conducted at various depths to properly define the conductivity. (C. Stewart, Action: refer to comments above). | In response to MOE previous queries PBM completed additional open pit site investigation and drilling in 2010. The results of this site investigation is documented in Appendix AG. Additonal information is also provided within Appendix H. | Unresolved; further discussion required. Carry forward. | In response to MOE previous queries PBM completed additional open pit site investigation and drilling in 2010. The results of this site investigation is documented in Appendix AG. Additonal information is also provided within Appendix H. An updated assessment is included in Section 6.3 of RRR Rev.2. | | Additional hydrogeologic assessment is presented in the 3rd Party Review Response Report. | | | |
| MOE-215 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management Plan | 9 | App K. 2007 Review of On-Site Hydrological Monitoring Data | Addendum | Comment: As noted on page 4-1, "there is relatively limited and incomplete coverage of hydrological data set for the Project area." (Rescan, February 2007) The discussion goes on to state that there are gaps in key areas of the project area, followed by a series of recommendations to continue and expand the hydrological monitoring program. It is unclear if these recommendations were followed up. (C. Stewart, Application, Action: Understanding the hydrologic regime of the project area is critical for project design, water quality predictions and identification of potential impacts to the receiving environment. A further evaluation of the robustness of the hydrological studies completed to date is necessary to ensure that the predictive power of the work is credible. As this is considered baseline, and represents a major component of project design, limitations of the hydrologic program have significant implications for all of the predictive work and the potential impacts to the receiving environment, and as such must be addressed at the application stage.) | The referenced comments are from 2007 documents. Significant site investigation has occurred since the date this document was published. The information contained within Appendix K is updated in other Addendum documents. | Unresolved; further discussion required. Carry forward. | The referenced comments are from 2007 documents. Significant site investigation has occurred since the date this document was published. The information contained within Appendix K is updated in other Addendum documents. Appendix I RRR Rev.2 documents overall data collection. PBM collected additional data in 2009, 2010 and 2011. The data throuhg January 2011 was used in preparing RRR Rev.2. A comparison of local precipitation data with regional data is included in Section 3.2 of RRR Rev.2. | | Additional hydrogeologic assessment is presented in the 3rd Party Review Response Report. | | | |
| MOE-216 (1) | MOE, Craig Stewart | 22-Oct-10 | Environmental Management Plan | 9 | App M. KP Geotech Site Investigations Report 060707 | Addendum | Figure 3.1 TMF Drill hole and Test pit Locations: The figure clearly demonstrates that geotechnical studies were focused on the North and South dam areas of TMF, while the vast majority of the impoundment has not been tested for overburden thickness, hydraulic conductivity, and structural integrity (faults, etc.) A major fault structure has been identified trending through the impoundment; however, this has not been tested to determine its significance relative to TMF seepage. There is an approximate distance of 1.8 km to 2.0 km between drill holes (N – S embankment, and there has been no testing to the SE or NW. (Cont. below) | The referenced comments are from 2007 documents. Significant site investigation has occurred since the date this document was published. The referenced fault structure is inferred derived from regional information so it is not certain that one exists. Additionally the controlling factor is hydraulic conductivity of tailings and till. The information contained within Appendix K is updated in other Addendum documents. (cont. below) | Partially resolved. MNRO has greater level of comfort. Confer with Vicki Carmichael on this issue but further confirmatiory information appropriater. | | | Additional hydrogeologic assessment is presented in the 3rd Party Review Response Report. | | | |
| MOE-217 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management Plan | 9 | App M. KP Geotech Site Investigations Report 060707 | Addendum | Table 4-1: Summary of Rock Permeability Results: test work on drill hole DH06-10 (testing the TMF north embankment), found that the "Permeability too high to measure" as the rock would not hold water. Geology was indicated as volcanic. There was no discussion as to the significance of this in terms of seepage rates, impacts to the receiving environment and mitigation strategies. (Application, C. Stewart, Action: What is the significance of and the implications of the very high permeability encountered in this location.) | The referenced comments are from 2007 documents. Significant site investigation has occurred since the date this document was published. The information contained within Appendix M is updated in other Addendum documents. The controlling factor for seepage is the hydraulic conductivity of tailings and till. PBM commits to complete further characterization of the TSF underlying material during construction and that any areas of high conductivity will be lined with till. | Unresolved; further discussion required. Carry forward. | Drill hole DH06-10 indicated that hydraulic conductivity could not be measured for the test from 21.9 m to 53.6 m within the bedrock.<br>The drill hole is located 250 m downstream of the centerline of the<br>left (northwest) abutment of the North Dam. The test log does not indicate what the limit of the test equipment was – for example, on a recent KCB project the limit of the test equipment (pump capacity) limited test values to > 10 -6 m/s. KCB has reviewed the drill core logs and photographs and no highly fractures zones were<br>identified and it is uncertain why the test was not successful.<br>Hydraulic conductivity tests carried out in 2007 by KCB in DH07-<br>02, located 250 m upstream indicated bedrock hydraulic conductivity of 2.0E-07 m/s (26.0 to 35.0 m depth). | | Additional hydrogeologic assessment is presented in the 3rd Party Review Response Report. | | | |
| MOE-218 (1) | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | App S. Geosim ABA Modeling (Geosim 2010) | Addendum | Comment: This appendix updates the geochemical model with the inclusion of the 2010 diamond drilling program and subsequent ABA analysis. Statistics were provided and the general distribution of materials was illustrated. Table 1 illustrates the ABA statistics based on two major lithologies (BFP and Sediments), but it does not distinguish between ore and waste. These are two very important sub-categories and require evaluation distinctly from each other as the vast majority of ABA samples are collected within the defined ore zone (Figure 1) and is clearly illustrated in Figure 3, which indicates large gaps in the dataset especially around the pit perimeter. The sample number discrepancy (waste to ore) is likely to bias the overall results, and as such the waste/ore sub-populations require splitting out and interpreted separately as they will be handled separately during the mining and milling process. (Cont. below) | See below | Unresolved; further discussion required. Carry forward. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. | | | Condition #8 | | |
| MOE-219 | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | App S. Geosim ABA Modeling (Geosim 2010) | Addendum | Comment: Page 4 notes that "sample support was weak in some regions of the outer pit wall where ABA estimates have been extrapolated over 200m from the closest sample" as illustrated in Figure 3. This indicates that the 2010 drilling program to address the lack of sampling along the outer pit wall and the area between the ore body and the pit wall was incomplete. (C. Stewart, Application, Action: The 2010 program was requested to address data gaps in the waste rock characterization and especially to assist in the characterization of the final pit wall material which will influence the long-term pit water quality. It is apparent that further in-fill drilling would have been appropriate and would certainly have assisted in a more refined predictive model. Without further refinement, the assumption must be made that those areas not drilled will be acid generating.) | As all the waste rock will be stored as PAG and the pit walls characterized as PAG with drainage chemistry been calculated on that basis, further refinement of the analysis will not significantly change the conclusions and design. PBM commits that appropriate pit wall characterization will occur during operations. | Unresolved; further discussion required. Carry forward. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. | | | Condition #8 | | |
| MOE-220 (1) | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | App S. Geosim ABA Modeling (Geosim 2010) | Addendum | Comment: Table 4: Linkage to this table as well as to Table 1 is through the kinetic test work; which is to evaluate rates of acid generation, neutralization, lag times, and to enable "up scaling" of the results. Five humidity cell tests (4 yrs of data) and four cubes/2 barrels field pads were established. It is unclear which of these may be ore or waste. Sulphide sulphur content for all of these was less than 1.8%. (App XI tables 4.1 and 4.2). Based upon the overall data sets, and as the goal is to have samples that represent the range of materials to be encountered, (AI Requirement), it would appear that the upper ranges of sulphide bearing materials are not represented. As indicated in Table 1 maximum total sulphur was 10.73% in the BFP and 9.34 in the sediments; which represents a significant difference from test maximums. As the kinetic tests to date indicate that acid generation within at least 14% of the waste material could occur within 3.5 years of exposure, it is reasonable to assume that exposure of materials with 4 – 5x more sulphide may reduce the lag time significantly. (Cont. below) | see below | Unresolved; further discussion required. Carry forward. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. The management plan for mine water during operations is based on controlling the pH of tailings water as described in Section 8.1 of RRR Rev.2. The managment plan for ARD from waste rock, as it is placed back into the open pit, is to control the pH as described in Section 8.3.3 of RRR Rev.2. | | | Condition #8 | | |

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| MOE-220 (2) | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | | | Without the detailed characterization and distribution information material for the waste rock alone, it is difficult to evaluate the significance of information presented. The significance of this is that a treatment plant may require building prior to start-up, to ensure that poor water quality may be handled immediately. (C. Stewart, Application: The kinetic characterizations of the materials for the Morrison Project are considered to be unrepresentative of the materials to be disturbed. This is especially true for materials with greater than a maximum of 2.6% and a median of 1.23% sulphide sulphur. As these are the materials with the greatest likelihood of generating acid upon exposure in the short term, it represents a significant risk to the project planning and water quality issues. Action: Initiate sufficient new humidity cells to provide a more comprehensive representation of the materials to be disturbed.) | The number of humidity cell samples (5) is considered low for the quantities of waste rock to be generated at site. The limitation on the number of humidity cell samples is principally offset by the large water quality database for both the Granisle and Bell Mine sites which has been used as an analogue comparison for Morrison waste rock. Due to the Bell and Granisle analogue and other available data PBM has prepared the waste management plan on the worst case basis storing all waste rock as if it were PAG. The predicted pit water quality is done on the basis of the waste rock dump being PAG and considering the analogue of Bell and Granisle EDCM. Updated TSF water quality is also provided on this basis. PBM commits to continuing field kinetic testing throughout the permitting process and during operations. | Unresolved; further discussions required. Carry forward. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. The management plan for mine water during operations is to control the pH of tailings water as described in Section 8.2.1 of RRR Rev.2. The managment plan for ARD from waste rock, as it is placed back into the open pit, is to control the pH as described in Section 8.3.3 of RRR Rev.2. | | | | PBM will continue field kinetic testing throughout the permitting process and during operations. | | |
| MOE-221 | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | App S. Geosim ABA Modeling (Geosim 2010) | Addendum | Table 3: Block Model Stats By Rock Code. This table lumps all samples in together. It would be more valuable to pull out the waste rock material (<0.2 %Cu) and evaluate the waste blocks. By lumping in with the ore samples, the interpolation may be skewed. Note that this was requested previously in both the AIR and subsequent correspondence. Note also that is was acknowledged in the modeling report that the outer perimeter sampling was weak; which is apparent in Figure 4 where only 3 drill collars are indicated outside the ore zone, approximately 50 within for the 760 level. (C. Stewart, Application, Action: Re-interpret the block model illustrated in Table 3 using a cut-off of >0.2% Cu and less than 0.2; thereby separating out the ore from the waste.). | As all the waste rock will be stored as PAG and the pit walls characterized as PAG with drainage chemistry has been calculated on that basis, further refinement of the analysis will not significantly change the conclusions and design. PBM commits that appropriate pit wall characterization will occur during operations. | Unresolved; further discussions required. Carry forward. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. The management plan for mine water during operations is to control the pH of tailings water as described in Section 8.2.1 of RRR Rev.2. The managment plan for ARD from waste rock, as it is placed back into the open pit, is to control the pH as described in Section 8.3.3 of RRR Rev.2. | | | | Condition #8 | | |
| MOE-222 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | App T. Waste Rock Storage Alternatives (PBM 2010) | Addendum | Comment: Overall, the alternatives assessment for waste rock storage strategy is weak, with the default position of short term cost and expediency overriding long term costs and site commitment, environmental risk reduction and other aspects of evaluation | See below. | Further discussions required. New proposal may resolve most ot this issue. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. | | | Condition #8 | | |
| MOE-223 (1) | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | App T. Waste Rock Storage Alternatives (PBM 2010) | Addendum | Page 7, para 1: States that the choice of option B as the tailings impoundment site, precludes the need to monitor in Nakinilerak Lake watershed. This is incorrect as seepage, surface drainage and other inputs will occur on the Nakinilerak side of the impoundment. As a results, baseline studies pre-development are required as well as monitoring through construction, operation and post-closure phases. (C. Stewart, Permitting, Action: Monitoring of surface and groundwater quantity, quality and biotic/other studies will be required within the Nakinilerak watershed as there will be inputs and possible impacts to that area from the tailings impoundment.) (Cont. below) | Although the risks to this lake are much lower than to Morrison Lake, baseline water quality, sediment and fish tissue sampling is required prior to mine construction as a discharge from the tailings storage facility will enter this lake and unforeseen accidents or effects may occur (G. Tamblyn, Permitting) PBM commits to collecting Nakinilerak Lake Baseline data prior to construction. PBM has already initiated a field work program to commence collection of baseline data. | Currently being resolved to some degree; on-going baseline information being collected. Excpect updated informtion to be provided with new proposal. | | | PBM has collecgted baseline data from Nakinilerak Lake and Stream 10 in September 2011. | | | |
| MOE-223 (2) | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | | | Appendix 1: Relative Costs; The analysis seems to minimize or not include certain aspects of the comparative analysis such as: • Changes to the waste rock dump in terms of height, grade and haul distance, return time and other factors; which thereby increases the incremental haul costs over time • The haulage and equipment costs required to build the waste rock dump cover. • The very long term collection, treatment, infrastructure, maintenance and other on-going costs such as lime, power and the replacement of the treatment plant every 20-25 yrs or so. Application, C. Stewart, Action: Re-do the cost comparison between the preferred waste rock disposal option and other options including all of the on-going costs over time into post-closure, as well as the incremental changes to costs as the waste rock dump evolves, and any changes to the mine equipment proposed, (i.e. haul truck capacity). | PBM believes that the environmental assessment should be completed on the project as designed. PBM believes the alternatives as presented show a signfiicant cost benefit for the selected alternative that will not be outweighed by further refinements to the financial model (ie the total PV capital and operating cost of the water treatment plant installed in Year 1 is $35 million and in Year 45 is $17 million, therefore, even if disposing of the waste rock in the TSF entirely eliminated the water treatment plant, the savings would not justify the additional $66 million dollar cost difference.). | Further discussions required. Expect to be resolved with the new development proposal. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The closure plan for the TSF and mine area has been revised to reduce the long term risks associated with acid rock drainage. | | | Condition #8 | | |
| MOE-224 | MOE, Craig Stewart | 22-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | App Y. Low Grade Ore Stockpile Alternatives (PBM 2010) | Addendum | Page 4: para 3. Correction in that the LGO stockpiles should be 50 and 35 million tonnes respectively rather than thousand-million tonnes. Page 7: Primary strategy for any “ore” stockpiles on the project will be removal and subaqueous disposal in either the pit or the tailings impoundment. (C. Stewart, Application and Permitting, As part of the potential closure plans, the removal and submergence of any remaining surficial ore piles must be accounted for.) | Acknowledged. The LGO stockpile is a maximum of 35 million tonnes with a total throughput of 51 million tonnes over 21 years. At no time does the tonnage in the LGO stockpile exceed 35 million tonnes. Early closure scenarios are addressed in Appendix AU Reclamation and Closure Financial Security. In the event that the LGO is not milled, PBM commits that any un-processed material from the LGO stockpile will be placed in the open pit and flooded. | Resolved. | The RRR Rev.2 presents a new mine closure plan, which includes placement of unprocessed LGO back into the open pit. | | | | | |
| MOE-225 | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | App Y. Low Grade Ore Stockpile Alternatives (PBM 2010) | Addendum | Page 7: It is acknowledged that seepage and surface run-off will be actively managed; however, more concrete plans as to how this will occur must be developed. Is a liner required? (C. Stewart, Application and Permitting: Provide details as to the mitigation strategy for low-grade ore stockpile seepage and surface drainage). | See appendix AC and Appendix AB. Runoff is collected in a sediment pond and returned to the tailings pump outbox. Seepage is limited to 0.63 m3/hr. In the event that the LGO is not milled, PBM commits that any un-processed material from the LGO stockpile will be placed in the open pit and flooded. PBM commits to develop a suitable management plan for permitting. Also see Vol III Appendix 13 and 14. Note that 2 monitoring wells are proposed are proposed for monitoring groundwater flow and quality from low grade ore stockpile. | Partially resolved. Expect further resolution as part of the new proposal. | | | | Carry forward to Permitting | | |
| MOE-226 | MOE, Craig Stewart | 22-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | App AA. Conceptual Design for a High Density Sludge Water Treatment Plant (SGS 2010) | Addendum | Comment: Table 2, page 9: Indicates that the expected feed chemistry will be alkaline. What would be the impacts to the design system using feed chemistry that is decidedly acidic? | The Process Criteria design parameters include a feed pH of 4.0. It is unlikely the pH will be more acidic however if it is additional lime will be added as required to achieve the process pH of 9.3. | Resolved. | | | | | | |
| MOE-227 | MOE, Craig Stewart | 22-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | App AA. Conceptual Design for a High Density Sludge Water Treatment Plant (SGS 2010) | Addendum | Comment: Would have been helpful to have the January 5th memo “Water Treatment and Discharge Rev B” attached with this design report. Unclear as to where this memorandum may be located. (Application, C. Stewart, Action: provide the location of this memorandum document.) | The January 5th memo provided water chemistry for the design which is presented in Appendix AA, Table 2. The memo is on file with PBM. | Unresolved. This memo would be appropriate to include as an appendix as part of the new proposal. | Water treatment of pit wall water is discussed in Section 8.3.5 and treated water parameters are included in Table 8.11 of RRR Rev.2. | | | Noted | | |
| MOE-228 | MOE, Craig Stewart | 22-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | 14; App AS. Natural Gas Pre-Feasibility Rev.0(2009 | III; Addendum | Report discusses the various fuel options for the Morrison Mine operation; primarily that of liquefied and condensed natural gas; LNG and CNG). Discussions consider various costs, infrastructure, supply risks, etc., however the study does not specifically address the energy requirements post-closure for the operation of the collection and treatment system. The very long term collection and treatment of mine waters will have substantial energy requirements which may be unique in terms of supply and management. Due to the importance of this operational component, the predicted energy usage, costs, supply, risks and other factors must be considered specifically for the long-term collection and treatment system. (Application. C. Stewart: Action; Provide a feasibility assessment of the energy requirements, costs, procurement, management, risks and other associated variables and considerations specifically for the post-closure, long term collection and treatment system.) | The energy supply and risks have been presented for each phase of the project. The primary energy supply for the water treatment plant is electricity suppled via the transmission line; also used during operations. A backup generator will provide emergency power supply. Risks to the energy supply are addressed Vol III, Chapter 14 Accidents and Malfunctions. Additionally the open pit will act as a attenutation pond. The rate of pit re-fill is slow such that the 4m elevation difference represents ~ 6 months pit filling with no water extracted and treated. This 6 months provides significant time for any interruption in energy supply or failures to be repaired or dealt with. | Partially resolved. Likely all to beresolved once put in context with new proposal. | | | | Noted | | |

| Issue No. | Commenter & Agency | Date | Issue Theme | Section in TOR | EAC Chapter or Supporting Document | EAC Volume | Additional information or clarification required in Application | Proponent Response | Status of Issue as of 01-24-2011 | Additional Proponent Response | Additional Working Group Comments | Additional Proponent Response | Final PBM Response | Key Project Component Number | Status of Issues as of May 2012 |
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| MOE-229 | MOE, Craig Stewart | 22-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | App AU. Reclamation & Closure Financial Security | Addendum | This appendix discusses bonding requirements pursuant to MEMPR legislation for a variety of bonding requirements. Although a good initial attempt, the evaluations do not appear to consider the long-term costs for lime and fuel (large cost components), on-going maintenance (ditching, ditch cleaning, equipment), sludge handling, access (barge, road maintenance), and other factors in the comparison of the various scenarios; especially backfilling of the open pit. (Application. C. Stewart: Action; Provide an updated security assessment which also incorporates long term lime costs, energy, sludge management, site maintenance, monitoring, access, staffing and other associated variables and considerations specifically for the post-closure, perpetual, long term collection and treatment system.) Note that these long-term costs must be considered during the alternatives assessment. | Appendix AU was prepared considering the long term lime costs, energy, sludge management, site maintenance, monitoring, access, staffing and other associated variables and considerations specifically for the post-closure, perpetual, long term collection and treatment system. | Unresolved. Will require new long term cost determinations based on the new proposal. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. The financial security is expected to now exceed $100 million. PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. PBM has considered the effect of the financial security in the project financial viability. | | | Noted | | |
| MOE-230 | MOE, Craig Stewart | 22-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | App AW. Toxicity Tests (TLC50 and IC25) and Water Chemistry (PBM 2010) | Addendum | Comment: Although raw data and some other information were provided, there was no discussion regarding the results. What interpretation was made, the conclusion, applicability and implications to the project? Was metal analysis done on the water? Was a comparison made to predicted tailings water quality? Is the test chemistry reflective of the potential discharge quality? Page 81, section 6.2 discusses tailings supernatant water. Were these the same as the toxicity tests? (Application, C. Stewart, Action: Clarify the water quality information available for the toxicity test work.) | The available water quality for each test is stated within the Appendix AW Section 2. | Unresolved. | The available water quality for each test is stated within the Appendix AW Section 2. Updated water quality predictions for the TSF and open pit are presented in Section 8 of RRR Rev.2. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-231 | MOE, Craig Stewart | 22-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9) | Addendum | Page iii, discusses volume of seepage from the tailings impoundment.. Contradictory statement regarding the volume of seepage collected by seepage collection system is found and as previously noted, the characterization of the TMF basin is considered incomplete. Page 11, paragraph 2: States that little is known regarding Nakinilerak Lake. This statement speaks to the lack of baseline characterization of the lake as previously identified by the reviewers. As a recipient of mine related discharges and possible upset condition related discharges, the characterization of this area is a requirement. (Application:, C. Stewart: What are the existing conditions in Nakinilerak Lake, what resources are at risk, what is the predicted impact to the lake from ongoing influences and from potential upset conditions?) Note that this information has been officially requested during both the AIR period and the application screening period. | Although the risks to this lake are much lower than to Morrison Lake, baseline water quality, sediment and fish tissue sampling is required prior to mine construction as a discharge from the tailings storage facility will enter this lake and unforeseen accidents or effects may occur (G. Tamblyn, Permitting). PBM commits to collecting Nakinilerak Lake Baseline data prior to construction. PBM has already initiated a field work program to commence collection of data. | Currently being resolved to some degree; on-goiong baseline collection. Excpect updated informtion to be provided with new proposal. | PBM submitted and received feedback from MoE on a proposed plan. An updated Nakinilerak Baseline Data Plan incorporating the input of MoE (Greg Tamblyn) was prepared and submitted April 26, 2011. Baseline data collection proceeded in June 2011 on the basis of this plan. | | | PBM has collecgted baseline data from Nakinilerak Lake and Stream 10 in September 2011. | | |
| MOE-232 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9) | Addendum | Page 11, Paragraph 3: What is meant by restoration of an area following a spill as being "impractical"? (C. Stewart; Application/permitting) | The context of this statement is the discussion of impact of tailings dam failure. The full statement is "In the event of a failure incident, it is expected that the environmental clean-up would require recovery of the tailings, clean-up of the affected water, and construction of a new containment facility. Restoration of the area is considered to have a rating between "highly possible" to "possible, but impractical". " | Resolved. | | | | | | |
| MOE-233 | MOE, Craig Stewart | 22-Oct-10 | Closure, Decommissioning and Reclamation | 9.3 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9) | Addendum | Page 17, Table 2.3: It is noted that the inflow into the open pit is not considered in "Criteria for Water Management Facilities". As the open pit is a critical component of the overall site water management strategy, especially post-closure, its lack of inclusion within the water management is significant. (Application, C. Stewart, Action: Re-evaluate the flood design criteria for the site overall, incorporating the open pit as a component. During operation there will be pumping requirements (and storage in the TMF), while post closure will require storage and treatment. It also speaks to the volume of storage capacity which must remain free at all times in order to accommodate the events. Is this the case?) | Since publication of Appendix AX further investigation, analysis and design has been completed and is documented in Appendix AC. | Unresolved. Expect that the new proposal will be addressing this issue. | Water management and water balance is updated in Section 7 of RRR Rev.2. Rationale for zero discharge is updated for the Expected Case and a management plan is defined for the Upper Bound water balance case. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-234 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9) | Addendum | Page 18, Diversion Channels: Design criteria are based on "average" flows is insufficient to provide conservative protection for downstream infrastructure. Design criteria of 1:100/ 1:200 are more appropriate and reflect requirements at other mine sites. This is especially true in the case of predicted increasing precipitation and flows in the future. (C. Stewart, Permitting, Action: Design criteria for the diversion channels to be changed to handle flows predicted for the appropriate event as determined through discussions with appropriate MoE staff. A minimum of 1:100 year peak flow event is probable). | PBM commits to resolving appropriate design criteria with MOE during permitting. | Unresolved; further discussions required. Carry forward. | PBM commits to resolving appropriate design criteria with MOE during permitting. | | | Carry forward to Permitting | | |
| MOE-235 | MOE, Craig Stewart | 22-Oct-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9) | Addendum | Page 59, Hydraulic Conductivity: This section indicates testing around the margins of the impoundment (beneath the proposed dams) and partially within the impoundment, however, there is no indication that fault structures or contacts were drilled and tested for hydraulic conductivity. Refer to previous comments on TMF basin characterization. | Fault structures below the TSF are inferred based on mapping of regional geology. The TSF impoundment currently has wetland areas and ponds indicative that the underlying rock formations do not have a high hydraulic conductivity. The drilling test work that was done did not indicate high hydraulic conductivity and these results were used in modelling. PBM stresses that irrespective of the underlying rock formations the controlling factor for seepage from the TSF will be the hydraulic conductivity of tailings and till. PBM commits to complete further characterization of the TSF underlying material during construction and that any areas of high conductivity will be lined with till. | Unresolved; further discussions required. Carry forward. | Fault structures below the TSF are inferred based on mapping of regional geology. The TSF impoundment currently has wetland areas and ponds indicative that the underlying rock formations do not have a high hydraulic conductivity. The drilling test work that was done did not indicate high hydraulic conductivity and these results were used in modelling. PBM stresses that irrespective of the underlying rock formations the controlling factor for seepage from the TSF will be the hydraulic conductivity of tailings and till. TSF and open pit seepage are addressed in Section 6 of RRR Rev.2. | | Additional hydrogeologic assessment is presented in the 3rd Party Review Response Report. And Addendum 1. | Condition #12 | | |
| MOE-236 | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 6.3 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9) | Addendum | Page 75, Table 6.3/6.4: It is noted that Modified Sobek ABA analysis was used for testing the low sulphide and total tails. Resistance by the proponent to the use of the modified methodology has prevented its usage for characterization of ore and waste; thereby compounding difficulties in interpretation and comparison with tailings data. It was also interesting to note that for the combined tails, total S equaled sulphide sulphur, whereas in the low "S" tails, other forms of sulphur appeared to dominate. Given the sulphate detection limit, unclear of the significance as the two samples did not correlate well with each other. | On February 9, 2010, in response to prior comments, PBM provided to the Commentor and EAO a letter regarding the use of the Modifed Sobek ABA analysis methodology for characterization of ore and waste rock. The letter was from PBM's consultant recommending and explaining the rationale for the continued use for the project of the US Environmental Protection Agency Standard Sobek Neutralization Potential methodology. The Commentor acknowledged receipt of the letter and did not comment further. | Unresolved; further discussions required. Carry forward. | On February 9, 2010, in response to prior comments, PBM provided to the Commentor and EAO a letter regarding the use of the Modifed Sobek ABA analysis methodology for characterization of ore and waste rock. The letter was from PBM's consultant recommending and explaining the rationale for the continued use for the project of the US Environmental Protection Agency Standard Sobek Neutralization Potential methodology. The Commentor acknowledged receipt of the letter and did not comment further. | | | Noted | | |
| MOE-237 | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 7.3 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9) | Addendum | Page 76: It is not quite clear as to how the sulphide content for the cycloned sands was determined. Inclusion of the actual steps would have been helpful. As acid generation is known to occur at sulphide levels as low as 0.1%, the extra sulphide flotation circuit would provide that extra level of conservatism. (Application and permitting, C. Stewart, Action: Include the sulphide flotation circuit as a component of the cyclone sands development in order to ensure that sulphide sulphur content remains very low in the cyclone sands used for tailings dam construction). | The methodology is described on the page referenced by the Commentor. Actual steps are per standardized laboratory procedures. PBM commits to producing a non-acid generating cylcone sand for damn construction. PBM commits that if producing the non-acid generating sand requires adding a desulphidization circuit to the tailings processing one will be installed. PBM further commits to a QA/QC testing program and management criteria will be required to guide tailings sand placement. | Resolved. Expected that a desulphidization circuit will be incorporated for the contruction tailings stream to ensure quality. | | | | Condition #6 | | |
| MOE-238 | MOE, Craig Stewart | 22-Oct-10 | Geology and ML-ARD | 8.3 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9) | Addendum | Page 92/93, Cyclone Sands: Discusses cyclone sand generation for cleaner tailings dam construction. If sulphide flotation is necessary, does this extra step occur in the mill before the tailings to be used are pumped to the crest and cyclones? (Permitting, C. Stewart, Action: describe where a sulphide flotation process fits within the generation of the sand product. What will be done with the product from the sulphide flotation circuit?) | Volume I, Section 4.10.4.10 Process Page 4-58 Flotation plant tailings will be pumped to the tailings dam through two booster pump stations where the tailings will be cycloned from April to October. The coarse fraction would feed to a 200 m3 pyrite flotation cell (optional). (After pyrite removal the coarse fraction) tailings sand would be used to build the dam perimeter by the centre-line method, with the fine fraction (and high pyrite coarse fraction) discharged within the upstream side of the dam. | Resolved. Refer to 237 above. | | | | | | |

| Issue No. | Commenter & Agency | Date | Issue Theme | Section in TOR | EAC Chapter or Supporting Document | EAC Volume | Additional information or clarification required in Application | Proponent Response | Status of Issue as of 01-24-2011 | Additional Proponent Response | Additional Working Group Comments | Additional Proponent Response | Final PBM Response | Key Project Component Number | Status of Issues as of May 2012 |
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| MOE-239 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9) | Addendum | Page 95: The downstream cyclone sand blanket will have drainage associated with its application. What collection and pump-back systems will be in place to collect and return to cyclone sand drainage back to the tailings impoundment? | Appendix AX and Appendix AC describe the design and function of seepage collection ponds and pump systems that will also collect and return cylcone sand drainage back to the tailings impoundment. | Resolved. | | | | | | |
| MOE-240 | MOE, Craig Stewart | 22-Oct-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9) | Addendum | Page 116: Geotechnical Conditions: Till thickness is described as typically being 30m thick, with one area up to 55m thick. In the determination of waste rock dump foundation, the 55m thickness was used. Using the maximum thickness encountered appears to be optimistic and further characterization of the actual area for the waste rock dump foundation is required. The thickness of the till has significance in many areas; one of which is seepage rate and quality. (C. Stewart, Application, Action: Confirm the characterization of the underlying foundation material of the area designated for the waste rock dump and the low grade ore stockpile, and re-calculate the density and hydraulic conductivity based upon the refined characterization.) | The use of the maximum thickness in the context described on Page 116 was solely to assess geotechnical stability. Assessment of hydraulic conductivity of the underlying till was not based on the maximum thickness. | Unresolved. Information on what values were used for till thickness and how it was detemined and applied were not provided. | The use of the maximum thickness in the context described on Page 116 was solely to assess geotechnical stability. Assessment of hydraulic conductivity of the underlying till was not based on the maximum thickness. | | | Noted | | |
| MOE-241 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9); 2.6 "Water Balance" | Addendum; RRR | Page 126: Water Balance: Recently, MEMPR brought forth concerns regarding the storage of large volumes of water within the tailings impoundment. This has major implications on discharge rates, water quality, potential impacts to receiving environments, water balance determinations, infrastructure, construction, operational requirements, collection and treatment scenarios, seepage rates and quality, etc. (C. Stewart, Application, Action: A decision regarding the permissible storage of supernatant is necessary in the near term as it affects a significant portion of the predictive work. Evaluate the effects to the project design and operation, that the inability to maintain a highly flooded impoundment would have). | Additional information regarding water balance is provided in the RRR. PBM commits during detailed design to determine the best application of the alternatives to manage the water balance to achieve zero contact water discharge and minimize the accumulation of surplus water. For example PBM commits to diverting, as is practical, clean surface water around the TSF at various stages during operations. | Resolved in part. Further information expected with the new proposall. | | | | PBM will during detailed design determine the best application of the alternatives to manage the water balance to achieve zero contact water discharge and minimize the accumulation of surplus water. | | |
| MOE-242 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9); 2.6 "Water Balance" | Addendum; RRR | Page 130, Section 9.3.2 Tailings Facility Flood Management: The report discusses a positive water balance as of year 8, and that this water would be stored in the TMF until closure. The storage of the PMF is also discussed, but is the capacity of the TMF capable of handling the PMF as it collects the site water not being discharged? This is especially true near the end of the mine life as the TMF continues to fill. )( C. Stewart, Permitting, Action: Determine at which point of the mine operation and TMF infill curve, that the PMF will no longer be handled by the TMF? What mitigation strategies are available, and what are the predicted impacts to the receiving environment?) | The TSF is designed to handle the PMF at all times during operations. Additional information regarding water balance is provided in the RRR. PBM commits during detailed design to determine the best application of the alternatives to manage the water balance to achieve zero contact water discharge and minimize the accumulation of surplus water. For example PBM commits to diverting, as is practical, clean surface water around the TSF at various stages during operations. | Unresolved. Appears to still be outstanding issues regarding water balance and handling. Confer with Vicki Carmichael on issue. Closure isses an important component of this. New proposal may address some of this. | Water management and water balance is updated in Section 7 of RRR Rev.2. Rationale for zero discharge is updated for the Expected Case and a management plan is defined for the Upper Bound water balance case. | | 3rd Party Review Response Report-Addendum | Condition #17 | | |
| MOE-243 | MOE, Craig Stewart | 22-Oct-10 | Aquatic Biology and Fisheries | 6.8 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9); 2.5 "Seepage Effects on Receiving Environment" | Addendum; RRR | Page 131: Para 2; Discusses reduction in flows in local streams due to the presence of the TMF. Flow to the SE will be reduced by 20%. What impacts beyond just the flow reduction, will occur to the streams and their biota; especially during period of low flow? (C. Stewart, Application) | Low flow is considered in the effect assessment, Volume II, Chapter 8. Where low flows have signficant effects on fish or fish bearing habitat fish habitat compensation will be implemented. Further consideration of low flows is presented in an updated effects assessment in the RRR. | | | | | Condition #23 | | |
| MOE-244 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9) | Addendum | Page 132, Seepage Recovery Pond Spillways: The spillway design is based on 1:1000 return period peak flow. Is these sufficient baseline data to meaningfully make this prediction? Impacts that climate change may have given the projected increase in precipitation over time? (C. Stewart, Permitting: Is this the correct return period), and if so, provide the information to justify the value determined.) | Emergency spillways are required for the Seepage Recovery Dams for dam safety protection. The spillway is sized for the 1000 year return period peak flow of 1.5 m 3 /s. The spillway will consist of a 2.0 m wide open channel with 2H:1V side slopes and a 0.5 m water depth plus 0.3 m freeboard. The spillway would be at a 0.5% slope. Design criteria is based on Canadian Dam Association Guidelines. | Unresolved; further discussions required. Carry forward. | Emergency spillways are required for the Seepage Recovery Dams for dam safety protection. The spillway is sized for the 1000 year return period peak flow of 1.5 m 3 /s. The spillway will consist of a 2.0 m wide open channel with 2H:1V side slopes and a 0.5 m water depth plus 0.3 m freeboard. The spillway would be at a 0.5% slope. Design criteria is based on Canadian Dam Association Guidelines. | | | Noted | | |
| MOE-245 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9); 2.1 "TSF Impoundment Water Quality" | Addendum; RRR | TABLE 10.3 Operational Water Quality: Average aged Process Water data is provided, however there is no indication of the range of water quality obtained in the tests. What was the worst case obtained? Were there exceedances from other samples of water quality guidelines from other samples? How many samples were used in the calculation? (C. Stewart, Permitting, Action: Provide the complete test work for the impoundment aging tests, or the location of the material if already submitted.) | Current predicted tailings pond water quality and pore water quality with the methodology of derivation are presented in the RRR. TSF water quality will be monitored during operations. | Unresolved. Expect further information and evaluation with the new proposal. | Considering the updated management plan for tailings as well as the current closure plan, updated water quality prediction for the tailings water is presented in Section 8.2 of RRR Rev.2. | | | Noted | | |
| MOE-246 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9) | Addendum | Page 140, Geochemistry Cyclone Sand (C. Stewart, Permitting, Comment: In addition to NPR, other criteria may also be defined for the cyclone sands such as sulphide/total sulphur.) | PBM commits to resolving appropriate criteria for coarse fraction cyclone sand for dam construction with MOE during permitting. | Resolved. | | | | PBM commits to resolving appropriate criteria for coarse fraction cyclone sand for dam construction with MOE during permitting. | | |
| MOE-247 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9); 2.1 "TSF Impoundment Water Quality" | Addendum; RRR | Page 146 Tailings Lake Water Quality: It is predicted in this section that the tailings water quality will return to background within 5-10 years. This would appear to be a very optimistic assessment. On what was this determination based? (C. Stewart, Permitting, Action: Provide the information used to determine the 5-10 yr prediction. What were the baseline conditions measured against and what parameters were considered?) | Current predicted tailings pond water quality and pore water quality with the methodology of derivation are presented in the RRR. PBM commits to on-going monitoring of TSF water quality during operations. | Unresolved. Uncertaintly regarding the water quality predictions and the potetnial impacts to Morrison Lake; both during operation and post closure. Expecct further resolution with new proposal and the incoporation of the new baseline data. | Considering the updated management plan for tailings as well as the current closure plan, the updated water quality prediction for the tailings pond water after closure is presented in Section 8.2.2 of RRR Rev.2. | | This assessment has been further updated in the 3rd Party Review Response Report. | EMP | | |
| MOE-248 | MOE, Craig Stewart | 22-Oct-10 | Environmental Management System | 9 | App AX. Geotechnical Feasibility Study Report Rev1 (Updated Appendix 9); 2.1 "TSF Impoundment Water Quality" | Addendum; RRR | Page 146 Comment. Discusses the discharge of TSF supernatant into the open pit, and the resulting dilution of pit water and subsequent release to Morrison Lake. This proposal ignores the acidic drainage inputs from the pit wall and up-slope waste rock dump. The probable scenario is treatment of pit lake water or other water management scenarios to control | Current predicted tailings pond water quality and pore water quality with the methodology of derivation are presented in the RRR. PBM commits to on-going monitoring of TSF water quality during operations. | Unresolved. Expect further information and evaluation with the new proposal. | Considering the updated management plan for tailings as well as the current closure plan, the respective water quality and water flow components are presented in RRR Rev.2. | | 3rd Party Review Response Report-Addendum | | | |
| MOE-249 | MOE - EPD | 4-Aug-11 | | | | RRR Rev.2 | The TSF represents a direct and complete change to the land base as it currently exists, replacing it with a system requiring on-going water collection, monitoring and site presence. | The change to the land base will be mitigated on closure by reclamation of 305 ha of habitat in the TSF, including approximately 1.7 km2 of ponded area, with 67.5 ha of Wetland.<br><br>All tailings dams require some form of long term monitoring to ensure public safety (spillways and geotechnical stability) as recommended by the Canadian Dam Association Guidelines. The water quality management requirements are predicted to be negligible once the TSF closure is complete. | | | | | Noted | | |
| MOE-250 | MOE - EPD | 4-Aug-11 | | | | RRR Rev.2 | Water Treatment Plant and Sludge Storage Facility have major implications:<br>• elevated risks to the environment from the treatment process, upset conditions, discharges, on-going liabilities, land alienation and production of secondary waste products,<br>• on-going need for reagent procurement, site monitoring, and infrastructure maintenance,<br>• production and storage of treatment sludge which represents an ongoing risk to the receiving environment through potential for drainage, spillage, erosion, and changes to sludge chemistry, and<br>• long-term discharge of variable, high ionic strength effluent to Morrison Lake. | The water treatment plant is proven technology and is commonly used so risks associated with its operation are low. The open pit area has a large capacity to store and attenuate high precipitation inflows in the event of any system upsets. On-going infrastructure support will be required, although it is planned that this plant, as for other projects, will have systems for remote control of the plant. The sludge can be safely stored on-land and will require monitoring for changes in solid- and aqueous-phase chemistry. | | | | | Noted | | |

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| MOE-251 | MOE - EPD | 4-Aug-11 | | | | RRR Rev.2 | Waste rock dumps have major implications including:<br>• oxidation of sulphides, and release of the oxidation products to ground and surface waters,<br>• requirements for long term collection and treatment,<br>• creation of a significant liability during mining (sub aerial PAG deposition), with a worse case risk of non-submergence of the PAG waste at end of mining operations,<br>• on-going metal leaching or acidic drainage over very-long time periods. | The waste rock dump will be located in the catchment of the open pit during operations. The waste rock dump will be removed for closure and, as such, do not present a requirement for long term collection and treatment of water. | | | | | Noted | | |
| MOE-252 | MOE - EPD | 4-Aug-11 | | | | RRR Rev.2 | Receiving Streams MCS7, 8 and 10<br>Overall, the accuracy of the water quality predictions contained in the RRRv2 are fully dependant on the representativeness of the baseline data and the data used to model 1) the WQ in the TSF, 2) the pore water quality beneath the TSF, and 3) the seepage rates. Generally, the quantity, and in some cases, the quality (e.g. groundwater) of baseline data is marginal, and in the case of MCS 8 and 10, it is inadequate.<br><br>It is somewhat difficult to follow predictions related to the quantities of seepage from the tailings storage facility (TSF):<br>• it is unclear what time of year / or what flows are covered in Table 10.4 –"Predicted relative concentrations of seepage in TSF receiving streams;"<br>• the seepage allocation % and seepage rate columns in Table 10.5 do not coincide;<br>• in Table 10.6, groundwater contributions are calculated using the numbers in the Seepage Allocation column of Table 10.5, rather than the Seepage Rate column; and<br>• "Average flow" in Table 10.6 is not defined. | Table 10.4 refers to water quality of groundwater that is a mix of seepage and regional groundwater flow. As such the concentration would apply year round and would mix with the surface water.<br><br>Table 10.6 was extracted from the EAC Application – Hydrology Baseline Report; and was used to back-calculate the approximate seepage allocation rates in Table 10.5. To update this estimate, PBM have gone into the hydrogeology MODFLOW model and extracted estimates of seepage allocation, which are approximately: 15% (MCS7), 10%(MCS8) and 6%(MCS10), and the approximate seepage flows to those areas would be corresponding to the relative percentage. The water quality predictions do not change as they are based on % solute as determined by the MODFLOW model Average flow was derived from site measurements and catchment areas. Low Flow considers only groundwater discharge. The values are for information only and are not used in the water quality calculation presented in Tables 10.7, 10.8 and 10.9. | | | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| MOE-253 | MOE - EPD | 4-Aug-11 | | | | RRR Rev.2 | Concerns related to the values used for baseline water quality in MCS 7, 8 and 10:<br>• MCS7: In Appendix 1 Baseline DataJJ, it appears that data values from 2 sampling dates were added to the EAC baseline value (an average value), at which time, the sum was averaged again. While perhaps not making a huge difference with this data, it is mathematically incorrect to calculate averages this way.<br>• MCS8 and 10: In past versions of this application, water quality data from MCS7 was used as a surrogate for MCS8 and 10. In RRRv2, baselines have been calculated using data from MCS8 and 10. However, as only 3 data points were used to characterize baseline water quality conditions for these two streams, the database is considered to be inadequate. An absolute minimum of 12 months of data, including winter data (the most sensitive time of year due to low flows), is required to start to gain an understanding of baseline conditions. | Baseline data for MCS 8 and MCS 10 continues to be collected. These drainages will not be potentially impacted for several years unti the TSF increase in size. Data has been attempted to be collected during witnter, however the streams have either had "no-flow" or were "frozen".Baseline water quality has been updated to correct the averaging error and revised baseline water quality in MCS 7, 8 and 10 and prediction models have been updated (Tables MOE-253) The inclusion of the revised baseline parameters has no material change to the Morrison Lake and Streams effects assessment. | | | | | Noted | | |
| MOE-254 | MOE - EPD | 4-Aug-11 | | | | RRR Rev.2 | The proponent has conservatively assumed that winter low flow will be wholly sourced from groundwater. Tables 10.7, 10.8 and 10.9 provide predictions for water quality for MCS7, 8 and 10, respectively:<br>• MCS7 will be affected to the greatest degree by the TSF seepage. According to the predictions outlined in Table 10.7, seven parameters will exceed B.C. Water Quality Guidelines (BCWQGs) in MCS7 during winter low flows: sulphate, Al (dissolved guideline), As, Cd, Co, Fe (dissolved guideline) and Se. Of these, Fe is not an issue, as the predicted values are less than the baseline groundwater concentration.<br>• In MCS8, sulphate, Al, As and Cd will exceed guidelines and baseline conditions.<br>• MCS10 is predicted exceed guidelines for sulphate and Cd during low flows, and Al, Cd, and Zn (upper bound only) during average flows.<br>• Most BCWQGs are based on total metals concentrations. However, in these predictions, dissolved metal concentrations from models have been added to total metals from baseline studies, increasing uncertainty related to what parameters will exceed BCWQGs. The use of dissolved metals and averages will underestimate both the number and sizes of exceedances. | Dissolved metals were used for groundwater to reflect that seepage water will not include total metals. This was discussed in a working group meeting with Lorax. The predictions tables have been updated to account for BCWQGs using Total concentrations for all parameters except Aluminum.<br>Site specific water quality guidelines for Cd and SO4 were developed for the Kemess North Project, which were in a similar order as those being predicted for Morrison. | | | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| MOE-255 | MOE - EPD | 4-Aug-11 | | | | RRR Rev.2 | Pacific Booker Minerals uses the "expected case" rather than the "upper bound" water quality predictions in determining its effects assessment. Thus, the effects assessment is not as conservative as it could be, especially given the questionable data used in the predictions. Nonetheless, the proponent states on page 143 that "The predicted water quality effects are considered to be moderate and that site specific water quality objectives can be developed that are protective of aquatic habitat and fish." The definition of moderate effect used in the report is "May result in a decline in condition...outside baseline levels....The receiving environment / community may experience a noticeable hardship or change...." | The Effects Assessment is typcially carried out on the Expected Case, with the proponent being able to demonstrate that Adaptive Management Plans can be implemented if the Upper Bound case were to materialize. | | | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| MOE-256 | MOE - EPD | 4-Aug-11 | | | | RRR Rev.2 | EPD's effects assessment for receiving-environment streams is as follows:<br>• Magnitude: Medium (agree with PBM). Water chemistry / quality in MSC7, 8 and 10 will be degraded, particularly during winter low flows, possibly to levels that will change aquatic communities in the streams. It is uncertain whether water quality objectives can be established that are protective of the aquatic ecosystem.<br>• Geographic extent: Local (agree with PBM). The streams are small and do not extend far beyond the geographic area of the mine footprint.<br>• Frequency and Duration: Continuous and long-term (agree with PBM). Once the seepage reaches the creek, it will be continuous and could last for as long as the tailings pond is in existence.<br>• Reversibility: Long-term ~ 100 years or more (agree with PBM). PBM indicate that water quality will improve over time in the TSF. Although significant uncertainty exists, the simple process of dilution and the continual removal of contaminants from the tailings material, will ultimately improve the water quality. The length of time this will require is a function of numerous factors.<br>• Probability: Medium to high (disagree with PBM). EDP considers the probability of water quality degradation to be higher than indicated by PBM.<br>• Uncertainty: Medium to High (disagree with PBM). Based on the quality and quantity of baseline data (surface and ground water), geological data related to faults, and large number of assumptions, the uncertainty in the predictions is believed to be significant.<br>• Context: MCS7, 8 and 10 are relatively small, short and may have very low flows in dry years. Fish habitat is limited to lower reaches; however, the entire length of each stream influences the riparian community and provides aquatic habitat for other biota, including benthic macro invertebrates, algae and amphibians. Beaver appear to live in the lower reaches of MCS 10 and the streams likely provide drinking water to other animals of all kinds. Some of these concerns may be addressed through the proposed fish habitat compensation projects.<br>• Significance: Low to moderate. | The highest classifications for "probability" and "uncertainty" is "high". For TSF seepage effects water quality effects on Streams 7, 8, 10 The Level of Significance was assessed by PBM as "Moderate". PBM assessed the Probability as "Medium" and Confidence Level as "Intermediate" while MOE-EPD believes both should be High. Based on the Significance Rating introduced in RRR Rev.2, irrespective of PBM or MOE-EPD assessments of Probability and Confidence Level, the effects are not significant due to the local nature of the effect. | | | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |

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| MOE-257 | MOE - EPD | 4-Aug-11 | | | | RRR Rev.2 | Pacific Booker Mineral has supplemented the data for Morrison Lake since RRRv1, so there is data from 2 depths at 5 sites for July 2008, Oct 2010, Jan 2011 and June 2011. Surface waters were sampled in 2006. Seasonal differences in the data were not examined or discussed.<br>Based on the modeled water quality predictions for the lake, water quality of the lake will be changed over the very long-term, with the steady state of the lake containing higher concentrations of sulphate, nitrates and metals than are currently present. The key questions are: 1) what is the reliability of the predictions and 2) will the predicted water quality have biologically significant effects?<br>The proponent shows expected and upper bound water quality predictions for proposed discharges to the lake and the associated long-term steady states. According to the data provided, the average (where available) and maximum BCWQG will be met for both the expected and upper bound cases, except for cadmium in the upper bound case. EPD has several concerns with this modeling process which may affect the reliability of the results:<br>• The steps in the modeling process have not been described, so cannot be verified.<br>• The predictions assume homogenous water quality throughout the lake based on average water quality data from a limited temporal period (equivalent to 4 quarterly samples over 1 year). Baseline values in Appendix 1 have been calculated by combining all data from all sites and depths. Limnological chemistry is complex; stratification of water will occur and it is highly likely that seasonal and spatial variations will occur, at least with some water quality parameters, meaning there may be pockets of water with higher levels of contamination present in the lake seasonally.<br>• A more conservative approach to predicting water quality than using averages would have been to use water quality values equivalent to the 95th percentile, or two standard deviations from the mean. This would have helped provide a more realistic “upper bound” prediction and would help address the heterogeneity of the lake. In many cases, individual baseline concentrations for dissolved Al and total Cd, and total and dissolved Cu, Fe and Se (as found in Appendix 1) exceed the predicted “average” upper bound steady state and sometimes maximum for the three discharges combined, meaning the predictions are underestimating possible “hotspots” of contamination.<br>• Discrepancies exist between the values of the baseline data summarized in Appendix 1 and the values that appear to have been used in the models as displayed in tables 10.10 and 10.11 | • The lake modelling has been carried out by Dr. Greg Lawrence at UBC. The only heterogeneity that the model accounts for is the difference between epilimnetic and hypolimnetic water quality. While this is the will be the primary source of heterogeneity (except in the immediate vicinity of the diffuser), it is true there may be horizontal variations not taken into account by the model. However, it should be noted that while these variations may exist (both in the natural case and if the project goes ahead), the action of the diffuser will generate a weak circulation within the lake, which over time will reduce any horizontal heterogeneity in the lake. The maximum concentrations experienced in “hotspots” may in fact be less if the project goes ahead than in the natural case.<br>• Improved estimates of background water quality will be incorporated into the model as more data is collected.<br>• The predicted increase in nitrate levels to a steady state of 0.5 mg/L is below the BC WQG for nitrate, where the 30-day average concentration to protect freshwater aquatic life is 3.0 mg/L and the maximum concentration is 32.8 mg/L. The diffuser is situated in the hypolimnion where the presence of phytoplankton / algae is limited. Any potential change in the phytoplankton community may become more evident at lake turnover when mixing from the hypolimnion occurs. However, as algae production increases in the spring/summer months, any increases in nitrate would be expected to reduce from plant uptake. A N:P ratio of >10:1 indicates a phosphorus limited system and a N:P ratio of 5:1 indicates a nitrogen limitation, Morrison Lake therefore is naturally a phosphorus limited system. The total N and P will continue to be monitored throughout mine operation as will the phytoplankton species composition, if Morrison Lake were to approach nitrogen limitation (N:P; 5:1) then any changes in phytoplankton species composition would be detected and mitigation strategies applied if required. A monitoring plan and resulting mitigation strategies would be developed in consultation with the agencies and adaptive management applied.<br>The use of the 95th percentile for baseline data does not appear applicable as the lake will behave as a “moderately” dynamic system that stretches over a long temporal period (years) with respect to changes and, therefore, the use of average baseline or potiially 75th percentile is appropriate. The use of dissolved loadings | | | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| MOE-258 | MOE - EPD | 4-Aug-11 | | | | RRR Rev.2 | Tables 10.14 and 10.15 show the residual effects assessment summaries separately for the effects of TSF seepage, PAG pore water transport to Morrison Lake, and the treatment plant discharge. EPD is concerned with the overall effects from the mine and will combine the effects of all three discharges on Morrison Lake, and by extension, on Morrison Creek.<br>• Magnitude: Medium (disagree with PBM). Water chemistry / quality in Morrison Lake and creek will be degraded, reaching a new general steady state. The model does not consider lake heterogeneity and is thus underestimating predicted metals concentrations in parts of the lake and underestimating the exceedance of guidelines. However, if the water quality predictions are accurate, the probability of a widespread biologically significant effect (which has not been defined) in the water column or substrate of the lake is low. There is, however, a moderate to high probability of localized biological impacts in areas of upwelling, where groundwater flows into the lake. If along the shoreline, or the littoral zone, the impacts would likely be more significant than deeper in the lake, and may affect fish spawning success. For example, if lakeshore sockeye spawning areas are affected (lake spawning fish tend to spawn in areas of upwelling), the population of this likely genetically distinct stock of fish could be affected. Generally, these biological impacts may be very difficult to detect as the areas of upwelling are not known, and many factors can affect fish populations.<br>• Geographic Extent: Watershed (agree with PBM). Effects will encompass Morrison Lake and Creek, but unlikely to extend to Babine Lake, and as indicated above, effects may be focused in a few areas. If lake spawning of sockeye is negatively affected, the effects may be seen on a regional level.<br>• Frequency and Duration: Continuous and far-future (agree with PBM).<br>• Reversibility: Far-Future (disagree with PBM). Seepage will likely improve over time just through the continual removal of contaminants, however it is the duration of impact which becomes critical as the contaminant loading to the environment will continue for a very long | The magnitude of the effect will be mitigated as discussed in MOE-257, above.<br>Reversibility in the Far-Future (which is defined as > 50 years) - agree that concentrations reduce with time but are not 100% reversible. | | | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| MOE-259 | MOE - EPD | 4-Aug-11 | Closure | | | RRR Rev.2 | 1) Closure Pictorial: The artistic rendition of the site at closure may be overly optimistic with the success of the reclamation activities. Remaining site infrastructure such as the HDS plant, sludge storage ponds, non-PAG waste rock and other long-term infrastructure are not shown. The greening of the impoundments is likely to be significantly harder to achieve with changing water balances (e.g. submergence/emergence cycles), and impoundment water chemistry. The open pit exposed walls will continue to spall and oxidize over time which impedes reclamation efforts and achievability. The plan also calls for the reforestation of the TSF. Experience has shown that reforestation of a TSF is generally not achievable or acceptable. | The closure artistic rendition presents the expected case in the far future after the water treatment plant and sludge storage cells are required. The reclaimed non-PAG waste rock dump will not be a major feature. The water pond level of the TSF will be controlled with the outlet spillway, with pond raises during extreme flood event as the flow is attenuated in the pond. Pit walls are not proposed to be reclaimed, although observations at some mines (e.g. Pinchi) indicate that some growth will occur on the benches. Reforestation of the beaches will be difficult, although we do not see any technical reason as why this would not be desirable or acceptable. | | | | | Noted | | |
| MOE-260 | MOE - EPD | 4-Aug-11 | Waste Rock Disposal | | | RRR Rev.2 | 2) Page iii Waste Rock Dumps: states that “the closure and reclamation plan for the waste rock has been revised to eliminate the above ground waste rock dump.” All of the above-ground waste rock dumps would be removed and deposited in the open pit and TSF as required. Given the potential problems with segregation, this may be the final outcome, however the current plan would have a non-PAG waste rock dump located above the open pit. It will be an EPD permit expectation that drainage from this waste rock dump will be collected and discharged to the open pit. This provides a contingency for inadequate segregation and/or prediction of non-PAG waste rock, as well as any neutral leaching which may occur. | PBM commits to comply with the EPD permit expectation that, as a contingency for inadequate segregation and/or prediction of non-PAG waste rock as well as any neutral leaching, provision for drainage from this non-PAG waste rock dump to be collected and discharged to the open pit. | | | | | PBM will comply with the EPD permit expectation that, as a contingency for inadequate segregation and/or prediction of non-PAG waste rock as well as any neutral leaching, provision for drainage from this non-PAG waste rock dump to be collected and discharged to the open pit | | |
| MOE-261 | MOE - EPD | 4-Aug-11 | Water Balance | | | RRR Rev.2 | 3) Page vi: The adaptive management plan discusses the discharge of pit water as a land area application. There are no details provided to discuss this option. The details of this mitigation strategy must be provided. | Land area (surface) discharge is one of a number of possible adaptive management mitigation options. It is identified as a contingency in Section 7.6.1 as follows:<br>*Inflows to the open pit may be separately collected and discharged in a land area via surface irrigation system at a rate of 68 m3/hr in Year 11, increasing to 110 m3/hr for Year 12 to Year 20.5. This would be feasible if large water volumes are coming from the perimeter pit dewatering wells.*<br>The basic concept would be to intercept non-contact groundwater from the open pit dewatering wells, confirm water quality is acceptable and to discharge the water with a conventional irrigation system in areas where there is the capacity to assimilate excess water avoiding impacts to terrestrial or aquatic life.system. | | | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| MOE-262 | MOE - EPD | 4-Aug-11 | Effects Assessment Methodology | | | RRR Rev.2 | 4) Page xii, significance conclusion: The conclusion that the residual effects are “principally negligible to minor” ignores the irreversible change to the landscape which will require a long-term site presence and accountability, active treatment and water management, facility maintenance over time period of 100s of years.<br>Refer to comments above. | The listed items were not ignored. Rather these items have been identiifed and duly considered in the effects assessment. “Significance” was considered in the context of a broader area, as opposed to the project footprint. | | | | | Noted | | |
| MOE-263 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | 5) Page 5, Revised Project Description, TSF: The separation of cleaner and rougher tailings is a positive project refinement as discussed in the report, as it reduces the risk of sulphide oxidation in the tailings and reduces the need for such an extensive water cover. However, depending upon the actual site water balance in association with site water quality, changing site conditions over time, on-going site management and receiving environment conditions, the | Effects assessments are based on the expected case. Adaptive management and contingency plans have been identified in the event of the water balance or water quality are not consistent with the expected case. Mitigating TSF pond size fluctuations on closure will require management of diversions, spillway elevation/outlet, pumping to the open pit, and potentially treatment to manage the | | | | | Noted | | |
| MOE-264 | MOE - EPD | 4-Aug-11 | Environmental Management Plans | | | RRR Rev.2 | 6) Page 5, Mine Area: Pre-production waste: A management plan detailing the infrastructure, monitoring programs and management strategies will be required prior to any disturbance of the materials overlying the ore body and site components. | PBM must develop and implement Environmental Management Plans (EMP) prior to construction to provide guidance for both construction and operations on actions and activities to be implemented as required to mitigate potential adverse impacts.<br>The EMPs must consist of the following plans:<br>• Air Emissions and Fugitive Dust Control | | | | | PD Section 8 | | |

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| MOE-265 | MOE - EPD | 4-Aug-11 | Waste Rock Disposal | | | RRR Rev.2 | 7) Page 6, Waste Rock Segregation: This is a critical component of the mine plan and requires careful development and implementation. Specific criteria must be defined and justified, sampling programs must be designed and demonstrated that implementation is effective, the physical ability to segregate must be clearly demonstrated, and drainage collection of all waste rock dumps and LGO stockpiles must be designed.<br><br>Segregation criteria as proposed may or may not be appropriate due to methodologies used and the incomplete evaluation of the material streams. With the exception of the recent (2010) pit wall drilling, the data has generally been handled as one data set which impedes the interpretation and predictive work. Note too that samples collected within the original dataset that may have been representative of the pit wall were not separated out. As a result, the predictions do not necessarily represent how the materials might be handled during mine development ( i.e. ore vs. waste rock stream, vs. low grade ore).<br><br>Segregation criteria will require the use of other parameters (e.g. ST) to ensure that adequate conservatism is built-in. Note that in the ARD/ML assessment of the application, that all samples with 2.5%S or greater were net acid generating; regardless of the NP, as such, | The criteria for segregation of PAG waste rock identified in the RRR is not based solely on SNPR as shown below:<br><br>PAG and non-PAG Segregation<br>• All waste rock with an Adj. SNPR less than 2 will be assumed to be PAG. This includes high PAG and low PAG.<br>• Waste rock with an Adj. SNPR greater than 2 will be non-PAG.<br><br>High PAG and Low PAG Segregation<br>• High PAG waste rock (> 2%S and Adj. SNPR < 1)<br>• Low PAG waste rock (<2% S and Adj. SNPR < 2) | | | | | PD Section 6.7.1 | | |
| MOE_266 | MOE - EPD | 4-Aug-11 | Waste Rock Disposal | | | RRR Rev.2 | Another concern is the inclusion of modified Sobek procedures within the segregation program at the operational stage. Although it was requested that a subset of ABA samples be analyzed using a modified Sobek methodology during the baseline data collection, this requirement was not completed. In order to understand what the modified Sobek results mean, a robust comparison test program is required. The inclusion of the modified Sobek is a positive, however, its usage must be accompanied by project context; what might it signify and how are the results to be interpreted for decision purposes. | On February 9, 2010, in response to prior comments, PBM provided to the Commentor and EAO a letter regarding the use of the Modifed Sobek ABA analysis methodology for characterization of ore and waste rock. The letter was from PBM's consultant recommending and explaining the rationale for the continued use for the project of the US Environmental Protection Agency Standard Sobek Neutralization Potential methodology. The Commentor acknowledged receipt of the letter and did not comment further. | | | | | Noted | | |
| MOE-267 | MOE - EPD | 4-Aug-11 | Financial Security | | | RRR Rev.2 | Bonding: It is critical that the bonding requirements remain lock-step with the outstanding liability at the project site as failure to carry out the proposed management plan will have very significant impacts on the overall site closure and long-term impacts on the site. | PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | | | | | Carry forward to Permitting | | |
| MOE-268 | MOE - EPD | 4-Aug-11 | Low Grade Ore | | | RRR Rev.2 | 8) Page 8, section 2.2.4 Low Grade Ore: It is unclear if water quality modeling included the disposal of oxidized LGO into the open pit and or the TSF. As this disposal method is a strong possibility, its effect on the tailings or open pit water quality must be assessed. | The expected case is the LGO will be processed and that disposal of unprocessed LGO in the open pit is a contingency plan. Therefore water quality modeling for the TSF and open pit was done without the LGO for the expected case as well as the upper bound case. Note that there is no proposal to place unprocessed LGO in the TSF. Regardless, water quality effects of placing LGO or waste rock in the TSF is | | | | 3rd Party Review Response Report-Addendum | | | |
| MOE-269 | MOE - EPD | 4-Aug-11 | TSF Construction | | | RRR Rev.2 | 9) Page 21, Chapter 4 TSF: provides data on the tailings geochemistry. Cycloned rougher tails may still require a second sulphide removal circuit to ensure the construction sands achieve the appropriate geochemistry to ensure minimal effect on discharge waters. Final criteria for the acceptable quality of the construction sands must be determined. Also, section 4.3.4 which provides some general information on how the construction tailings will be evaluated. Further details would be required during permitting. | Within the RRR Rev.2 Table 12.1 the criteria for cyclone sand not meeting a non-PAG criteria is identified: SNPR values greater than 2.0. | | | | | Condition #4 | | |
| MOE-270 | MOE - EPD | 4-Aug-11 | TSF Construction | | | RRR Rev.2 | 10) Page 24, section 4.4: Accommodation to raise the TSF dam height has been made. Presumably this decision would occur at or near the end of mine life. A major concern would be the volume of available rougher tailings for the raises. If a dam raise is required near the end of mine life, would there be enough rougher tailings available to actually complete the raise as well as sufficient volume to cover the cleaner tails for final closure? | As documented in RRR Rev.2 the volume of available rougher tailings is addressed in Section 4.4.1. Regarding the decision to raise the tailings damn this decision is made during the mine life well before the end of mine life. This is an adaptive management plan determined based on factors including water balance, quantities of waste rock and segregation of non-PAG waste rock and the likelihood that LGO will be processed. There is sufficient storage capacity with the dam raises to address all of the aforementioned issues. | | | | | Noted | | |
| MOE-271 | MOE - EPD | 4-Aug-11 | TSF Construction | | | RRR Rev.2 | 11) Page 26, PAG and LGO disposal:. The commitment to submerge the PAG waste rock and any un-milled LGO is an improvement on the original proposal as it dramatically reduces the ongoing oxidation of the PAG material, and reduces the volume and strength of the mine water that must be collected and treated post-closure. As the development plan currently stands, waste rock is not submerged until after mining ceases; end of year 19. A volume equal to the LGO stockpile (if it may not be milled), may be deposited in the TSF between year 10 and 15.<br><br>A further refinement on the mine plan would be to dispose the waste rock from startup immediately to the TSF. The volume to be taken to the TSF would be equivalent to the excess | As documented in the RRR Rev.2 there is sufficient capacity in the TSF given a operating phase decision with a larger data set derived during construction and operations. Additionally placing the waste rock in the TSF requires a wider road to the TSF, additional haul trucks and results in increased fuel consumption with associated emissions of GHG. There is a large capital cost to place PAG rock into the TSF (haul roads and trucks and dam) and there is a low likelihood that that surplus PAG rock will be required to be placed in the TSF due to lack of available volume in the open pit. Accordingly, the Adaptive Management Plan provides for a review in Years 10 to 15 to ensure that PAG storage is managed. | | | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| MOE-272 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | 12) Page 101, Predicted pore water chemistry is provided using a combination of tailings aged tests and pH controlled EDCM predictions. The pore water assessment may have also benefited from conducting pore water sampling in the Bell and Granisle tailings, which is representative of 30 or more years of aging and weathering. As these two mines have been used as analogues for Morrison, tailings pore water and weathering profiles from their respective impoundments would have provided useful in-situ information for the longer term assessment of the Morrison project. | The EDCM model was developed on the basis of water samples including monitoring wells in the vicinity of the Bell and Granisle tailings storage facilities. Therefore the prediction of tailings pore water done for Morrison Project has been done on the basis of available in-situ information. However caution must be exercised in use of Bell and Granisle tailings pond water and porewater quality data over the closure period. The tailings beaches contain both cleaner and rougher tailings, and the tailings pond collect some drainage from runoff from mine rock. As such, they represent different geochemical conditions. | | | | | Noted | | |
| MOE-273 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | 13) Page 103, Table 8.5: Bell and Granisle Analogue Data: As noted in previous correspondence to the proponent, tailings impoundment water quality data from Bell and Granisle is available for a far longer time period than used in the table. | Caution must be exercised in use of Bell and Granisle tailings pond water and porewater quality data over the closure period. The tailings beaches contain both cleaner and rougher tailings, and the tailings pond collect some drainage from runoff from mine rock. As such, they represent different geochemical conditions | | | | | Noted | | |
| MOE-274 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | 14) Page 105, Table 8.6: Baseline Surface Runoff Water Quality. What do these values represent? Ave, mean, median, parameter max, min? Is there a seasonal variability in the baseline data? | Table 8.6 is titled TSF Closure Water Quality Inputs. The table presents the expected case average water quality of water in or entering the TSF from all sources throughout closure. | | | | | Noted | | |
| MOE-275 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | 15) Page 103/104, TSF Pond Water Quality at Closure: This section discusses tailings beach weathering contribution to the TSF pond. | Section 8.22 addresses TSF Pond Water Quality - Closure. The contribution of tailings beach sand is addressed therein. | | | | | Noted | | |

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| MOE-276 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | The closure plan (chapter 9) discusses a small pond and covered reclaimed tailings; however the closure scenario in section 8.2.2 discusses a 1m deep pond over 89% of the TSF catchment. Based on this, the "beach loading is expected to decrease with time as the TSF pond increases in size and the exposed beach is progressively submerged." As this is not the final closure plan for the TSF, the assumptions made regarding the beach infiltration contribution to the TSF pond quality are not appropriate. Note on page 118, final closure will have a pond occupying only 35% of the impoundment. It could also be expected that the pond will increase and decrease over time, resulting in the periodic flooding and emergence of the tailings beaches. This will change the geochemical dynamics of the beaches and the impacts to the tailings pond. This characterization study requires a revisit to test all of the assumptions and clarify the possible closure scenarios and changing potential impacts. The success of the reclamation will determine the beach influence on the tailings pond water quality over time. | The closure plan is for a water pond of approximately 35% of the TSF area. The useof 89% value in Section 2.2.2 came from an extrapolation if surplus water was not treated or sent to the open pit. We agree that the closure transition will require active management as discussed in Item 5.The water quality estimate with the varying beach areas are within the order of accuracy of the predictions and will be managed until the system stabilizes. | | | | | Noted | | |
| MOE_277 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | 16) Page 107, Table 8.7: This table does not include nitrate, nitrite and ammonia. Considering that waste rock is proposed to be discharged to the impoundment, these parameters must be included in the assessment. | Nitrate, nitrite and ammonia will be added to the pond water quality predictions (Tables 8.7, 8.8 and 8.9). The reductions in these concentrations will be similar to the other parameters. Although exlcuded from the tables nitrate is included in the Morrison Lake effects assessment (Table 10.10 and Table 10.11). | | | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| MOE-278 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | 17) Section 8.3.2, page 108: PAG waste rock pore water quality was determined but only average values were provided. As with all other predicted work, an upper bound (95%ile) is required for comparative purposes. The use of runoff data from Bell/Granisle acid dumps would also be appropriate. | PAG water quality predictions are used to assess lime requirements and geochemistry of pore water after liming and submergence in the open pit. It is appropriate to use the average water quality, for a conservatively assumed pH, for this purpose. | | | | | | | |
| MOE-279 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | This also applies to section 8.3.3 (page 110) Treated Water Quality, where Morrison humidity cell MO-00-19 was used. The humidity cell program for the project was minimal and using this cell as representative does not provide sufficient information. The use of worst case Bell/Granisle waste rock acidic drainage would be more appropriate. It is noted that treated Bell water quality data was used. | Predicted water treatment concentrations were assessed with bench-scale treatment runs on leachate from the only Morrison humidity cell that is currently acidic, MO-00-19 83-83.4 m BFP / ArSe3+Si3 (199999). This leachate was chosen to represent, as best as possible, the expected water matrix at the project. In addition, elemental spikes were added to approximate the Final Morrison prediction concentrations at pH 3 (Table 8.9). In addition, elemental spikes were added to approximate the Final Morrison prediction concentrations at pH 3 (Table 8.9). Bench scale results indicate that in order to remove Zn from solution; a pH of at least 8 is required. Also note that a retention time of 670 minutes, compared to bench-scale testing of 40 minutes, will be required to decrease sulphate to 2,000 mg/L. Table 8.9 also shows the comparison of the Final Morrison EDCM predictions at pH 8. These predictions incorporate water quality data from Bell mine, where active lime treatment occurred in the TSF pond. | | | | | | | |
| MOE-280 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | 18) Page 109, Table 8.8: This table does not include nitrate, nitrite and ammonia. It would be expected that the waste rock would contain substantial amounts of blasting residue which will be released to the water column upon flooding. These parameters must be included in the assessment. | Nitrate, nitrite and ammonia will be added to the PAG pore water quality prediction in Table 8.8. Although exlcuded from the tables nitrate is included in the Morrison Lake effects assessment (Table 10.10 and Table 10.11). | | | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| MOE-281 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | 19) Page 114/115: PAG pore water quality: The volume of lime required to effectively raise the pH of the pit water will depend upon the acidity of the pore water which is dependent upon the oxidation rate of the waste rock sulphides. By using an average pore water value, a certain volume of lime is predicted to achieve treating the pit water to pH 8. If the water quality predictions are low, the required amount of lime and the associated costs will be underestimated. Conversely, any method of oxidation suppression (such as early TSF disposal) will reduce the lime requirements. | A conservative pH was assumed for purposes of estimating lime requirements and water quality. | | | | | Condition #10 | | |
| MOE-282 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | Given that there are two analogues available, an upper bound acidity assessment using Bell/Granisle data must be completed in order to determine an upper bound lime requirement is necessary based on Bell/Granisle higher acidity values. | Liming will occur as the waste rock is placed in the open pit after closure will occur in the future approximately 25 years. PBM believes that determination of lime requirements in the EAC Application is sufficiently accurate for the environmental assessment. A more accurate determination will not change the effects assessment. Actual lime requirements will be much more accurately determined nearer closure. PBM commits to updating the acidity assessment during operations and to using sufficient quantities of lime to ensure the ph is 8.0. Active liming during waste rock inundation will be done to raise the pit lake to pH 8. | | | | | | | |
| | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | 20) Page 8.3.3, Treated Water Quality: For the predicted water quality requiring treatment, the only Morrison humidity cell that generated acidity was used. As provided in previous correspondence to the proponent, "kinetic studies are limited and unrepresentative of materials with a sulphide sulphur content greater than 2.6%. Note that up to 10.73% and 9.34% sulphide sulphur occur in the BFP and Sedimentary units respectively; consistent also with what was observed at Bell and Granisle Mines." This limited program is considered insufficient to determine the range of water quality, and the potential treatment requirements, necessary to determine the probable treatment requirements and the outcome of the treatment for the Morrison project specifically. | Predicted water treatment concentrations were assessed with bench-scale treatment runs on leachate from the only Morrison humidity cell that is currently acidic, MO-00-19 83-83.4 m BFP / ArSe3+Si3 (199999). This leachate was chosen to represent, as best as possible, the expected water matrix at the project. In addition, elemental spikes were added to approximate the Final Morrison prediction concentrations at pH 3 (Table 8.9) for treatment assessement. Ongoing geochemistry testing during operations will provide a much more reliable basis for the final design of the treatment plant. | | | | | | | |
| MOE-283 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | 21) Page 115, Section 8.3.5: Only the one acidic humidity cell was used to predict the pit wall runoff water quality and it is unclear as to how representative this sample is. As noted in comment (21), the kinetic test program is considered inadequate in its characterization of the Morrison deposit. | Pit wall runoff water quality is not based on the acidic humidity cell. Rather the potential water quality of the pit wall drainage, as it is mixed with the local precipitation, has been made on the basis of the Final Morrison Prediction and an assumed pH=3 and the corresponding water quality is shown in Table 8.11. | | | | | | | |
| MOE-284 | MOE - EPD | 4-Aug-11 | Water Quality | | | RRR Rev.2 | 22) Page 121, Water Treatment: Open Pit pond water treatment is expected to carry on throughout the winter, however, this may be problematic for a variety of reasons such as freezing infrastructure, breakdowns, storms, disruption of supplies, lime storage, etc. As such, this may alter the volume of water which may be stored and the ability to treat in a timely manner. It is noted that the open pit has excess water storage capacity. What volume does this equate too and what type of event would result in that volume within the open pit? | Winter operation of the treatment plant is not a concern. System upsets could happen at any time due to power failure, extreme weather events, etc. The open pit has a very large storage capacity, and the worst case would see temporary flooding of the wetland area, until operations were restored and surplus water treated. As documented in Section 9.3.2 "A pond area is required to seasonally store water to allow the water treatment plant to be operated year round. The pond will be approximately 10 ha in area and 3 m deep. PAG rock will be placed to elevation 729.5 m and capped with glacial till to elevation 730 m. The pond may develop a 1 m thick ice cover during the winter and the required storage volume below the ice is based on the water treatment rate of 55 m3/hr over 4.5 winter months, which is approximately 180,000 m3." | | | | | | | |

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| MOE-285 | MOE - EPD | 4-Aug-11 | Waste Rock Disposal | | | RRR Rev.2 | If the reclaimed waste rock was all impounded, what would be the expected changes to overall pit water quality at the time of flooding and once the pit was drawn down to normal levels (e.g. cross-contamination through cover)? | | | | | | | | |
| MOE-286 | MOE - EPD | 4-Aug-11 | Water Treatment Plant | | | RRR Rev.2 | 23) Page 123, Sludge Production: Only an average scenario for sludge production is provided. Upper bound cases are also required. Plant capacity can be increased to 85m3/hr and as such, this case, as a minimum, must also be presented to determine long-term sludge production, storage requirements and estimated costs. | Sludge estimates are based on a conservative average pH = 3 for all pit wall runoff, and as such, represent a conservative estimate. Sludge production is determined only on the average or expected case basis. The effects assessment is based on the expected case. Particularly due to the benign nature of the sludge and the relatively small annual volumes a higher volume of sludge production will be dealt with via adaptive management. PBM commits for permitting and determination of financial security to developing contingency plans for adaptive management in the event of the sludge production exceeds the expected case. | | | | | Carry forward to Permitting | | |
| MOE-287 | MOE - EPD | 4-Aug-11 | Financial Security | | | RRR Rev.2 | 24) Page 127, Table 9.3, Post closure costs: The annual operating cost of the water treatment plant is estimated at $260,000/yr. It is unclear if this value includes lime and power costs. | Per Addendum Appendix AA the annual operating costs include lime and power. | | | | | | | |
| MOE-288 | MOE - EPD | 4-Aug-11 | Environmental Management System | | | RRR Rev.2 | Monitoring is expected to decrease after 5 yrs. This is unlikely to occur and it may actually increase depending upon the data that is being collected. | PBM must implement monitoring as required to meet regulatory and permitting requirements. | | | | | Carry forward to Permitting | | |
| MOE-289 | MOE - EPD | 4-Aug-11 | Financial Security | | | RRR Rev.2 | Infrastructure support of $100,000/yr may be light given the probability of continuing on-site changes and operational expenditures including snow plowing, drainage ditch cleaning, road maintenance, etc. Note also that the treatment plant has a finite life and will require multiple replacements over the lengthy required treatment period. | PBM commits to resolving the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | | | | | PBM will resolve the appropriate required level and form of financial security with MEMPR for Mines Act Permitting. | | |
| MOE-290 | MOE - EPD | 4-Aug-11 | Water Balance | | | RRR Rev.2 | 25) Chapter 9, Water balance contingency issues: Managing the water balances at a mine site is a critical component of the mine operations; both during the mining phase and throughout the closure phase. At the Morrison site, only the TSF and the open pit are capable of storing water at closure. As a result, the project is vulnerable to water balance issues, especially where treatment considerations occur. An inability to adequately store site water may result in significant impacts to the receiving environment if the water is of poor quality and discharges occur. | Using the open pit and the TSF to attenuate and store temporary surpluses of water mitigates the risk of un-managed discharges; during operations and closure the TSF provides additional capacity for water storage and during Closure the open pit provides additional capacity. PBM has identified adaptive management and contingency options for addressing the variations in the water balance. | | | | | PBM will during detailed design determine the best application of the alternatives to manage the water balance to achieve zero contact water discharge and minimize the accumulation of surplus water. | | |
| MOE-291 | MOE-Schell | 10-Aug-11 | Wetlands | | | RRR Rev.2 | While improved, the current mine plan has an approximately 20 years lag between when the wetlands will be destroyed, and when the rehabilitated tailings impoundment facility will potentially provide wetland function and habitat. While the proponent stresses that this is a short period of time relative to “in perpetuity”, the lack of continuity of habitat precludes the ability of wildlife to move from the destroyed habitat to the new habitat, increasing the impact on species dependant on wetland habitat (wetland function). | PBM recognizes there will be a lag between when wetlands are destroyed and the rehabilitation of the TSF and mine area. The TSF does not reach capacity until Year 15-25 of operation when the full extent of wetland loss will occur. The revised closure plan will include a total wetland area of 50 ha for the TSF and the creation of wetland habitat in the interior of the bermed area of the open pit in the order of 68 ha. Although there will be some lag, these reclaimed wetland habitats in the TSF and open pit will replace the baseline at a ratio of 2:1 (gain:loss). | | | | | | | |
| MOE-292 | | | | | | | | A blue-listed bog (Wb01) will be inundated by the TSF and waste dumps (approximately 27 ha and 1.2 ha respectively). However, the direct compensation of this bog cannot occur as it can take decades for these communities to reach functional maturity, however, compensation of wetlands in the TSF and Mine Area will ensure functions carried out by wetlands in the Project will continue. | | | | | | | |
| MOE-293 | MOE-Schell | 10-Aug-11 | Stream Water Quantity | | | RRR Rev.2 | Manning equation instead of instream flow methodology? | A theoretical flow volume and average monthly runoff was calculated, the Manning equation was applied to determine an area in $m^2$ of fish habitat loss in terms of wetted width for habitat compensation planning purposes. | | | | | | | |
| MOE-294 | MOE-Schell | 10-Aug-11 | Fish and Fish Habitat | | | RRR Rev.2 | FLNRO feels that the constructed off-lake channel is highly unlikely to provide spawning habitat. Given that there is no flow through the channel, the spawning habitat will be dependent on ground water infiltration. According to the FHCP (pg 52) however, the channel will be lined with clay, rock fabric, and heavy duty pond liner in order to inhibit any possibility of ground water infiltration or exfiltration. While the clay and liner may be necessary to prevent channel dewatering, it will preclude any spawning habitat in the channel, even in the unlikely event that groundwater is present at sufficient flows at the channel location. | The primary purpose of the off-lake channels is to replace rearing, foraging and overwintering habitat for juvenile rainbow trout. Limited spawning habitat will be created in the inlet and outlet of the off-lake channels, with an estimated 9 $m^2$ of spawning habitat being affected by the Project. The off-lake channels will be subject to variations in water levels and will depend on lake levels and freshet flows. To improve flow, water will be diverted from Stream 25500 into Channel B (Figure 4.5 of the FHCP) with flow directed to the spawning habitat. | | | | | | | |
| MOE-295 | MOE-Schell | 10-Aug-11 | Fish and Wilderness Values of Morrison Lake | | | RRR Rev.2 | Morrison Lake is the receiving environment for most of the mine’s effluents. FLNRO would like to identify that this lake has high value as a sport fishery, and destination lake for wilderness activities, as evidenced by the guide-outfitter’s cabin on the lake. The existence of a large mine development along the shore of the lake will have an obvious negative impact on the its value as a wilderness setting. Changes in water quality, and associated impacts on the aquatic environment, will erode the value of this pristine sport fishery. Any uncertainty regarding the water quality predictions, or the water quality impacts on Morrison Lake, is seen to be a high risk to the fisheries values associated with the lake. | The listed items were not ignored. Rather they have been duly considered in the effects assessment. The effects assessment is based on the expected case scenario.<br><br>The environmental assessment is not itself a risk assessment. However the EAC Application does include consideration of Upper and Lower Bound scenarios for some key items such as water quantity and water quality. The outcome is that contingency options are identified to address significant variation from the expected case.<br><br>Risk is further addressed in that PBM is committed to implementation of an Environmental Management System that includes the identification of Environmental Management and Environmental Effects Monitoring Plans. These plans include mitigation measures and also identify adaptive management options and contingency measures to address any deviation from the expected case.<br><br>Additionally Accidents and Malfunctions are considered in EAC Application Volume III Section 9. Accidents and malfunctions are unplanned events that could adversely affect the environment or human health and safety. The potential for accidents and malfunctions to occur will be mitigated by designing Project components in accordance with good engineering standards and by developing and implementing effective construction and operation environmental management plans (EMPs). Emergency preparedness and response plans (EPRPs) will be developed to address the identified environmental risks from potential accidents and malfunctions. EPRPs will include instructions that must be followed to control areas where accidents or malfunctions are anticipated based on monitoring programs, or remediate areas where accidents or malfunctions have already occurred. Pacific Booker Minerals Inc. (PBM) will ensure that contractors and service providers have effective EMPs and EPRPs consistent with those developed<br>by the mine to meet the environmental and human health and safety objectives. Adequate training will be provided to ensure that field personnel | | | | | Condition #20 | | |

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| MOE-296 | MOE-Schell | 10-Aug-11 | Terrestrial Vegetation | | | RRR Rev.2 | Recommended Commitment | Prior to permitting, PBM will provide a detailed and comprehensive Vegetation Management Plan, which will include, in addition to what is already in the application (Sections 13.9 and 14.8):<br><br>1. Detailed mapping of rare and sensitive ecosystems, including the 2 dry grassland ecosystems (SBS mc2 81 and 82), with the purpose of identifying overlaps with the project footprint, and development of mitigation.<br>2. Detailed plan for a monitoring and control program for invasive plant species, including the frequency, timing and extent of surveys, and the qualifications of the personnel conducting the surveys. This plan will be developed in consultation with the Northwest Invasive Plant Council.<br><br>This plan will be submitted to the Skeena Region Ecosystem Branch of MFLNRO for review prior to acceptance in permitting to ensure it has a high likelihood of meeting stewardship objectives. | | | | | EMP | | |
| MOE-297 | MOE-Schell | 10-Aug-11 | Wildlife | | | RRR Rev.2 | Recommended Commitment | Prior to permitting, PBM will provide a detailed and comprehensive Wildlife Effects Monitoring and Adaptive Management Plan which will include, in addition to what is already in the application (Sections 13.10 and 14.9):<br><br>1. detailed mapping of key wildlife habitats discussed during the review, and how human/project activities will be limited in these key habitats to mitigate impacts,<br>2. a statistically robust monitoring plan should be designed to track project affects on grizzly bear habitat use in the project area. (Note to EAO: my original comment referred to monitoring habitat USE, not simply monitoring habitat, as stated in the proponent response. Big difference.) Results of this monitoring will inform an adaptive management plan that would require additional mitigation for unforeseen impacts.<br>3. Surveys for western toad breeding habitat, and mitigation strategies for impacts on any habitat discovered by these surveys.<br><br>This plan will be submitted to the Skeena Region Ecosystem Branch of MFLNRO for review prior to acceptance in permitting to ensure it has a high likelihood of meeting stewardship objectives. | | | | | EMP | | |
| MOFR-01 | MOFR, Shauna Norman | 6-Oct-10 | Assessment of Alternative Options | 3.9 | | | I would like to let PBM know that the Granisle connector road is currently being upgraded and will be finished before mine construction begins. This would be a good alternative route. | PBM acknowledges the information. | Resolved. | | | | | | |
| MOFR-02 | MOFR, Shauna Norman | 6-Oct-10 | Noise | 5.19 | EAC Appendix 47 | XI | A one day sample in 3 locations does not seem like enough samples. | PBM acknowledges that the baseline noise monitoring appears to have occured over a short period period of time. However, the study and effects assessment was completed by a professional environmental consultancy with extensive experience in baselines studies and environmental assessments. Further PBM believes that additional data is unlikely to change the analysis or conclusions. | Response satisfactory? | | | | | | |
| MOFR-03 | MOFR, Shauna Norman | 6-Oct-10 | Land Use | 5.15 | | | There are 4 plantations in the mine site that have obligations till they are at Free Growing stage. The removal of certain areas in those plantations will occur with the issuance of the OLTC but what will PBM do to allow the obligations to be carried out for the other areas? Have they been in discussion with that licensee? | PBM has been and will continue to discuss with the licensees (Canfor and HFP) options for accommodating their plantation obligations on the mine site. | Response satisfactory? | | | | | | |
| MOFR-04 | MOFR, Shauna Norman | 6-Oct-10 | Project Permits and Development Commitments | 3.6.1 | | | The Nadina Forest District does not have enough information to finish processing the OLTC application. PBM has been notified that there is addition information (cruise and appraisal submissions) that is needed. A FN consultation summary will be needed before any of the MFR permits are issued. Road Use permits will be required from the MFR for use of all FSR's. Road use agreements will be needed with all road users. | PBM understands that a timber cruise and appraisal are required for the OLTC application. PBM understands that Road Use Permits and road use agreements will be required before construction begins. | Resolved. Permitting requirement. | | | | | | |
| MOFR-05 | MOFR, Shauna Norman | 6-Oct-10 | Forest Tenures | 1.7.4 | | | There is a statement in this section that states that PBM holds a woodlot license. I believe that they currently have an OLTC for exploration not a woodlot license. This permit will expire soon. | The clarification is acknowledged. | Resolved. | | | | | | |
| MOFR-06 | MOFR, Shauna Norman | 6-Oct-10 | Permanent Access to the Mine Site | 3.5.5 | | | The haul route study and the haul route options analysis was done very well. | Acknowledged. | Resolved. | | | | | | |
| MOFR-07 | MOFR, Shauna Norman | 6-Oct-10 | Ecosystem and Vegetation | 6.11 | 13.9; 14.8 | III | Will PBM be submitting a plan to reduce the chance of invasive/noxious plants? | PBM has described a Vegetation and Ecosystems Management Plan (EAC Application Vol III, Section 13.9) and a Vegetation and Ecosystems Monitoring Plan (EAC Application Vol III, Section 14.8) that includes management and monitoring of invasive and/or noxious plants. | Response satisfactory. | | | | | | |
| MOFR-08 | MOFR, Shauna Norman | 6-Oct-10 | Land and Resource Use | 6.15 | | | Regarding the statement of 3,235 ha covering the mining lease will not be available for other tenured and non-tenured land users. This will have an impact to the amount of volume available to harvest. It is mentioned that Canfor has 90,000 m3 of timber scheduled for removal from that site, what has been done to alleviate this. The Morice LRMP has specific objectives for maintaining riparian integrity/function. How are the overburden stockpile, organic bearing material stockpile and the pit extent going to maintain this? Table 7.20.2 has the summary of objectives but does not mention the intent. | The mining lease covers an area of 856 ha, in contrast to the number cited in the EAC Application (3,235 ha). The remainder of the area on the minsite will be covered by a MEMPR Mines Act Permit. PBM will continue to discuss with Canfor options regarding scheduled timber removal from the minesite. PBM understands that the Morice LRMP is binding on forestry but not for mining. | Response satisfactory? | | | | | | |
| MOTI-01 | MOTI, Sherrie Applegate | 26-Jul-10 | Permanent Access to the Minesite | 3.5.5 | | | BCMOTI requires the proponent to commit to undertaking the design of both the intersection of Mill Bay Road and Hwy 118 as well as the access to Mill Bay road. As well, a report indicating what is necessary to bring Mill Bay Road up to a standard that will allow 100% legal axle weight loading 365 days a year. PBM is required to commit to the construction of Mill Bay Road to bring it up to 100% legal axle weight and also the intersection up grade and access upgrade as per the designs that are submitted. All construction is to meet the BCMOT standards as laid out in the standard specifications for road construction, the TAC manual and the BC Supplement to the TAC manual. | PBM commits to undertaking the design of the intersection of Mill Bay Road and Hwy 118, and the access to Mill Bay Road. PBM commits to preparing a report describing what is required to bring Mill Bay Road up to a standard that will allow 100% legal axle weight loading 365 days per year. PBM commits to construction of Mill Bay Road to bring it up to 100% legal axle weight and also the intersection up grade and access upgrade as per the designs that are submitted. All construction will meet BCMOT standards, the TAC manual and the BC Supplement to the TAC manual. This work will be done during Permitting in advance of obtaining MOTI permits. | Resolved. Certificate commitment required. | | | | | | |
| NRCan-01 | NRCan | 19-Aug-10 | Hydrology and Surface Water Quality and Quantity | 6.6 | 8.4, Pg. 8-63;<br>8.5, Pg. 8-67;<br>8.6, Pg 8-111;<br>8.7, Pg. 8-131;<br>8.8, Pg. 8-157;<br>8.9, Pg 8-169;<br>8.10, Pg. 8-191;<br>11.4, Pg 11-25;<br>11.5, Pg 11-38;<br>11.6, Pg. 11-41;<br>11.7, Pg. 11-42;<br>Appendix AB;<br>4.0 "Morrison Lake Effects" | II<br>III<br><br><br><br><br><br><br><br>Addendum RRR | (a1) The effect of groundwater contaminant migration from the Tailings Storage Facility to Morrison Lake and Nakinilerak Lake should be assessed. What is the effect of this source of contamination on these surface waters and how does this relate to water quality guidelines? | Refer to Addendum Appendix AB Lake Effects, Sections 3.2 and 7.1.2. Also refer to the updated Morrison Lake effects in the RRR. In addition to mitigating factors presented, Morrison Lake has an overwhelming dilution capacity in proportion to the relatively low seepage flows from the TSF, and the potential effect is not significant. Regarding Nakinilerak Lake influences, Stream MCS-10 is predicted to have slightly elevated level of some contaminants, although given the mitigating factors related to the prediction, it is a low risk that even these concentrations would be present. Additionally, the low seepage flow requires very little mixing with creek or near shore water to meet BCWQGs and the potential effect on Nakinilerak Lake therefore is not significant. | See below. | | | | | | |

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| NRCan-01b | NRCan | 17-Dec-10 | Hydrology and Surface Water Quality and Quantity | | | | The Proponent has provided an assessment of the effects to Morrison Lake resulting from TSF seepage. Surface water specialists will need to assess whether the effects are significant. The Proponent predicts water quality exceedances for Al and Cd based on TSF seepage in combination with discharge of treated open pit effluent. The Proponent plans to reduce Al concentrations to guideline levels by adding a polishing pond to the effluent treatment plant. It is recommended that the Proponent mitigate cadmium exceedances with polishing treatment of the effluent using ion exchange or activated silica gel. The Proponent has also provided an assessment of the effects to Nakinilerak Lake resulting from TSF seepage. Only a slight exceedance for Cd is predicted, and this is predicted using a conservative estimate. Taking into account physical and/or chemical processes that will likely occur in the groundwater system between the TSF and Nakinilerak Lake, Cd levels will likely be within guideline levels. | | Requires further discussion. | Refer to Addendum Appendix AB Lake Effects, Sections 3.2 and 7.1.2. Also refer to the updated Morrison Lake effects in the RRR Rev.2. In addition to mitigating factors presented, Morrison Lake has an overwhelming dilution capacity in proportion to the relatively low seepage flows from the TSF, and the potential effect is not significant. Regarding Nakinilerak Lake influences, Stream MCS-10 is predicted to have slightly elevated level of some contaminants, although given the mitigating factors related to the prediction, it is a low risk that even these concentrations would be present. Additionally, the low seepage flow requires very little mixing with creek or near shore water to meet BCWQGs and the potential effect on Nakinilerak Lake therefore is not significant. | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| NRCan-02 | NRCan | 19-Aug-10 | Hydrology and Surface Water Quality and Quantity | 6.6 | 8.4, Pg. 8-63;<br>8.5, Pg. 8-67;<br>8.6, Pg 8-111;<br>8.7, Pg. 8-131;<br>8.8, Pg. 8-157;<br>8.9, Pg 8-169;<br>8.10, Pg. 8-191;<br>11.4, Pg 11-25;<br>11.5, Pg 11-38;<br>11.6, Pg. 11-41;<br>11.7, Pg. 11-42;<br>Appendix AB;<br>4.0 "Morrison Lake Effects" | II<br>III<br><br><br><br><br><br>Addendum RRR | (a2) What are the cumulative effects of groundwater contaminant migration from the Tailings Storage Facility to Morrison Lake and Nakinilerak Lake on surface water quality in combination with other Project impacts to these surface waters? | Refer to Addendum Appendix AB Lake Effects, Sections 3.2, 7, 8 and especially 9.3. Also refer to the updated Morrison Lake effects in the RRR. | See below. | | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| NRCan-02b | NRCan | 17-Dec-10 | Hydrology and Surface Water Quality and Quantity | | | | The Granisle and Bell mines (now closed) are proximal to the Morrison mine site. The literature predicts that drainages from waste rock dumps, dams, and tailings impoundments associated with these mines will turn to acidic pH within the next several decades, accompanied by increased concentrations of several metals. Given the uncertainty associated with the potential effects of these existing mines on seepage of contaminants through groundwater to surface water, the Proponent should employ additional strategies to reduce seepage of contaminated water that may further contribute to future degradation of surface water quality. | | Requires further discussion. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| NRCan-03 | NRCan | 19-Aug-10 | Assessment of Alternative Options | 3.9 | 15.7, Pg. 15-36; | III | (b) Additional treatment/protective measures should be considered at the Tailings Storage Facility to protect groundwater quality and water quality in surface water receptors. The Proponent should consider the use of Permeable Reactive Barriers or other measures within the Tailings Storage Facility to neutralize acid and trap trace metals. | Other alternatives were considered including a liner. PBM commits to complete further characterization of the TSF underlying material during construction and that any areas of high conductivity will be lined with till. | See below. | | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| NRCan-03b | NRCan | 17-Dec-10 | Assessment of Alternative Options | | | | Provide specific details on what value of hydraulic conductivity (and over what size an area) would constitute high conductivity. Provide details on the timing of potential till liner placement as well as the thickness of till to be placed. | | Unresolved; further discussions required. Carry forward. | Detailed sensitivity analysis would be carried out as part of the detailed site investigation for the TSF to limit seepage rates to less than predicted in the RRR Rev.2, Section 6.2.4. Typically, hydraulic conductivities > 10-6 m/s over 4 ha may constitute high conductivity. Placement of till would occur progressively as the TSF impoundment level rises over the life of the mine. The thickness of till would be up to 1 m thick. PBM commit to developing a detailed seepage mitigation plan for permitting, based on the detail site investigation and detail design of the TSF. | | The 3rd Party Review Response Report - Addendum 1 signingicantly mitigates the potential for TSF seepage effects as a result of the geomembrane liner. | | | |
| NRCan-04 | NRCan | 19-Aug-10 | Hydrology and Surface Water Quality and Quantity | 6.6 | 8.4, Pg. 8-63;<br>8.5, Pg. 8-67;<br>8.6, Pg 8-111;<br>8.7, Pg. 8-131;<br>8.8, Pg. 8-157;<br>8.9, Pg 8-169;<br>8.10, Pg. 8-191;<br>11.4, Pg 11-25;<br>11.5, Pg 11-38;<br>11.6, Pg. 11-41;<br>11.7, Pg. 11-42;<br>Appendix AB | II<br>III<br><br><br><br><br><br>Addendum | (c) The effect of groundwater contaminant migration from the Waste Rock Dump and Low Grade Ore Stockpile to Morrison Lake should be assessed. | See Addendum Appendix AB Lake Effects, Sections 3.4 and 7.1.3. Water quality of LGO and WRD seepages are considered to be similar. The predicted quantities reaching Morrison Lake will be small, about 0.63 L/s. The LGO stockpile is to be removed for processing in the mill prior to closure, thereby removing that source of contamination in seepages. The LGO stockpile is a maximum of 35 million tonnes with a total throughput of 51 million tonnes over 21 years. At no time does the tonnage in the LGO stockpile exceed 35 million tonnes. Early closure scenarios are addressed in Appendix AU Reclamation and Closure Financial Security. In the event that the LGO is not milled, PBM commits that any un-processed material from the LGO stockpile will be placed in the open pit and flooded. | See below. | | | | | | |
| NRCan-04b | NRCan | 17-Dec-10 | Hydrology and Surface Water Quality and Quantity | | | | The Proponent's response is sufficient. The seepage to Morrison Lake from this source is minimal. Groundwater monitoring wells installed between the stockpile and Morrison Lake would alert the Proponent of deviations from predicted rates. | | Response satisfactory. | | | | | | |
| NRCan-05 | NRCan | 19-Aug-10 | Assessment of Alternative Options | 3.9 | 15.6, Pg. 15-34;<br>15.5, Pg. 15-25;<br>Appendix T | III<br><br>Addendum | (d1) Additional treatment/protective measures should be considered at the Waste Rock Dump. | The waste rock dump is located in the catchment for the open pit and has been designed with a number of protective measures including removal of organic soils, till overburden remaining in-situ, drainage capture pumping system, diversion ditches and a cover. | Response satisfactory. | | | | | | |
| NRCan-05b | NRCan | 17-Dec-10 | Assessment of Alternative Options | | | | The Proponent has committed to several protective measures at the WRD site. | | No further comment received from agency. | | | | | | |
| NRCan-06 | NRCan | 19-Aug-10 | Assessment of Alternative Options | 3.9 | 15.6, Pg. 15-34;<br>15.5, Pg. 15-25;<br>Appendix T | III<br><br>Addendum VI | (d2) The Proponent might be interested in the use of additives to promote a reducing environment that will allow biological reduction of sulphate to convert elements of concern into more stable sulphide mineral phases, similar to technology used in permeable reactive barriers. | Accelerated MLARD using biological reduction and recovery with enhanced evaporation has been considered. However this option was not met with favourable regulator response when presented. Regulators expressed a preference for rapid refill of the open pit. | Response satisfactory. | | | | | | |
| NRCan-07 | NRCan | 19-Aug-10 | Assessment of Alternative Options | 3.9 | 15.6, Pg. 15-34;<br>15.5, Pg. 15-25;<br>Appendix T | III<br><br>Addendum VI | (d3) It is also recommended that the Proponent consider lining at least the portion of the Waste Rock Dump that reports to Morrison Lake with low permeability material (compacted till) or an engineered liner. | The seepage from the LGO stockpile and waste rock dump is addressed in greater detail in the Addendum Appendix AB Lake Effects. The source for the majority of the subject seepage bypassing the open pit is the LGO. The Proponent has therein identified the use of a low permeability material below the LGO stockpile with the resulting seepage estimated at 0.63 m3/hr. | Response satisfactory. | | | | | | |
| NRCan-08 | NRCan | 19-Aug-10 | Assessment of Alternative Options | 3.9 | 15.6, Pg. 15-34;<br>16.4.2.2;<br>Appendix 23, Pg 2-8;<br>Appendix AA, AB, AC | III<br><br>VIII<br><br>Addendum VII, VIII | (e1) It is recommended that the Proponent more adequately define the period of time they expect treatment of open pit waters to be needed. | Water treatment of open pit waters is concisdered to occur from Year 45 forward in perpetuity. However it is expected that depletion of contaminants will eventually result in the open pit water quality improving such that both pumping to keep the pit lake level below the level of Morrison Lake and water treatment may be stopped. | Response satisfactory. | | | | | | |

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| NRCan-09 | NRCan | 19-Aug-10 | Assessment of Alternative Options | 3.9 | 15.6, Pg. 15-34; 16.4.2.2; Appendix 23, Pg 2-8; Appendix AA, AB, AC | III<br><br>VIII<br><br>Addendum VII, VIII | (e2) It is also recommended that the Proponent consider options of treatment that will reduce the need to treat open pit waters in perpetuity. | The Proponent has considered deferral of filling of the open pit resulting from direct discharge of TSF pond water as soon as water quality meets guidelines, as well as aggressive interception of water prior to entering the open pit. Additionally, accelerated MLARD with enhanced evaporation has been considered. However, no scenarios have been found that completely avoid treatment of some water from Year 45 forward in perpetuity. | See below | | | | | | |
| NRCan-09b | NRCan | 17-Dec-10 | Assessment of Alternative Options | | | | The Proponent's response is sufficient. It is recommended that treatment options be re-considered throughout project planning and implementation. | | Response satisfactory. | | | | | | |
| NRCan-10 | NRCan | 19-Aug-10 | Assessment of Alternative Options | 3.9 | Chapter 16, Pg. 16-1; Chapter 15, Pg. 15-1; 16.4, Pg 16-24; 15.5, Pg 15-25; 15.6, Pg 15-34; 15.6.4, Pg 15-35 ; Appendix 23, Pg 2-8; | VIII | (f) It is recommended that the Proponent discuss the length of time of monitoring for the post-closure period and provide a justification for the length of time specified. | The Proponent has considered deferral of filling of the open pit resulting from direct discharge of TSF pond water as soon as water quality meets guidelines as well as aggressive interception of water prior to entering the open pit. Additionally, accelerated MLARD with enhanced evaporation has been considered. However, no scenarios have been found that completely avoid treatment of some water from Year 45 forward in perpetuity. | Unresolved; further discussions required. Carry forward. | The revised waste management plan presented in RRR Rev.2 accelerates improved TSF pond water quality and reduces the risk of long term ARD/ML. As such, the monitoring period should reduce for some project components. Water treatment and effects on Morrison Lake will require monitoring for the far-future. | | 3rd Party Review Response Report-Addendum | | | |
| NRCan-10b | NRCan | 17-Dec-10 | Assessment of Alternative Options | | | | The Proponent's answer does not address NRCan's concern. It is a repeat of the answer provided to NRCan comment NRCan-09 and may have been copied under NRCan-10 in error. | | Unresolved; further discussions required. Carry forward. | The revised waste management plan presented in RRR Rev.2 accelerates improved TSF pond water quality and reduces the risk of long term ARD/ML. As such, the monitoring period should reduce for some project components. Water treatment and effects on Morrison Lake will require monitoring for the far-future. | | 3rd Party Review Response Report-Addendum | | | |
| NRCan-11 | NRCan | 19-Aug-10 | Assessment of Alternative Options | 3.9 | 8.6.4; 13.3, Pg. 13-7; 13.13, Pg. 13-134; Appendix C, 3.6, Pg. 3-34; Appendix T, AA, AB, AC; Appendix AX, Section 9, Pg. 120; | II<br>III<br>IV<br><br>Addendum II<br><br>Addendum VI, VII, VIII<br>Addendum XIII | (g) It is recommended that the Proponent discuss mitigative measures for the post-closure period in the case that groundwater quality predictions are not correct. | Refer to EAC Application Volume II Chapter 8.6.4 Mitigation and Management and Addendum Appendix AB Lake Effects, Sections 8 and 11. | Response satisfactory. | | | | | | |
| NRCan-12 | NRCan | 19-Aug-10 | Monitoring | 9.4 | Chapter 13; Chapter 14, Pg. 14-1; 14.5 | III | (h) NRCan requests to see the details of the groundwater monitoring plan when they become available. | Refer EAC Application Volume III Chapter 14.5 and Addendum Appendix AB Lake Effects, Section 11. For permitting and prior to construction, as part of the EMS, PBM commits to updating the Groundwater Monitoring Plan. | Response satisfactory. | | | | | | |
| NRCan-13 | NRCan | 19-Aug-10 | On-site Support Facilities | 3.5.3 | 4.16.10, Pg. 4-170; 15.7, Pg. 15-36; Appendix C, 5.2.4, Pg. 5-8 | I<br><br>III<br>Addendum II | (i) It is unclear whether effluent from the Sewage Treatment Plant (STP) will be discharged to the TSF or to the environment (Section 4.1.6.10). Clarification is requested. | During construction, treated sewage effluent will be discharged to the environment via a permitted septic field or ground surface discharge. During operations, sewage effluent will be mixed with tailings and pumped to TSF. Post closure sewage effluent will report to the open pit. | Response satisfactory. | | | | | | |
| NRCan-14 | NRCan | 19-Aug-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix 23, 4.3.5, Pg 4-14; Appendix 25; Appendix 25, Table 2.1-4, Pg 2-17, Table 2.1-5, P2-18; Appendix AB | VIII<br><br>IX<br><br><br><br>Addendum VII | (a) It is unclear why the Proponent considers the glacial till to be a confining unit above the bedrock, when the hydraulic conductivity of the glacial till (geometric mean) is 1.7 x 10 -7 m/s and the hydraulic conductivity of the bedrock (geometric mean) is 1.6 x 10 -7 m/s (Appendix 25, Sections 2.1.5.1-2.1.5.2). These values are nearly identical. Clarification is requested. | The general condition of the glacial till being a confining layer over the more permeable bedrock fits with observations made on site, particularly the emergence of groundwater in the TSF area and artesian groundwater conditions in several bedrock monitoring wells and piezometers in both the TSF and Open Pit areas. Additionally, the glacial till in the TSF area is a clay till with a laboratory measured hydraulic conductivity of 1 x $10^{-10}$ m/s and falling head tests indicated k values of > $10^{-9}$ m/s. | Response satisfactory. | | | | | | |
| NRCan-15 | NRCan | 19-Aug-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | Appendix 23, 4.3.5, Pg 4-14; Appendix 25; Appendix 25, Table 2.1-4, Pg 2-17, Table 2.1-5, P2-18; Appendix AB | VIII<br><br>IX<br><br><br><br>Addendum VII | (b) It is unclear why the potentiometric surface is depicted in only 2 localized areas (Figures 7.7-3a and 7.7-3b) of the study area rather than for the entire study area. Specifically, it would be useful to see the potentiometric surface west of the Tailings Storage Facility between the TSF and Morrison Lake. | The potentiometric surface is expected to follow near the ground surface as found in the studied areas. | See below | | | | | | |
| NRCan-15b | NRCan | 17-Dec-10 | Hydrogeology and Groundwater Quality and Quantity | | | | The potentiometric surface should be depicted for the entire study area. | | Unresolved; further discussions required. Carry forward. | Refer to the EAC Application: Volume IX Appendix 25. Hydrogeological Modelling Report : Figure 3.8-1 "Simulated Head Equipotential Contours and Flow Directions at Pre-Mining (Layer 1)". | | | Noted | | |
| NRCan-16 | NRCan | 19-Aug-10 | Closure, Decommissioning and Reclamation | 9.3 | 16.5, Pg. 16-30; 16.4, Pg. 16-23; | III | (c) Specify whether the Waste Rock Dump will be re-vegetated following contouring in the post-closure period. | The Waste Rock Dump will be revegetated following contouring in the post-closure period. EAC Application, 16.5.1 Reclamation Schedule Pg. 6-31 " The final lifts of the WRD will be suitably contoured, capped and seeded to promote long-term stability and compatible wildlife use. " | Response satisfactory. | | | | | | |
| NRCan-17 | NRCan | 19-Aug-10 | Terrain, Soils and Overburden | 5.4 | | | The proponent should note that there is a recent open file report which contains data on till composition in the Morison Lake region which should be consulted (Ferbey et al. 2009): Ferbey, T., Levson, V. M., and Lett, R. E. 2009. Till geochemical exploration targets, Babine porphyry copper belt, central British Columbia. British Columbia Ministry of Energy, Mines and Petroleum Resources, Open File 2009-4, Geoscience BC Report 2009-10, Victoria. | Proponent notes and will refer to the indicated study. | Response satisfactory. | | | | | | |
| NRCan-18 | NRCan | 19-Aug-10 | Mine Development | 3.5 | 4.12.4.9, Pg. 109; 4.12.4.11, Pg. 4-111; 4.13.3, Pg. 4-122; 4.13.4, Pg. 4-126; 4.13.5, Pg. 4-128; Appendix 10 & 11 Appendix 11, Appendix V:<br><br>Appendix AX, Section 7, Pg.78; Section 8, Pg. 110 | I<br><br><br><br><br><br>V<br><br><br><br>Addendum XIII | Geotechnical Properties of Materials | Refer to Appendix AX Updated Geotechnical Feasibility Study. | Response satisfactory. | | | | | | |
| NRCan-19 | NRCan | 19-Aug-10 | Closure, Decommissioning and Reclamation | 9.3 | 16.9, Pg. 16-59; 16.11, Pg. 16-60; Chapter 13, Pg. 13-1; Chapter 14, Pg. 14-1 Chapter 16, Pg. 16-1 | III | Closure Environmental Management Plan – Dam Safety. NRCan would like to know if the final design will consider the values presented in section 4.12. If this is the case, why are these values selected over those presented in the Geotechnical Feasibility Study Report (Appendix 9) and how will this influence the geotechnical design. | The geotechnical parameters and stability design criteria summarized in the EAC Application Section 4.12 document are in error. The geotechnical design is based on parameters and criteria presented in the KCB Geotechnical Feasibility Study (Jan. 2009) as submitted with the Addendum as Appendix AX. Management, operation and closure of the TSF will follow the guidelines developed by the Mining Association of Canada. Accordingly, an Operations, Maintenance and Surveillance (OMS) manual and an Emergency Preparedness Plan (EPP) will be prepared prior to operations to guide responsible management of the facility | Response satisfactory. | | | | | | |

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| NRCan-20 | NRCan | 19-Aug-10 | Closure, Decommissioning and Reclamation | 9.3 | 13.3, Pg. 13-7; 13.4, Pg. 13-14; 13.5, Pg. 13-19; 13.6, Pg. 13-32; 13.7, Pg. 13-44; 13.14, Pg.13-138; 13.17, Pg. 13-146; 14.11, Pg. 14-58; Appendix 23; Appendix AA, AB, AC | III<br><br><br><br><br><br><br>VIII Addendum VII, VIII | Decommissioning - Water Treatment Plant. NRCan requires additional information i.e.: How long is a very long period of time? Who will be maintaining the water treatment plant? | The water treatment plant may be required in perpetuity. Care and maintenance of the Site including the water treatment plant will be provided by Pacific Booker Minerals personnel. | Response satisfactory. | | | | | | |
| NRCan-21 | NRCan | 19-Aug-10 | Closure, Decommissioning and Reclamation | 9.3 | 16.9, Pg. 16-59; 16.11, Pg. 16-60; Chapter 13, Pg. 13-1; Chapter 14, Pg. 14-1 Chapter 16, Pg. 16-1 | III | Closure Environmental Management Plan – Dam Safety. NRCan requires additional information with respect to the above citation and the following two topics, i.e.: Satellite Monitoring: What type of satellite image will be used? What would be resolution of these images? Will the resolution be high enough to detect movement and any other stability problems?<br><br>Geotechnical Monitoring: For how long will the inclinometers and piezometers be installed after the closure of the site? Who will be reading and maintaining this instrumentation? | Satellite Monitoring: Satellite Monitoring is not included in the monitoring plan presented in EAC Application Volume III Section 14.10.3.2 for the Tailings Dam. However, if such imagery is used resolution will be high enough to detect movement and any other stability problems. Ground level inspections and photography will be used to validate and supplement satellite monitoring.<br>Geotechnical Monitoring: Allowance in the closure plan provides for inclinometers and piezometers to remain in perpetuity after the closure of the site. Care and maintenance of the Site including reading and maintaining this instrumentation will be provided by Pacific Booker Minerals personnel.<br><br>Management, operation and closure of the TSF will follow the guidelines developed by the Mining Association of Canada. Accordingly, an Operations, Maintenance and Surveillance (OMS) manual and an Emergency Preparedness Plan (EPP) will be prepared prior to operations to guide responsible management of the facility | Response satisfactory. | | | | | | |
| NRCan-22 | NRCan | 19-Aug-10 | Effect(s) of the Environment on the Project | 7 | 10.5, Pg. 10-21; Appendix AC, AH ; Appendix AX, Page ii; Appendix AX, 4.3.1, Pg. 41 | III Addendum VIII, IX Addendum XIII<br><br>Addendum XIII | All of the newer (updated) documents refer to using "Extreme" as the design criteria for the tailings dams… it should be confirmed that this is the case. | As described the TSF dams are currently classified as Very High consequence. As described, flood and seismic criteria have been selected from the "Extreme" category to reflect possible changes to land use. However, a universal change to the "Extreme" consequence category for all design criteria was not made. | Response satisfactory. | | | | | | |
| NRCan-23 | NRCan | 19-Aug-10 | Effect(s) of the Environment on the Project | | 2.7.1 Water Cover | RRR | No specific requests for information nor clarification were made by reviewer. | PBM acknowledges the comments made. Additionally PBM advises the following. The TSF design assumes that a water cover will be required on closure to prevent oxidation of potentially acid generating (PAG) tailings. Although the existing data on the geochemistry tailings presented in the TSF Feasibility Study suggests that the tailings should not be acid generating, there is uncertainty that the samples are representative of the entire deposit and, consequently, there is a risk of PAG tailings.The option to install a pyrite removal cell exists if it is found such is required. | No further comment received from agency. | | | | | | |
| NRCan-24 | NRCan | 23-May-11 | | | | RRR | "…Baseline conditions for groundwater quality and quantity, including groundwater levels, flow direction and velocity, and recharge and discharge zones, have not been adequately characterized using on-site data. The proponent relies heavily on information presented in the literature. The data focuses on shallower hydro stratigraphic information, and often fails to examine deeper hydro stratigraphic units. This is significant, as excavation of the open pit will reach these deeper units." | Since 2006, the baseline hydrogeology report (EAC Appendix 24) covers the abovedata requirements, including hydraulic conductivity values from over 70 test sections in soils and bedrock to depths of approximately 150 m. The data also includes water level measurements from over 62 drillhole/piezometer locations.<br>The 3-D MODFLOW regional model is based on site data (as opposed to literature) and is presented in Appendix 25 of the EAC Application.<br>The 3-D MODFLOW groundwater model extends to approximately 450 m below the pit floor elevation. Hydrogeological characterization at depth in the open pit area has been appropriately assessed on the basis of trend plots relating hydraulic conductivity and depth (Figures 2.1-6, 2.1-7 and 2.1-8 of the Hydrogeological Modeling Report (Appendix 25 of the EAC Application).<br>Measured data extends to approximately 150 m depth. The trend of the data does not suggest that anomalous high hydraulic conductivities should be expected below 150 m depth. A review of drill core at depth has not identified anomalous fracture density. The typical trend of<br>hydraulic conductivity in bedrock is to reduce with depth as the confining pressure increases. | | | | The hydrogeology database and groundwater modeling are addressed in the 3rd Party Review Response Report. | | | |
| NRCan-25 | NRCan | 23-May-11 | | | | RRR | "Seepage of groundwater between the open pit and Morrison Lake was modeled using the 2-D SEEPW groundwater model. A 2-D model may not be sufficient for a project of this scale and complexity. The proponent did not provide adequate justification for the use of the chosen model." | The Upper Bound inflow predictions were based on the original EAC Application 3-D MODFLOW groundwater model which did not consider backfilling the open pit with waste rock. A 2-D SEEPW model was used to assess the change of infilling the open pit with waste rock and was used to assess the Expected Case pit inflows. In addition, analog models from Bell Mine and Granisle Mine were used to provide additional support for the assessment. The Bell Mine and Granisle Mines are in similar geological environments, adjacent to Babine Lake.<br>The assessment of Expected Case and Upper Bound case incorporated the weight of evidence of the 3D-MODFLOWS, 2-D SEEPW and analog models. | | | | see above | | | |
| NRCan-26 | NRCan | 23-May-11 | | | | RRR | "The EAC MODFLOW groundwater model was used to model other groundwater flows. This model relies heavily on off-site data" | Refer to response for Item 1 above. On-site baseline monitoring data from monitoring wells from 5 consecutive quarters, fall 2007 and through 2008 was used to calibrate the 3-D Modflow model. | | | | see above | | | |
| NRCan-27 | NRCan | 23-May-11 | | | | RRR | "In revising the mining plan (as outlined in the RRR), the Proponent has failed to update the model based on the revised plan. Specifically, prediction of inflows into the mine pit has not been updated. This is significant, as pit inflows have the potential to reduce water levels in Morrison Lake and to affect the project water balance" | The model has been updated to include the revised plan. Refer to Item 2 above. | | | | see above | | | |
| NRCan-28 | NRCan | 23-May-11 | | | | RRR | "The seepage collection plan for the TSF is unclear with respect to whether or not all potential seepage will be collected and treated. The proponent has not adequately assessed the fate of seepage through the base of the TSF, which is likely given the uncertain nature of the sediments that will line the TSF. | The seepage collection ponds will collect and recycle, or treat, all seepage that reports to the ponds. Nonetheless, the effects assessment of the TSF seepage assumes that all seepage will report to the receiving environment, which is specifically appropriate for closure.<br>The TSF will be constructed in stages over the life of the mine providing adequate time to continue with ongoing detailed site investigations and groundwater modeling to confirm and refine the groundwater model and predictions. | | | | | Noted | | |
| NRCan-29 | NRCan | 23-May-11 | | | | RRR | "A detailed monitoring plan is essential to show that sufficient information will be collected prior to project commencement in order to characterize baseline conditions. It is also needed to show that sufficient information will be collected during project operations and in the post-closure period to verify the Proponent's prediction of groundwater quality and quantity. The proponent has not provided such a monitoring plan" | The detailed monitoring plan will be developed for the Environmental Management Plans and the Environmental Effects Monitoring Plan, which will be prepared for permitting. The plan will be based on the detailed design of the mine facilities, which will include the next phase of geotechnical and hydrogeological site investigations and modeling and detail design. | | | | | EMP | | |
| NRCan-30 | NRCan | 23-May-11 | | | | RRR | The close proximity of the open pit and waste rock dump to Morrison Lake means that there is a short travel time for potential contaminants originating from the open pit to reach Morrison Lake, should a component of flow be in this direction. Therefore there is little chance for natural attenuation to reduce concentrations of any such contamination. There is also minimal time and space to use monitoring for early detection of potential contamination and to implement mitigative measures. | The effects assessment calculations assume that there is no natural attenuation. Natural attenuation would further reduce the potential effects.<br>The open pit will be developed over a period of approximately 22 years, following by a post closure period of backfilling the open pit with waste rock and reclamation of the mine area. This provides suitable time to continue to refine the hydrogeological and geochemical models and to implement adaptive management plans as described in Section 13 of the RRR. | | | | | Noted | | |

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| | | | | | | | | The open pit will be developed over 19 years in a number of stages: Phase I and II will be developed to 576 masl, a depth of ~156 m below Morrison Lake (~732 masl); Phases III and IV will be developed to 480 masl, a depth of ~252 m below Morrison Lake:<br>□ Phase I will be mined Year 1 to Year 7.<br>□ Phase II will be mined Year 4 to Year 11.<br>□ Phase III, an expansion of the Phase I pit will be mined Year 8 to Year 17 and<br>□ Phase IV, an expansion of the Phase II pit will be mined Year 12 to Year 19.<br>The slow development of the open pit will allow time for assessment of actual conditions and implementation of adaptive management measures if and as required. | | | | | | | |
| | | | | | | | | Although the open pit limit is within 85m of Morrison Lake at the closest point, the elevation of the pit limit at that point is ~800 masl. Therefore, considering the nominal 1:1 slope of the pit wall away from the Morrison Lake the horizontal distance between pit and the lake at the elevation of the lake (~732 masl) is ~ 153m. It should be further noted that the lake bottom slopes away from the open pit and that lake depth is limited to a maximum of approximately 13m in the vicinity of the open pit. Thus, the separation between the open pit and the lake increases rapidly at deeper pit levels. In fact at the full depth of the open pit the closest proximity of the lake to the pit is ~ 477m. | | | | | | | |
| | | | | | | | | During operations the waste will be stored in a natural catchment area draining into the open pit. Further during operations the area in the vicinity of the open pit will be dewatered to ensure pit wall stability. Post closure the waste rock will be placed in the open pit and the water level will be maintained below lake level. These measures all contribute to and are intended to reduce the likelihood that a significant volume of contaminated water will reach Morrison Lake. | | | | | | | |
| SFC-001 | Skeena Fisheries Commission | 20-Sep-10 | Aquatic Biology and Fisheries | 6.8 | 13; 14 | III | What does PBM propose for eliminating the threats to fisheries, aquatic habitat and water quality proposed by the mine? | A fish habitat compensation plan approved by the Department of Fisheries and Oceans will be implemented. An Environmental Management System will be implemented that comprises a series of envrionmental management plans including for fish & fish habitat, surface water quality and ML/ARD addressing mitigation and monitoring as well as reporting and assignment of responsibility (see EAC Application Vol III, Chapter 13). Additionally environmental monitoring and followup will include groundwater, aquatic effects and ML/ARD (see EAC Application Vol III, Chapter 14). | | | | | | | |
| SFC-001a | Skeena Fisheries Commission | 8-Dec-10 | Aquatic Biology and Fisheries | | | | This still does not address the issue of adequate baseline water quality data particularly for Morrison Lake itself. Will an up to date water quality regime be determined for Morrison Lake? Will Morrison Lake water quality be monitored regularly before, during and after mine operation and closure? The daily migration of zooplankton and rearing salmon between the hypolimnic zone and the hyperlimnic zone needs to be included in effects models. | | Unresolved; further discussions required. Carry forward. | The RRR Rev.2 presents a new mine plan, which includes placement of PAG rock back into the open pit represents a significant environmental benefit to the project. Appendix I RRR Rev.2 documents overall data collection. PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. The updated analysis uses all data collected up to January 2011 in preparing RRR Rev.2. The predicted impacts on Morrison Lake water quality are presented in RRR Rev.2, Section 10.2. For permitting and prior to construction, as part of the EMS, PBM commits to negotiating the monitoring requirements and including them in an Aquatic Effects Monitoring Program. | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | EMP | 4 | |
| SFC-002 | Skeena Fisheries Commission | 20-Sep-10 | Project Description | 3 | 4 | I | Will PBM site the open pit such that the closest edge is 1km or more from the shoreline of Morrison Lake? | Ore deposits cannot be moved; they exist where nature has placed them. The proposed open pit is designed to access the existing ore deposit and its location cannot be moved. As the ore is the reason for the mine the open pit cannot be sited 1km from Morrison Lake. | See below | | | | | | |
| SFC-002a | Skeena Fisheries Commission | 8-Dec-10 | Project Description | | | | PBM's own documents reveal that the ore body does extend beyond the dimensions of the proposed pit in both directions, towards/into the bed of Morrison Lake and around 1000m inwards from the pit edge farthest from the lake shore. Not all of the commercial minerals can be economically reached, perhaps not all of the deposit can be developed because of environmental constraints. At least various options for development need to be transparently considered. We note that the majority of adverse aquatic impacts associated with their project are due to the physical proximity of the open pit mine and the mine site to the shores of Morrison Lake. | | Response satisfactory to EAO. | | | | | | |
| SFC-003 | Skeena Fisheries Commission | 20-Sep-10 | Aquatic Biology and Fisheries | 6.8 | 8.1 | II | (a) Much of the fisheries data that is being relied on by PBM for the purposes of their EA application is out of date and in some cases significantly data deficient. | Over 100 years of literature was considered by qualified Registered Profesessional Biologists during gathering of baseline data and assessment of potential effects on fish. Additionally, Coho and Sockeye salmon are addressed in the Bustard and Rescan field studies commissioned by PBM in the period 2003 to 2009. Effects on both Coho and Sockeye were assessed and presented within the EAC Application, Vol II, Section 8.10). Also, LBN has been asked to provide any additional information they may have available, particularly that resulting from their fisheries surveys and field work funded by DFO. Also see below. | See below | | | | | | |
| SFC-003a | Skeena Fisheries Commission | 8-Dec-10 | Aquatic Biology and Fisheries | | | | Here PBM seems to be missing the heart of the issue. The coverage of existing literature may include some old references but it misses many relevant documents.. As my original criticism indicates, the quality of fisheries data used to make predictions of mine impacts on fisheries and aquatic resources is inadequate. If data are not available from previous studies and those that exist are old, new information needs to be collected. There are a variety of issues at work here, but at the root of things is that the fisheries and aquatics issues sections for the Morrison Mine EA seem to have been poorly conceptualized and thought out. We need more and better data in the Morrison mine EA for it to be considered scientifically acceptable. It is our (SFC) opinon that the way things currently stand with the Morrison Mine EA, there is not sufficient information available in the current EA to effectively evaluate what impacts the project might have on aquatic resources and the scale of these impacts. | | Requires further discussion. Carry forward. | RRR Rev.2 provides updated effects assessment tables in Sections 10 and Appendix IV. The assessment of effects on fish and fish habitat are presented in the Fish Habitat Compensation Plan (March 2011). | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| SFC-004 | Skeena Fisheries Commission | 20-Sep-10 | Aquatic Biology and Fisheries | 6.8 | | | (b) The current level of understanding Lake Morrison fish stocks and their associated population dynamics is limited. | See above. Also a shoreline spawning survey proposed by LBN is underway and PBM is contributing up to $20,000 towards this survey. MOE's (Chris Schell 2003) report detailing salmon populations for Morrison Lake and Morrison River within the Babine Lake watershed. The following text is quoted from the report: Morrison Creek – The flows, temperatures, and turbidities in Morrison Creek are moderated by Morrison Lake, creating excellent spawning and rearing habitat. This creek is used by a significant run of non-enhanced Babine sockeye, with an average of 8,900 annual escapement during the 1990's. This stream is also used by coho (263 average during 1990's), and pink (<100 fish) during high escapement years. Babine rainbow trout do not appear to spawn in Morrison Creek itself, but do use unnamed tributaries to Morrison Creek for spawning,as do coho. | See below | | | | | | |

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| SFC-004a | Skeena Fisheries Commission | 8-Dec-10 | Aquatic Biology and Fisheries | | | | Talo Creek, Morrison Lake and Morison Creek (The Morrison Watershed) is one of the major sockeye salmon producers of the Skeena region. Morrison lake contains the critical rearing habitat for juvenile sockeye. As such First Nations of the Babine Lake area and the Skeena downstream are dependent on the continued productivity of Morrison Lake. Discssion of the data on Morrison Lake productivity for sockeye and coho salmon is needed. The literature review and baseline work conducted to date is not adequate for assessing what impacts the project might have, and the extent of these impacts on fisheries and aquatic resources. | | Requires further discussion. Carry forward. | The predicted impacts on Morrison Lake water quality are presented in RRR Rev.2, Section 10.2. | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| SFC-005 | Skeena Fisheries Commission | 20-Sep-10 | Aquatic Biology and Fisheries | 6.8 | | | (c) There is a lack of understanding of the nature of the interactions between Morrison Lake fish stocks and others (e.g. Lake Babine fish stocks). | See above. Also the Project cumulative effects assessment (EAC Application Vol III, 11) spatial boundary was the regional study area that included Babine Lake and identified negligible lethal and low sublethal effects on fish. | See below | | | | | | |
| SFC-005a | Skeena Fisheries Commission | 8-Dec-10 | Aquatic Biology and Fisheries | | | | How can one make the determination that there are "negligible lethal and low sublethal effects on fish" when there is not an up to date picture of the stocks in Morrison Lake? The sockeye productivity of Morrison lake has not been measured for several decades. The current (depressed) status of the population is not discussed. | | Requires further discussion. Carry forward. | Salmon spawning rates at about 10,000 sockeye and a few hundred coho in 2011 appear to be within natural variation of annual spawning so are not indicative of depressed spawning based on ~60 years of historical data (See Figure "Salmon Spawning). The predicted impacts on Morrison Lake water quality are presented in RRR Rev.2, Section 10.2. An updated FHCP has been submitted to DFO (March 2011). | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| SFC-006 | Skeena Fisheries Commission | 20-Sep-10 | Aquatic Biology and Fisheries | 6.8 | 11; 13.6 | III | (d) The thinking on fish habitat issues requires expansion. Proposed mitigative actions have been constrained to Morrison Lake itself thus far, but what about fish habitat concerns in other water bodies of the Skeena watershed? | See above. Also the Project cumulative effects assessment (EAC Application Vol III, 11) spatial boundary was the regional study area that included Babine Lake and identified only low significance effects on fish habitat. The effects that result in harmful alteration, disruption or destruction of fish habitat (HADD) as defined by DFO are in Morrison Lake watershed will be mitigated via a fish habitat compensation plan as included in the Environmental Management System (EAC Application Vol III, Section 13.6). | See below | | | | | | |
| SFC-006a | Skeena Fisheries Commission | 8-Dec-10 | Aquatic Biology and Fisheries | | | | OK, however, PBM does not seem to be considering the impacts a water quality change might potentially have on fish populations and their associated food sources and habitats in Morrison Lake, Babine Lake and other tributaries downstream. | | Response satisfactory to EAO. Aquatic health issues are assessed separately from physical habitat impacts in the EA. | | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| SFC-007 | Skeena Fisheries Commission | 20-Sep-10 | Aquatic Biology and Fisheries | 6.8 | | | (e) An up to date shoreline spawning assessment of Morrison Lake is required. | A shoreline spawning survey proposed by LBN is underway and PBM is contributing up to $20,000 towards this survey. | See below | | | | | | |
| SFC-007a | Skeena Fisheries Commission | 8-Dec-10 | Aquatic Biology and Fisheries | | | | This is great and to be commended. The shoreline spawning survey, however, should be regarded as a start and not a finish in terms of gaining an up to date picture of the current status of the fisheries and aquatic resources of Morrison Lake. Data on this topic needs to be presented not just collected. | | Requires further discussion. Carry forward. | The salmon spawning survey was completed by LBN in 2010 and the report submitted in January 2011. An updated FHCP has been submitted to DFO (March 2011). | | An additonal spawning survey was carried out n fall 2011. | | | |
| SFC-008 | Skeena Fisheries Commission | 20-Sep-10 | Aquatic Biology and Fisheries | 6.8 | | | (f) Save for a background literature compilation little mention of Morrison lake Coho or Sockeye salmon is made in any of the fisheries related EA documents, only rainbow trout. Coho and Sockeye salmon are important to the Gitxsan and Lake Babine Nations among others as a food source, and Morrison Lake contributes significant numbers of Coho and Sockeye towards this purpose. Thus a clearer picture of the current status of Morrison Lake Coho and Sockeye stocks needs to be ascertained as well as the potential impacts the proposed mine might have on these populations. | See above. Also Coho and Sockeye salmon are addressed in the Bustard and Rescan field studies commissioned by PBM in the EAC Application. A shoreline spawning survey proposed by LBN is underway and PBM is contributing up to $20,000 towards this survey. PBM would be pleased to receive any current data or information on salmon stocks within Morrison Lake that Skeena Fisheries Commission may have. | See below | | | | | | |
| SFC-008a | Skeena Fisheries Commission | 8-Dec-10 | Aquatic Biology and Fisheries | | | | This goes back to my original comments of the fisheries data being relied on being close to out of date. The Bustard report is essentially a literature review. The field work that was performed for the Bustard report was essentially confined to the physical mine site itself, with very little sampling conducted in Morrison Lake. The spawning survey being performed by LBN will provide valuable data but more field work will be required to gain an accurate picture of the situation in Morrison Lake itself. | | Requires further discussion and may result in a commitment. Carry forward. | The predicted impacts on Morrison Lake water quality are presented in RRR Rev.2, Section 10.2. An updated FHCP has been submitted to DFO (March 2011). | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| SFC-009 | Skeena Fisheries Commission | 20-Sep-10 | Aquatic Biology and Fisheries | 6.8 | | | Is PBM willing to rectify the knowledge gaps cited above by funding the required research and work that is required or via other means? | PBM is committed to filling baseline data gaps that may be necessary to meet the requirements of the Federal and Provincial Environmental Assessments. A shoreline spawning survey proposed by LBN is underway and PBM is contributing up to $20,000 towards this survey. | See below | A salmon spawning survey was completed by LBN in 2010 and the report submitted in January 2011. Salmon spawning rates at about 10,000 sockeye and a few hundred coho in 2011 appear to be within natural variation of | | | Condition #25 | 2 | |
| SFC-009a | Skeena Fisheries Commission | 8-Dec-10 | Aquatic Biology and Fisheries | | | | Would PBM be willing to fund a hydroacoustic study of Morrison Lake to collect current information on the current use of Morrison Lake rearing habitat by salmon and the density and number of fry present? | | Requires further discussion. Carry forward. | A salmon spawning survey was completed by LBN in 2010 and the report submitted in January 2011. Salmon spawning rates at about 10,000 sockeye and a few hundred coho in 2011 appear to | | | Condition #25 | | |
| SFC-010 | Skeena Fisheries Commission | 20-Sep-10 | Project Description | 3 | | | (a) The entire Morrison mine project site (not just the open pit) is in very close physical proximity to the shoreline of Morrison Lake, likely posing a long term water quality problem overall. Again (related to point 1): Is PBM willing to relocate the project site such that there will be 1 km or more of buffer between the mine site and the shores of Morrison Lake? | Ore deposits cannot be moved; they exist where nature has placed them. The proposed open pit is designed to access the existing ore deposit and its location cannot be moved. As the ore is the reason for the mine the open pit cannot be sited 1km from Morrison Lake. Drawing 3204 (attached on Page 4) shows plan and section views of the open pit, waste rockdump and Morrison Lake. | See below | | | | | | |
| SFC-010a | Skeena Fisheries Commission | 8-Dec-10 | Project Description | | | | I realize the nature and concentration of a gold deposit is likely considered proprietary information within the mining industry, however, the view of SFC is such that the way the current Morrison mine project is proposed may not be justifiable in terms of the high risk environmental factors associated with executing the mining activities in such close physical proximity to Morrison Lake. The costs associated with eliminating any negative environmental impacts affiliated with mining so close to the shores of Morrison Lake might substantially erode economic gains. The environmental assessment phase should include discussion of alternative mine design and siting. | | Response satisfactory to EAO. | | | | | | |
| SFC-011 | Skeena Fisheries Commission | 20-Sep-10 | Geology and ML-Ard | 6.3 | | | (b) Mine tailings will be stored underwater on site - Is this truly the best practice available for managing mine tailings? | The practice of storing mine tailings and waste rock underwater on the mine site is a proven technique used globally to eliminate the possibility of acid rock drainage from submerged tailings. Submerging the tailings or rock stops the mechanisms that generate acid as oxygen cannot access the tailings and chemically react. For this reason MEMPR Guidelines for MLARD state "If problematic materials are to be excavated, exposed or created during mining, underwater storage is generally the most effective means of preventing ARD and reducing metal leaching. Due to the low solubility of oxygen in water, underwater disposal can essentially prevent sulphide oxidation, thereby reducing acid generation and metal leaching to levels that generally no longer pose an environmental concern." | See below | | | | | | |
| SFC-011a | Skeena Fisheries Commission | 8-Dec-10 | Geology and ML-Ard | | | | What about the impacts of this practice on groundwater quality? | | Requires further discussion. Carry forward. | Section 8.2 and Section 8.3 of RRR Rev.2 updates predictions of seepage water quality. | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |

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| SFC-012 | Skeena Fisheries Commission | 20-Sep-10 | Environmental Management System | 9 | 13.3; 13.17; 14.5; 14.11 | III | (b) Mine tailings will be stored underwater on site - If the aforementioned practice is truly the best option then what is PBM proposing to eliminate any potentially deleterious ground water issues? | Per MEMPR comments "The option chosen for the location of the tailings impoundment appears reasonably defensible." As part of the Environmental Management System EAC Vol III, 13.17 "ML/ARD Prediction and Prevention Plan" will be implemented as well as a 13.3 "Water Management Plan" and a 13.13 "Tailings and Waste Rock Management Plan". Additionally, an Environmental Management Plan "Groundwater Monitoring Plan" in EAC Vol III, 14.5 and "ML/ARD Monitoring Plan" in EAC Vol III, 14.11 will be implemented. | See below | | | | | | |
| SFC-012a | Skeena Fisheries Commission | 8-Dec-10 | Environmental Management System | | | | The groundwater model used by PBM had some glaring oversights from the perspective of various hydrogeological professionals on the technical working group. Will the monitoring plans be able to compensate for the worst case scenario/compensate for a water quality reality that turns out to be far worse than predictions? How is "reasonably defensive" defined? | | Requires further discussion. Carry forward. | The groundwater model in the EAC Application and the revised groundwater model in the RRR Rev.2 were prepared and reviewed by hydrogeological professionals who found that the models did not contain glaring oversights. Modelling is not an exact science, uses simplifications of the real world, and model outputs must be considered in context. "Reasonably defensive" refers to taking these caveats into account and to the quality of groundwater modelling results obtained. | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| SFC-013 | Skeena Fisheries Commission | 20-Sep-10 | Aquatic Biology and Fisheries | 6.8 | 11; 13.6 | III | (c) The "footprint" of the mine/project site in terms of aquatic habitats and resources. - Does PBM plan to engage in developing predictions their proposed mine project might have on the entire Skeena watershed instead of just the immediate physical project area? | The regional study area for the project does not extend to the entire Skeena watershed. Also the Project cumulative effects assessment (EAC Application Vol III, 11) identified low signficant residual effects on fish habitat. These low significance effects in Morrison Lake watershed that result in a HADD as defined by DFO will be mitigated via a fish habitat compensation plan. Other mitigative measures related to fish and aquatic habitat are included in the Environmental Management System (EAC Application Vol III, Section 13.6). | See below | | | | | | |
| SFC-013a | Skeena Fisheries Commission | 8-Dec-10 | Aquatic Biology and Fisheries | | | | PBM seems to be missing the point that although project might have a limited geographical scope in terms of physical territory disturbed, the effects of the projects disturbance are likely to be much farther reaching. | | Requires further discussion. Carry forward. | Section 11 of RRR Rev.2 "The cumulative effects of the water flow and water quality, particularly on Morrison River and Babine Lake, are negligible." | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| SFC-014 | Skeena Fisheries Commission | 20-Sep-10 | Hydrogeology and Groundwater Quality and Quantity | 6.7 | 7.6; 7.7; App 24, 25 | I<br>I<br>VIII | (d) Developers of the EA Application do not appear to have used any hydrogeological studies of groundwater regimes in the proposed project area. - Is this indeed the case? If not, then how has groundwater data been used in the development of the EA Application? | Hydrogeological modelling and studies of the groundwater regimes in the proposed project area were used. | See below | Multiple extensive groundwater modelling exercises were completed for the Project. Refer to EAC Application Appendices 23, 24, 25 for detailed information on hydrogeological information used for the Project. Additional updated hydrogeological information is provided in the RRR, Section 6, 7 and 8. | | | | | |
| SFC-014a | Skeena Fisheries Commission | 8-Dec-10 | Hydrogeology and Groundwater Quality and Quantity | | | | Acknowledging the comments of other technical reviewers, the data relied upon and assumptions upon which the hydrogeological models were built is dubious. Additionally, it is remarkable that the groundwater modelling exercises conducted did not indicate any interactions between the waters of Morrison Lake, the open pit waters and ground water. | | Requires further discussion. Carry forward. | Data used for hydrogeological modelling was collected by registered environmental professionals. A concern was raised by reviewers that the EAC baseline groundwater quality may not properly reflect the actual groundwater quality due to a few samples (of many) which had a high turbidity. The high turbidity values could be due to insufficiently developed groundwater monitoring wells or due to a high extraction rate during sampling. Accordingly, the groundwater quality database was reviewed by professionals and a revised groundwater quality that excludes the high turbidity samples was generated for the Project. Revised groundwater modelling and results are presented in RRR Rev.2, Sections 6, 7 and 8. | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| SFC-015 | Skeena Fisheries Commission | 20-Sep-10 | Aquatic Biology and Fisheries | 6.8 | Appendix AB, Table 5.2 Pg. 69 | Addendum | (e) There does not appear to be any recent water quality data for Morrison Lake and the northern section of Lake Babine. Does PBM intend to help rectify this knowledge gap? | 2008 water quality data for Morrison Lake is provided in the EAC Application. PBM has continued to collect surface water data in 2009 and 2010 with the most recent samples taken in October, 2010. | See below | PBM continues to collect baseline water quality information for Morrison Lake. PBM collected additional data in 2009 and 2010 as well as January 2011. Freshet (ice-off) data was collected in June, 2011. Appendix I RRR Rev.2 documents overall data collection. Data available through January 2011 was used in preparing RRR Rev.2. | | | Condition #22 | | |
| SFC-015a | Skeena Fisheries Commission | 8-Dec-10 | Aquatic Biology and Fisheries | | | | Would like to see this data and a map of where water quality samples from Morrison Lake were taken. | | Requires further discussion. Carry forward. | A map showing the locations of water quality samples for Morrison lake is in EAC Application, Vol. 1, Section 7.9, Fig. 7.9-1 | | | | | |
| SFC-016 | Skeena Fisheries Commission | 20-Sep-10 | Closure, Decommissioning and Reclamation | 9.3 | Appendix AA, Exec Summary | Addendum | (f) According to the current version of the EA Application, the process that will be used to filter out potentially deleterious substances such as sulphate, cadmium and selenium will be what is called a High Density Sludge (HDS) filtering technique. Of note is that this technique does not filter out the aforementioned compounds to levels acceptable to British Columbia water quality guidelines. What will PBM do to rectify this deficiency? | The conventional HDS treatment process is less effective for removal of selenium and cadmium. If the project requires further removal of selenium and cadmium additional treatment can be added; the overflow from the clarifier can be sent to the columns containing either ion exchange resin or activated silica gel. PBM commits to not discharging water that does not meet permitted guidelines. | See below | | | | | | |
| SFC-016a | Skeena Fisheries Commission | 8-Dec-10 | Closure, Decommissioning and Reclamation | | | | Is the additional treatment the "ion exchange resin/activated silica gel" or just an expansion of the conventional HDS treatment process? Need clarification. Are there checks and balances to ensure that an excess of water high in selenium and/or cadmium does not get discharged inadvertently? | | Requires further discussion and may results in a commitment. Carry forward to tracking table 2. | The quality of water discharged from the treatment plant will be monitored and reported as required by MoE. | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| SFC-17 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | The RRR is focused primarily on revisions to water quality predictions associated with the proposed mine site itself. | The report incorporates all of the changes to the project since the submission of the Environmental Assessment Certificate (EAC) Application in 2009 and the EAC Addendum in 2010. Changes to the project required that analysis of both water quality and water quantity be updated. Additionally effects assessments are also updated. | | | | | | | |

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| SFC-18 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Very little new fisheries field work has been conducted; and what has been done has been performed on Nakinilerak Lake. | Previously documented fisheries work has been presented in prior reports and in the Fish Habitat Compensation Plan as submitted to DFO March 21, 2011. Field work for which reports are provided with the RRR was done for a variety of purposes (e.g. Snow Survey, Moose and Mule Dear, Water Quality Monitoring and Baseline Data gathering for Nakinilerak). Nakinilerak Lake is not intended as a reference lake. As such, there is no intent or requirement to make fisheries ecological comparisons with Nakinilerak Lake. Another reference lake that will not be potentially affected by the project may serve this purpose. Rather as some seepage may report to that watershed PBM committed to gathering baseline data for Nakinilerak Lake which commenced in 2010. A Nakinilerak Baseline Plan was submitted to and commented on by MoE in March, 2011. | | | | PBM has collecgted baseline data from Nakinilerak Lake and Stream 10 in September 2011. | | | |
| SFC-19 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Fisheries Habitat analyses are being considered only in terms of physical habitat Disruptions e.g. Loss of Lake Bottom surface area caused by an effluent pipeline. No serious consideration of water quality impacts on fish and fish habitat in Morrison Lake have been entertained thus far. | Effects on water quality which may result in effects on fish are included. The plume represents a very limited volume of the lake and, for the expected case, it is only within the plume that water quality exceeds water quality guidelines. Effects were assessed considering the both the small size of the plume and the brief residence time individual fish are expected to have within the plume. | | | | 3rd Party Review Response Report-Addendum | | | |
| SFC-20 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | The fisheries values of Morrison Lake particularly Sockeye still have not received any attention in the EA process. | Studies of fish and fish habitat have been a key aspect of the EAC Application as fish, most notably salmon are identified as a Valued Ecosystem Component (VEC). In addition to prior studies by Bustard and Rescan, LBN completed a Salmon Spawning Survey in October/November 2010. The total salmon escapement for the Morrison watershed was 10,132 Sockeye and 1,002 Coho. Therefore, relative to the size of the overall salmon run in the Babine watershed the Morrison Lake<br>and River spawning provides a minor contribution. However, PBM further notes that irrespective of determination of any absolute or quantified salmonid values the EA is intended to assess effects.<br>No significant residual adverse effects on salmon have been determined thus the absolute salmonid value, though of interest to all parties, is not impacted and not specifically relevant to<br>the EA. | | | | | Condition #26 | | |
| SFC-21 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | PBM is unable or unwilling to say at this time how and when potential technical problems with the execution of their mine will be dealt with. | Within the RRR and EAC Application Volume III Sections 9, 13 and 14 PBM has dealt with accidents, malfunction, and other circumstances that require a response. Although PBM has endeavoured to address reasonably foreseeable events and identified<br>management and mitigation measures, not every circumstance can be addressed. | | | | | Noted | | |
| | | | | | | | | PBM has endeavoured to address reasonably foreseeable events and identified management and mitigation measures , not every circumstance can be addressed .<br>Accidents and malfunctions are by their nature unpredictable events.<br>Designs are intended to prevent occurrence however, a number of potential events are addressed in EAC Application Volume III Section 9. As described therein "Emergency preparedness<br>and response plans (EPRPs) will be developed to address the identified environmental risks from potential accidents and malfunctions."<br>PBM has identified contingency plans which may be applicable as adaptive management in some circumstances. PBM has made commitments to implement adaptive management that will be triggered based on specified criteria . | | | | | | | |
| SFC-22 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Skeena Fisheries Commission (SFC) received two documents on DVD from Pacific Booker Minerals (PBM) on July 15 th 2011<br>(a) AIK = Application Information Key -- an excel spreadsheet consisting of 130 rows of information.<br>(b) Review Response Report - Revision 2 - an 804 page PDF report prepared by PBM's consultant Klohn Crippen Berger (KCB). | Note that the Fish Habitat Compensation Plan March 21, 2011 provides additional details. | | | | | Noted | | |
| | | | | | | | Overall, the intent of the aforementioned documents was for PBM to address the latest technical criticisms of the Morrison EA technical working group provided to PBM in December 2010 and January 2011. BCEAO decided that the RRR was acceptable to justify lifting the suspension of EA proceedings on July 18th 2011. The latest RRR is still under review by technical working group members with comments due back to the BCEAO by August 3rd | The Review Response Report addresses the following:<br>• Inclusion of additional baseline data collected since submission of the EAC Application<br>• Modification to the management plans for overburden, waste rock and tailings to reduce the long term risks associated with closure of the mine and long term metal leaching and acid rock<br>drainage (ARD/ML). The main modifications include:<br>o Placement of all potentially acid generating (PAG) waste rock back into the open pit post closure, where it will be submerged and capped with a low permeability cover.<br>o Separation of sulphide (Cleaner) tailings for a controlled disposal. The Cleaner and Rougher tailings will be sent to the TSF in separate pipelines. The Cleaner tailings will be discharged near the central operating decant pond. The Rougher tailings will be discharged around the perimeter and will form the majority of the beaches. On closure, the TSF pond water will be piped to the open pit and the TSF will be closed as a combination of pond, wetland, and forest.<br>o Relocation of the overburden stockpile from Morrison Point, which is an important area to the LBN, to a location farther inland from Morrison Lake.<br>o Updating of the water management plan based on the revised waste management schedule, with the objective of minimizing the volume of water stored on closure. | | | | | Noted | | |
| | | | | | | | | The project changes result in modifications to the Effects Assessment related to improved water quality in Morrison Lake and ecosystem restoration on closure. The project changes result in reductions in both the volume of water discharged and geochemical loads from the mine area, as well as changes to the reclamation areas. In addition, closure of the TSF and mine area is accelerated. Also introduced is an<br>effects significance rating that is applied to all project effects.<br>(3) After reviewing the latest RRR SFC has concluded that there have indeed been improvements to the EA on PBM's part to technical gaps in the EA; however, the vast majority of the improvements are in reference to water quality and the mine site itself. No new information has been gathered with reference to the fisheries data gaps on Morrison Lake and its associated watershed. | | | | | | | |
| | | | | | | | | PBM has addressed baseline data gaps as required to complete the EAC Application and Fish Habitat Compensation Plan. | | | | | | | |
| SFC-23 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | PBM is advocating that a more comprehensive treatment of water quality effects be delayed to the permitting stage. SFC objects strongly to this approach, as we cannot advise our member Nations on potential impacts to their Aboriginal rights without a full understanding of all treatment and mitigation strategies. | For clarity, PBM has completed the effects assessment based on the baseline water quality data and analysis of future water quality. Statements in the RRR indicate that:<br>• Site specific water quality objectives for cadmium and sulphate could be required for the receiving streams and will be developed during the permitting stage of the project.<br>• Further evaluation to determine if anoxic conditions in Booker Lake will be undertaken prior to construction and design of oxygenating works, if required, will be carried out as part of detailed<br>design and permitting. | | | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |

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| SFC-24 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 13 RRR 4 "The water quality effects on Morrison Lake, therefore, are negligible and site specific water quality objectives are not required." 4SFC says that this conclusion is not for PBM to make. Environment Canada should be making an assessment of the water quality effects on Morrison Lake and, from there, decide whether specific water quality objectives are required. | Both CEAA and EAO require that PBM be obligated to submit an assessment of effects for their consideration. | | | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the | | | |
| SFC-25 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 33 RRR 4 The main overburden stockpile has been relocated from Morrison Point to a location that is 700m away from Morrison Lake." SFC questions whether this is a realistic safe distance to store toxic compounds away from the lake? | The material stored in the overburden stockpile will not be toxic. Additionally it will be non-PAG. Further runoff will be managed using ditches and sediment ponds to prevent erosion and siltation. | | | | | Noted | | |
| SFC-26 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 33 RRR 4 The open pit, after placement of waste rock, would be closed as a combination of grassland and shallow pond." SFC questions whether this bucolic outcome is possible when using a waste rock dump? | This "pleasant" outcome is the result of design that is deemed to achievable by qualified and experienced professionals. | | | | | Noted | | |
| SFC-27 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 58 RRR - Anoxic bottom waters of Booker Lake and Ore Pond . SFC repeats its comments from #5 above in relation to this delay by PBM on describing how they will deal with these impacts. The approach is unacceptable to SFC. | A methodology and approach for dealing with anoxic water is presented. Further evaluation to determine if anoxic conditions in Booker Lake will be undertaken prior to construction and design of oxygenating works,<br>if required, will be carried out as part of detailed design and permitting. | | | | | Condition #1 | | |
| SFC-28 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 62 RRR - Operational Segregation of mine waste rock - "A waste dump and a low grade stockpile will be located 100m north and east of the open pit." SFC considers this to be remarkably close to Morrison Lake despite the extreme risk to a highly productive salmonid fishery. | The waste rock dump and low grade ore stockpile are located almost entirely in open pit catchment and this location is duly considered in the effects assessment. | | | | | | | |
| SFC-29 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 70 RRR - Elevation of surface of Pit waters = 730m; Elevation of surface of Morrison Lake = 733m. SEC observes that this small difference in elevation is likely to lead to problems. | The reference to the elevation of 730m is not the closure pond water level but rather is stated with respect to establishing the available volume for pit infilling with waste rock and tailings during closure. The water level in the closed open pit will be similar to Morrison Lake at about 733m.<br>During operations the waste will be stored in a natural catchment area draining into the open pit. Further, during operations the area in the vicinity of the open pit will be dewatered to ensure pit wall stability. Post closure the waste rock will be placed in the open pit and the water level will be maintained below lake level. These measures all contribute to and are intended to reduce the likelihood that a significant volume of contaminated water will reach Morrison Lake. | | | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| | | | | | | | | The groundwater system will return to a "similar" pre-mining baseline condition. An estimate of the regional groundwater flow into the open pit area on closure can be made on the basis of the hydro-geologic<br>recharge area and the net annual infiltration rate of 77 mm/yr (14% of total precipitation goes into groundwater). The open pit is approximately 1.2 km long, and it is approximately 4.2 km to the<br>groundwater divide, which then equates to a groundwater flow into the pit area of approximately 40 m3/hr. | | | | | | | |
| | | | | | | | | The elevation of the pit lake area is the same as Morrison Lake and groundwater flow will: a) move into the pit lake; b) move through the PAG waste rock and into Morrison Lake; and/or c) move around or<br>under the open pit or flow parallel to Morrison Lake and the regional groundwater system. Maintaining the open pit level at lake level will minimize seepage. Within the RRR PBM has identified contingency plans, which may be applicable as adaptive management in some circumstances. PBM has made commitments to implement adaptive management that will be triggered based on specified criteria. | | | | | | | |
| SFC-30 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 84 RRR 4 "The slow development of the open pit will allow time for assessment of actual conditions and implementation of adaptive management measures if and as required." SFC asks whether adaptive management can compensate for wall collapse between Morrison Lake and the open pit mine? | Pit wall stability will be assessed as the wall rock is exposed during pit development. Lower strength or higher hydraulic conductivity rock will be identified will be addressed before the pit wall becomes unstable. | | | | | Noted | | |
| SFC-31 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 95 RRR "The elevation of the pit lake area is the same as Morrison Lake and Groundwater flow will... (b) move through the PAG (potentially acid generating) waste rock and into Morrison Lake -*SFC says that this is a particularly troubling point given the significant lack of quantification. | The seepage from the open pit to Morrison Lake is quantified in the RRR 10.2.4.2 Loading Sources Pg 147. | | | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, | | | |
| SFC-32 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 96 RRR 4 "An understanding of the hydraulic connectivity between Morrison Lake and the Open Pit will be developed during operations."-> SFC requires that the hydraulic connectivity be examined and well understood long before operations commence, for the same reason as stated above. | PBM believes the quotation is actually from RRR Section 6.4.3 Pg 97. PBM points out that a key word 'improved' is omitted by SFC. The correct quotation is "An improved understanding of the hydraulic connectivity between Morrison Lake and the Open Pit will be developed during operations. The refined groundwater models will be used to reassess the potential for groundwater movement of PAG porewater into Morrison Lake." Thus, there is an<br>understanding of the hydraulic conductivity, but during operations it will be improved.<br>The open pit limit is within 85m of Morrison Lake at the closest point. The elevation of the pit limit at that point is ~800 masl. Therefore, considering the nominal 1:1 slope of the pit wall away from the Morrison Lake the horizontal distance between pit and the lake at the elevation of the lake (~732 masl) is ~ 153m. | | | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| | | | | | | | | The lake bottom slopes away from the open pit and that lake depth is approximately 9.1m in the vicinity of the open pit. Thus, the separation between the open pit and the lake increases rapidly at deeper pit levels. At the full depth of the open pit, the closest proximity of the lake to the pit is ~ 477m . The baseline hydrogeology report (EAC Appendix 24) provides hydraulic conductivity values from over 70 test sections in soils and bedrock to depths of approximately 150 m. The data also includes water level measurements from over 62 drill-hole/piezometer locations. The 3-D MODFLOW regional model is based on site data and is presented in Appendix 25 of the EAC Application. | | | | | | | |

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| | | | | | | | | The 3-D MODFLOWS model extends to approximately 450 m below the pit floor elevation. Hydrogeological characterization at depth has been appropriately assessed on the basis of trend plots relating hydraulic conductivity and depth (Figures 2.1-6, 2.1-7 and 2.1-8 of the Hydrogeological Modeling Report (Appendix 25) of the EAC Application. Measured data extends to approximately 150 m depth. The trend of the data does not suggest that extremely anomalous high hydraulic conductivities should be expected below 150 m depth. A review of drill core at depth has not identified anomalous fracture density. The typical trend of hydraulic conductivity in bedrock is to reduce with depth as the confining pressure increases. | | | | | | | |
| SFC-33 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 100 RRR A claim of a "zero" water discharge system - This is an obviously false statement: how can a zero discharge system be achieved when there is groundwater infiltration? | A zero surface water discharge is referred to by PBM during operations. This is applicable to contact water that does not meet water quality guidelines. Seepage is clearly identified and addressed in the water balance and in the effects assessment most notably for Morrison Lake water quality. It should be noted that contributing to the Project's ability to achieve zero surface water discharge are clean water diversions as well as accumulation of water as tailings pore water. Additionally tailings pond water will be used and recycled through the process plant. | | | | The 3rd Party Review Response Report provides additional clarifiaction of potential water balance and water flows and management of the waste rock and LGO and tailings. | | | |
| SFC-34 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 117 RRR "The quantity of water that will require treatment and discharge into Morrison Lake is 55 m3/hour (55,000 litres/hour) - SFC observes that if the water treatment is to go on in perpetuity as is mentioned in the current iteration of the Morrison EA, the costs of continual water treatment will far outweigh the potential economic gains of the project. | The cost of closure and operating water treatment on a perpetual basis has been considered on a present value basis in the project financial model. The project economic benefit is net of the cost of water treatment. Note also that the water quality in the open pit pond used for design of the water treatment plant may improve over time as the ML/ARD diminishes. Although this has not been included in assessing the operating costs of the water treatment plant if it does occur the cost of operating the treatment plant will also be reduced. | | | | The 3rd Party Review Response Report provides additional clarifiaction of potential water balance and water flows and management of the waste rock and LGO and tailings. | | | |
| SFC-35 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | $850,000.00/year = cost of lime to treat water in the open pit upon mine closure. SEC observes that water treatment will be required for a minimum of 100 years, and potentially for 500 years or longer. | The cost of closure and operating water treatment on a perpetual basis has been considered on a present value basis in the project financial model. The project economic benefit is net of the cost of water treatment. | | | | | Noted | | |
| SFC-36 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | PBM acknowledges in this latest RRR that there will be seepage into Morrison Lake from the open pit (some PAG), yet still have not collected the fisheries data for Morrison Lake, which would ultimately be affected by said seepage. This approach is unacceptable to SFC. | Studies of fish and fish habitat have been a key aspect of the EAC Application as fish, most notably salmon are identified as a Valued Ecosystem Component (VEC). In addition to prior studies by Bustard and Rescan, LBN completed a Salmon Spawning Survey in October/November 2010. The total salmon escapement for the Morrison watershed was 10,132 Sockeye and 1,002 Coho. This compares with historical averages based on ~60 years of historical data (See Figure "Salmon Spawning below). Therefore, relative to the size of the overall salmon run in the Babine watershed the Morrison Lake and River spawning provides a minor contribution. However, PBM further notes that irrespective of determination of any absolute or quantified salmonid values the EA is intended to assess effects. No significant residual adverse effects on salmon have been determined thus the absolute salmonid value, though of interest to all parties, is not impacted and not specifically relevant to the EA. | | | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| SFC-37 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 97 - Technique that PBM intends to use to intercept contaminated groundwater (and thereby prevent discharge into Morrison Lake) is unclear. SFC requires more detail and clarity on the proposed technique. | Interception is identified as a contingency plan and can be achieved using wells drilled to intercept the flow. | | | | | EMP | | |
| SFC-38 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 133 - PBM makes assertions as to establishing water quality objectives and determining what can and cannot be discharged and at what levels: "... This discharge concentration would be lower than the site specific water quality objective to be developed for Stream 7 and could, therefore, be discharged." -SFC again says, as in #6 above, that these statements are for the appropriate regulatory authority to make, not PBM. | Both CEAA and EAO require that PBM be obligated to submit an assessment of effects for their consideration. | | | | | Noted | | |
| SFC-39 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 161 - Classification of significance - by PBM's own admission: "... the rating does not answer the key question: Is the project likely to cause significant adverse residual environmental effects?" In light of this statement, SFC questions BCEAO's acceptance of the RRR as sufficient answer to questions already raised by itself and other Working Group members. | The statement referred to is in reference to the original classification of effects provided in the EAC Application. Hence in the RRR Rev.2 a supplementary classification is included, that incorporates the Residual Effects Rating Factors, to answer the basic question: are the effects significant or not significant? This approach provides EAO and CEAA a clear Yes or No answer as to whether or not the project will cause significant adverse residual environmental | | | | | Noted | | |
| SFC-40 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 163 - Fish Habitat Compensation Plan (FHCP) - has still not been expanded to consider Morrison Lake in the context of Fish Habitat. This is completely unacceptable to SFC. | Fish Habitat has been addressed in the FHCP March 21, 2011. | | | | The project does not result in a HADD to Morrison Lake. | EMP | | |
| SFC-41 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 169 -By PBM's own analysis their project will exceed the British Columbia water quality guidelines for the following 6 parameters: (i) Sulphate (ii) Aluminum (iii) Arsenic (iv) Cadmium (v) Cobalt and (vi) Selenium. SFC asks how BCEAQ will address these circumstances? | Agreed however per effects assessment as any resulting adverse residual effects are of negligible to minor significance. PBM will apply for SSWQG. PBM cannot address the query as to BCEAO's approach. | | | | 3rd Party Review Response Report-Addendum | EMP | | |
| SFC-42 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 175 - PBM cites that the Potentially Acid Generating (PAG) porewater seepage will be at a rate of 40,000 liters/hour with significant PAG potential from year 30 to 80 (50 years). This observation is very troubling to SFC, and demands a mitigation strategy. | Additional mitigation is not required as any resulting adverse effects are of negligible to minor significance. It should also be noted that the PAG porewater quality will improve over time. As described in RRR Rev.2 "An approximation of the potential loading sources over 100 years is shown in Figure 10.1, which indicates that the maximum load (shown as Total % of Potential) could be reached in Year 40 and would reduce with time." | | | | The project changes presented in the 3rd Party Review Response Report (Addendum 1) result in a minor impact on the water quality of Morrison Lake, but still well below BCWQGs, and, consequently, negligible effect on the aquatic habitat. | | | |
| SFC-43 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 182 - "The potential residual effect on Morrison Lake is negligible to minor, with the main effect being an increase in sulphate concentration, particularly near the diffuser. Nonetheless, the concentrations are well below BCWQGs" SFC asks how this assertion can be made when the full fisheries dynamics of Morrison Lake are not well understood? | The statement is based on the data and analysis as well as the judgement of the qualified professionals completing the assessment. | | | | see above | | | |

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| SFC-44 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 182 - SEC asks how potential project effects can be considered both minor and long-term? | Description of ratings descriptors are presented within the RRR Table 10.2 Residual Effects Rating Descriptors. However, the final determination of the significance is subject to the judgement of the qualified professional completing the assessment. | | | | see above | | | |
| SFC-45 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 189 - Mention of Morrison Lake and fish habitat: "...minor losses in Morrison Lake due to the footprints of the freshwater and treated effluent pipelines." - SFC remains very concerned that there is no mention or discussion of Morrison Lake Salmonids and water quality interactions. | The referenced losses relate directly to habitat. | | | | see above | | | |
| SFC-46 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 202 "The cumulative effects of the water flow and water quality, particularly on Morrison River and Babine Lake, are negligible and not significant" -SFC observes that there is no evidence to support this statement, and notes too that Morrison Lake is not included in the statement. | Morrison Lake effects are assessed as not significant. | | | | see above | | | |
| SFC-47 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 207 - Cadmium -SEC asks what is the effect on fish inhabiting the area adjacent to the mine site? | The asessed effect is not significant.<br>There is no expectation that fish will not inhabit the area adjacent to the mine site. Rather it is believed that their residence time in the zone of higher contaminant concentration in the vicinity of the diffuser will be very limited. | | | | see above | | | |
| SFC-48 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 455 - During field work conducted in January 2011 by KCB only three (3) sites on Morrison Lake were sampled for water quality. SFC says that this is insufficient. | Water quality samples collected for Morrison Lake at 5 locations August 2006, July 2008, March, September, October 2010 and January, June 2011. In January 2011 for water quality 11 samples from 5 locations, however physical parameters were successfully collected from only 3 locations. Morrison Lake – water quality samples were taken from surface (2 m) and deep (30 m) waters on five locations on the lake, and a third set of samples were taken at a middle depth (15 m) at the proposed diffuser location. A YSI-600 probe was used to construct a vertical profile at each location of physical parameters (temperature, pH, EC, DO, TDS and ORP), but due to extreme cold the probe did not function as intended at sample locations B and D (diffuser). | | | | | Noted | | |
| SFC-49 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 563 onward - SFC notes that PBM's consultant conducted additional fieldwork from May 31/2011 - June 9/2011. The focus for Morrison Lake was water quality parameters e.g. Depth, temperature, dissolved oxygen, clarity/transparency, etc. SFC further notes that no substantive fish and fish habitat sampling or analysis of Morrison Lake or Morrison River was conducted. | Acknowledged. Sufficient fish and fish habitat data was already available for FHCP and EAC Application. | | | | | Condition #26 | | |
| SFC-50 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 573 Minnow trapping activities were focused in and around the proposed mine site and areas around Nakinilerak Lake. SFC says that this is insufficient, and that further sampling activities are required, particularly in Morrison Lake. | Acknowledged. Sufficient fish and fish habitat data was already available for FHCP and EAC Application. | | | | | Condition #26 | | |
| SFC-51 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 574 Gill Netting efforts were focused on Nakinilerak Lake only (7 Rainbow trout were caught) - SEC observes that no fishing activity, Gill Netting or otherwise, was made in Morrison Lake. This is unacceptable to SFC. | Acknowledged. Sufficient fish and fish habitat data was already available for FHCP and EAC Application. | | | | | Condition #26 | | |
| SFC-52 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Page 575 - Angling (hook and line) surveys were conducted. SEC notes that, contrary to accepted scientific practice, there is no methodological description of the approach used, and also that no fish were caught and sampled from the angling activities. | Angling was conducted as a supplementary method to gill netting and minnow trapping in Nakinilerak Lake. Trawling was conducted at slow speed when travelling between sites (Nak 1, Nak 2 and Nak 3). No fish were captured. PBM is not aware of any protocol for angling. | | | | | Condition #26 | | |
| SFC-53 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Pages 781 - 804 (end of document) - SFC notes that while there is some consideration (in tabular form) of potential impacts on Morrison Lake water quality by mining activities; there is no quantification of what fish species and fish habitats are in Morrison Lake adjacent to the proposed mining site. This is a glaring oversight and far from acceptable to SFC. | Sufficient fish and fish habitat data was already available for FHCP and EAC Application. | | | | | Condition #26 | | |
| SFC-54 | Skeena Fisheries Commission | 2-Aug-11 | | | | RRR Rev.2 | Overall, the additional fisheries work conducted for the latest RRR is superficial at best. Many serious questions about the extent of Morrison Lake fisheries resources that are at risk remain unanswered, as do questions about the extent of the risks the mine would pose to Morrison Lake. | PBM believes that sufficient baseline data and information was gathered since 2002 as a basis for the EA. Additional data and information would not be likely to change the assessment. | | | | | Condition #26 | | |
| TranCan-01 | Transport Canada, John Mackie | 16-Aug-10 | Navigable Waters | 6.12 | 3.4.1 of Draft FHCP Options, prepared by KCB for PBM, August 9, 2010 | | 3.1.4 Pipeline Installation. The placement of the freshwater and treated effluent pipelines in Morrison Lake would require approvals under the NWPA section 5(3). Technical information required for the regulatory process to move forward include general arrangment drawings (plan and profile) of these pipelines and a 'legal' location (legal description) at the place where the pipes will be located in the waterway. Latitude and Longitude is helpfull. | Requested drawings have been provided to TC. | Resolved. | | | | | | |
| TranCan-02 | Transport Canada, John Mackie | 16-Aug-10 | Navigable Waters | 6.12 | 4.1 of Draft FHCP Options, prepared by KCB for PBM, August 9, 2010 | | 4.1 Compensation for Fish Bearing Streams (HADD's). Generally proposed as 'off channel' habitat near Morrison Lake or the ponds downstream of the TSF. Based on the descrition in the report, no approval under the NWPA is required and no further requirement for technical information. | Acknowledged | Resolved. Information / clarification point. | | | | | | |

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| TranCan-03 | Transport Canada, John Mackie | 16-Aug-10 | Navigable Waters | 6.12 | 4.2.3 of Draft FHCP Options, prepared by KCB for PBM, August 9, 2010 | | Figure 3.1 TMF Drill hole and Test pit Locations: The figure clearly demonstrates that geotechnical studies were focused on the North and South dam areas of TMF, while the vast majority of the impoundment has not been tested for overburden thickness, hydr | The conceptual design for a rock reef is not part of the current feasibility level designs prepared for the FHCP. As such, subject to acceptance of the feasibility level design by DFO, it is unlikely the rock reefs will be installed. | Resolved. Information / clarification point. | | | | | | |
| TranCan-04 | Transport Canada, John Mackie | 16-Aug-10 | Navigable Waters | 6.12 | 4.2.3 of Draft FHCP Options, prepared by KCB for PBM, August 9, 2010 | | Both the reef and pipeline works would require approval under the NWPA prior to their construction. This would be in addition to the section 23 exemption required for Booker Lake. | Acknowledged - PBM will ensure approval and permitting of any works will be acquired prior to construction. | Resolved. Information / clarification point. | | | | | | |
| MFLNRO-1 | DRT-D.Tamblyn | 17-Aug-11 | Hydrogeology and Groundwater Quality and Quantity | | | RRR Rev.2 | A single laboratory test of glacial till is insufficient. Till is extremely spatially variable (heterogeneous) as the minimal field testing shows. Particle tracking (figure II-4 and solute concentration isopleths (Figure II-5 are misleading and inappropriate for an acknowledged highly heterogenous medium modelled as homogeneous. | · Hydraulic conductivity testing has been completed on 5 samples of undisturbed glacial till and 4 samples of re-compacted glacial till. The geological interpretation of the glacial till for the TSF design is based on all of the drill holes and soil classification of all of the samples. Modeling of the TSF as a homogeneous isotropic system is the only practical means of modelling the system, recognizing the inherent deficiencies in any modelling exercise. Testing and mapping has shown heterogenity within the till occurs at the local scale. This variability will influence local pathways for seepage migration (primarily within the till). Regional flow paths, and hence the ultimate fate of contact seepage is dependent primarily upon the sub-regional and regional hydrogeological setting and processes.<br><br>The objective of the modelling study was to assess impacts to all potential receptors near the site. Concentration isopleths and particle tracking assisted with this assessment. It is impractical to simulate local-scale system variability in a numerical model intended for regional asesssment; it is unlikely this would change the outcome of the assessment, or add to the predictive capacity of the model. | | | | The hydrogeology database and groundwater modeling are addressed in the 3rd Party Review Response Report. | | | |
| MFLNRO-2 | DRT-D.Tamblyn | 17-Aug-11 | Hydrogeology and Groundwater Quality and Quantity | | | RRR Rev.2 | Dams span several thousands of metres. If only 4 samples show till covering 5 orders of magnitude, significant high K zones will be present in many areas. Not clear how areas where dam core will need to be keyed into rock would be identified as dam construction progresses, nor how low K rock would be identified in the field. | · Construction of earth dam cores in glacial till environments is common and requires on site QA/QC to ensure excavation of permeable soils and fractured rock. Insitu falling head tests are carried out in areas of uncertain hydraulic conductivity. | | | | | | | |
| MFLNRO-3 | DRT-D.Tamblyn | 17-Aug-11 | Hydrogeology and Groundwater Quality and Quantity | | | RRR Rev.2 | Basis for assuming vertical K lower than horizontal by a factor of 10 should be explained. Tailings would be expected to be a much more uniform material than a natural soil, especially till. Why would layering be so prevalent? | Tailings is typically isotropic as it is laid down in a fluvial environment with changing % solids, beach lengths and gradation (cyclone overflow versus total tailings). The use of a factor of 10 is common. | | | | | | | |
| MFLNRO-4 | DRT-D.Tamblyn | 17-Aug-11 | Hydrogeology and Groundwater Quality and Quantity | | | RRR Rev.2 | Basis for this estimate (14% infiltration) is not given. Seems low unless vegetative cover is extensive. What are the consequences of underestimating recharge? If infiltration were, say, 30% it would approximately double the flux out of the TSF. | The 14% recharge rate applied to the tailings is consistent with that for the glacial till in the TSF area in the baseline (pre-development) model. This rate was optimized through calibration. Although the till is not an analogue for placed tailings, both materials are of low permeability relative to others included in the model. The 14% recharge rate is therefore considered appropriate given the small effect recharge has on TSF seepage rates.<br><br>For all scenarios, the constant head boundary representing the pond is by far the controlling influence on rates of TSF seepage; varying recharge has no effect on seepage for cells assigned this condition. The rate of seepage from areas outside the pond is not directly proportional to recharge as suggested, as the low premeability of the tailings and underlying till tend to increase mounding within the tailings outsid ethe pond in preference to seepage.<br><br>The applied 14% recharge rate is considered appropriate for the folllowing reasons:<br>(1) evaporative losses were not considered seperately in the model, and were accounted for through adjustment of recharge.<br>(2) The beach mateirals will be saturated when placed and will be sloped toward the pond to promote drainage. These factors will promote recharge rejection and surface runoff, ahead of infiltraiton.<br>(3) 14% is comparable to recharge rates applied to tailings on other projects in BC for forested areas. | | | | The hydrogeology database and groundwater modeling are addressed in the 3rd Party Review Response Report. | | | |
| MFLNRO-5 | DRT-D.Tamblyn | 17-Aug-11 | | | | | Basis for defining upper and lower bounds should include consideration of K. Uncertainty in K (orders of magnitude) swamps questions about pond size. If the "large pond" is a possibility, the rest of the report should make that clear. The Executive Summary only refers to the "small pond." Section 4 on the TSF should present plans showing the size of the pond under different contingencies (4.4.1 to 4.4.5). Given the wide range of contingencies affecting pond size and the wide uncertainty regarding K for the tailings and the natural sediments, the use of the terms "upper bound" and "lower bound" may be inappropriate.MODFLOW and SEEP/W are appropriate codes on which to base a numerical flow model to predict average flux, but not specific flowpaths. Both use an equivalent porous media (EPM) approach, and this decision should be discussed and justified. There is likely no other option given the minimal baseline data. The resulting model can aim at "average" flow and chemical flux, not upper bounds as suggested throughout the report. The model and the report also overstate the ability to correct or mitigate potential problems. Seepage collection may be ineffective if flow follows preferential pathways which should be the expectation. | Sensitivity analyses for K are not a proxy for defining bounds for expected seepage, but can be used to assist with evaluating uncertainty, and could be undertaken in future. All calibrated models are 'unique' in the sense that inputs are related - varying K in isolation of recharge to define bounds violates the existing calibration. The exisitng calibrated inputs are within the measured and expected range.<br><br>An EPM approach in discretely fractured geology is common for region scale modelling assessments for the purpose of environemental impact assessment, and has previously been accepted by regulators. The modelling approach is not limited by data availability as suggested, but rather the problem scale. It should be noted that faults were included in the model, and were conservatively assumed to be universally of higher K than surrounding geology.<br><br>If seepage migraiton along prefernetial flow paths is detected, then the mitigation approach would be developed accordingly (eg. grouting or pumping from localized permeable zones). | | | | The hydrogeology database and groundwater modeling are addressed in the 3rd Party Review Response Report. | | | |
| | | | | | | | The use of upper bound seepage rates for environmental effects is appropriate and protective of groundwater and surface water values. | Agreed. However, any mitigation or design considerations need to be judged based on the expected liklihood and consequence of the risk, rather than juston results of a numerical model. | | | | | Noted | | |
| MFNLRO-6 | DRT-D.Tamblyn | 17-Aug-11 | Hydrogeology and Groundwater Quality and Quantity | | | | The stated range of K almost certainly underestimates the true range of uncertainty. The methodologies (slug tests, recharge tests) test only a very small volume of the rock mass immediately around the hole, and are not suitable for identifying preferential pathways which control flow in discrete fractures. Mine depth is 372 m, hydrogeological investigation depth is 150 m. Review of drill core is not an acceptable substitute for field investigation. We have no hydrogeological data on the lower 60% of the mine. It is true that the typical trend of K in bedrock is to reduce with depth as confining pressures increase. However, the open pit reduces confining pressures, and the public interest is served when mining EAs are based on site-specific investigations. Pumping tests have been repeatedly requested in previous regulatory reviews (Wei,2009; Carmichael et al, 2011). Pumping tests would demonstrate the volume of rock tested via an observed zone of drawdown. The use of inappropriate field methodologies (or no field methodology for the lower 60% of the pit) casts serious doubt on the modelled results. | PBM concur that flow in bedrock will be largely controlled by fracture flow however the use of a homogeneous isotropic MODFLOW or SEEPW model is appropriate for providing an averaged model basis for planning. The measurement of hydraulic conductivity due to stress relaxation in the open pit could only be carried out after the pit has been excavated. Review of drill core is used to augment field hydraulic conductivity data, not replace it. The stress relaxation will also be mitigated, particularly at depth, by the 3-D confinement of the pit. Hydraulic conductivity data is available down to elevation 608 m and the maximum pit floor is approximately elevation 480 m. Therefore, the volume of mine rock below the elevation of hydraulic conductivity is approximately 25% of the total (not 60%). Although slug tests measure localized K, the exisitng data coupled with mapping and geological/structural data suggests no regionally extensive structures which might represent preferential flow pathways exist. Regardless, there is no 'silver bullet' solution to define potential pathways; the scale of geopysical assessment at the regional scale is too coarse to identify, and pumping tests for this purpose are inherently restricted by the placement of observation wells.<br><br>Review of drill core geology and structure is extremely valuable with qualitatively defining whether hydrogeological characteristics at depth differ from those encountered previously, but it is agreed this should be backed up with in situ testing for verification.<br><br>Pumping tests may be completed during later design work to assist with optimization of dewatering management for the pit. | | | | The hydrogeology database and groundwater modeling are addressed in the 3rd Party Review Response Report. | | | |

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| MFNLRO-7 | DRT-D.Tamblyn | 17-Aug-11 | Hydrogeology and Groundwater Quality and Quantity | | | RRR Rev.2 | The uncertainty in **measuring** flows is almost a factor of four. Uncertainty in **predicted** flows at other mines is a factor of ten (Kemess). These analogs are useful, but significant differences need to be taken into account – inflow depends on driving hydraulic gradient and bulk effective hydraulic conductivity in the surrounding bedrock and lakebed sediments. We have no information on lakebed sediments or surrounding bedrock at the other mines. | As described in the text the range of flows is related to changes in catchment areas of the Bell and Granisle pits. The analog pits are included for context. The lakebed sediments are predcited to have only a slight effect on controlling seepage rates from the lake to/from the pit, as the models assumed full hydraulic connection between the lake and groundwater throughout mining. | | | | | Noted | | |
| MFNLRO-8 | DRT-D.Tamblyn | 17-Aug-11 | Hydrogeology and Groundwater Quality and Quantity | | | RRR Rev.2 | The treatment of pit inflows is highly subjective (all values assumed; "upper bound" scenario not defined – assumed to be professional judgement). Despite suggesting that faults may be significant contributors to flow and act as preferential pathways, there is no mention that these were actually included in the analysis in any way. | Faults were not included in the SEEP/w simulations. The assumption that these will act as preferential pathways is highly conservative, and there has been no suggestion in the data to date that these zones exist. It is in the operational interest of the site to minimize potential pumping requirements during operation, and consideration may therefore be given to grouting to minimize inflow along faults where these are encountered and act as long-term preferential flow pathways. | | | | The hydrogeology database and groundwater modeling are addressed in the 3rd Party Review Response Report. | | | |
| MFNLRO-9 | DRT-D.Tamblyn | 17-Aug-11 | Hydrogeology and Groundwater Quality and Quantity | | | RRR Rev.2 | There is no design basis for what is termed the "upper bound", so it is assumed to be based on professional judgement. The infiltration rate drives the flows – at 14% it seems reasonable for many landscapes, but there is no specific justification or field measurement for what is a key variable driving many of the flow rates. | The recharge rate is only one contributing factor defiing seepage rates. Reliable quantificaiton of recharge is notoriously difficult, particularly given spatial and temporal variability. | | | | The hydrogeology database and groundwater modeling are addressed in the 3rd Party Review Response Report. | | | |
| MFNLRO-10 | DRT-D.Tamblyn | 17-Aug-11 | Hydrogeology and Groundwater Quality and Quantity | | | RRR Rev.2 | The hydrogeological assessment by KCB appears to have included all significant impacts on valued components – that is, it appears **complete**. Its overall adequacy, however, hinges on whether or not the predicted effects have been reliably quantified, if "upper bound" estimates do actually encompass a reasonably conservative range of possible effects. | | | | | | Noted | | |
| | | | | | | | B.C.'s environmental assessment process aims to "ensure that major projects meet the goals of environmental, economic and social sustainability". Sustainability cannot be assessed unless the effects are understood and quantified within reasonable bounds of uncertainty. The DRAFT Water and Air Baseline Monitoring and Initial Impact Assessment Guideline for Mine Proponents and Operators, v.3 (MoE, January 2011) suggests guiding principles for conducting hydrogeological investigations regarding mine proposals in BC, including the following under **uncertainty analysis**: | | | | | | Noted | | |
| | | | | | | | It is the proponent's responsibility to collect all required data for a thorough groundwater assessment. Particular attention should be paid to identifying and acquiring critical missing and incomplete data (gaps) that are needed to assess the impact(s) of the proposed mine. | | | | | | Noted | | |
| | | | | | | | … Where project data is insufficient to define the probability distribution, Monte Carlo simulation or conservative estimates, e.g., published ranges, may be used with caution. Lack of data can only justify expanding, never contracting, uncertainty bounds. | | | | | | Noted | | |
| | | | | | | | These standards of uncertainty analysis do not appear to have been met. Reliance is instead placed on the professional judgement of the authors. All EAs depend on professional judgement to some extent because environmental effects are defined on the basis of a hypothetical future project. However, the public interest is served when professional judgement begins with adequate field data to characterise the pre-project conditions. The present review suggests that the baseline characterisation of hydrogeology is deficient. | Uncertainty is compensated with the use of appropriately conservative assumptions; e.g. : 1) 100% TSF seeapge reports to directly to Morrison Lake without attenuation,; 2) 100% of regional groundwater flow transports 100% of PAG porewater into Morrison Lake, in addition to assuming no attenuation; 3) Effects assessment is based on peak loadings from the TSF, PAG porewater and Treatmetnt Plant occurring at the same time: Figure 10.1 indicates that full loadings will occur occur for a limited time; and 4) Hydraulic conductivity of rock between Morrison Lake and the Open Pit is assumed to be equivalent to that measured for the fault zone. | | | | | Noted | | |
| | | | | | | | The professional judgements expressed by the authors provide an unwarranted air of precision and apparent certainty – opinions presented as facts. The estimates presented appear reasonable, based on the information at hand; but the information at hand (baseline characterisation) is inadequate for the stated purposes. | | | | | | Noted | | |
| | | | | | | | Such an outcome might be defensible if this was the first review to offer feedback on the site characterisation, but it is at least the third consecutive review of hydrogeological assessment for this project to suggest that additional field work was required. In the current proposal (RRR Rev 2), the proponent has modified the project proposal in several ways to reduce the potential adverse environmental effects to water resources. The size and timing of those effects are still highly uncertain because of the poor site characterisation work done in the past. | PBM is commtted to continual development and refinement of the hdyrogeological models and predictiions throughout the project life. The Adaptive Management Plan is designed, and will be further refined during the Permitting Phase, to ensure protection of the environment. | | | | | Noted | | |