Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
EAO-001	21-Apr-2016	EAO	Alternative Means	General TAA comments: Two of "fatal flaws" are AuRico preferences (avoidance of MMER trigger and location in mineral claims) as opposed to technical, enviro, socail constraint per se. This is OK, but rationale should be offered.	Appendix 4-C *Alternatives Assessment for Tailings and Waste Rock Disposal* was updated in response to this comment. Please see the red line version of the appropriate word document.	6-Jul-2016
EAO-002	21-Apr-2016	EAO	Alternative Means	Reference to consequences of chosen option should be in main text of tailings alternative assessment (as opposed to referring readers to the accidents and malfunctions section in an appendix of the appendix).	Appendix 4-C Alternatives Assessment for Tailings and Waste Rock Disposal was updated in response to this comment. Please see the red line version of the appropriate word document.	6-Jul-2016
EAO-003	1-Nov-2016	EAO	Harvestable Plants	Please provide some further details on why no residual effects were identified for harvestable plants, considering that the loss of 39.6 ha and the alteration of 170.6 ha harvestable plant habitat was predicted. I note that in the Application, it's indicated that mitigation measures such as dust suppression, erosion and invasive plant control are considered adequate to prevent residual effects but presumably these measures wouldn't be entirely adequate for habitat lost in the subsidence zone or on roads, for example.	The response is provided in memo **20161124_A.1 KUG Comment EAO-003_Harvestable Plants_Memo**.	25-Nov-2016
EAO-004	3-Nov-2016	EAO	Cummulative Effects - Wildlife	One of the concerns raised by working group members with not considering various potential habitat effects to wildlife species as residual is that they would then not be considered for a cumulative effects assessment. We understand that in the forthcoming memo there will be further information regarding what AuRico's "threshold" is for residual effects for each wildlife VC. However, in the interest of time, EAO requests that for all plant and wildlife valued components where the Application predicts any impacts to habitat, that AuRico provide a quantitative cumulative effects assessment. If you are able to include this in the forthcoming memo noted above that would be great, however if this would delay your submission of the request from the wildlife meeting beyond Nov 10th then please keep the two items separate in order to meet the Nov 10th deadline for the original request.	The response is provided in memo **20161124_A.1 KUG Comment EAO-004_CEA Wildlife_Memo**.	25-Nov-2016
EAO-005	9-Nov-2016	EAO	Cummulative Effects - Water	A cumulative effects assessment for groundwater quantity, groundwater quality, surface hydrology and surface water quality ("the water VCs"). EAO acknowledges that the KUG water VC assessments were cumulative in nature, as post-KS conditions were used as KUG baseline conditions for the water VCs. However, what is missing is AuRico's characterization / interpretation and significance determination on the resultant cumulative effects. I note that in the final AIR it states the following for each of the water VCs "Cumulative residual effects will be described and their significance will be assessed" (sections 6.1.5, 6.2.5 and 6.3.5). Note that during this EA EAO has heard particular concerns related to cumulative effects to waste rock creek (e.g. from TKN and FLRNO), and potentially to Attichika creek. Accordingly, please provide a thorough interpretation of cumulative effects to water quality for these watercourses in consideration of all relevant related VCs (e.g. fish and aquatic species).	The response is provided in memo **20161128_A.1 KUG Comments EAO-005 CEA for Water VCs.**	29-Nov-2016
EAO-006	18-Nov-2016	EAO	Fish and Aquatic Habitat	EAO is requesting additional information for our fish and fish habitat chapter of the draft technical report. We are looking for additional information on the changes in water quality and quantity on fish and fish habitat. Can AuRico quantify the effects for fish and fish habitat from water quality and quantity effects? We note (as did the Application) that the residual effects are habitat changes and reduced habitat quality; but yet the residual effects characterization does not speak specifically to what those changes mean for fish (other than in the context). Ideally we would like to have more information in this table especially for magnitude and what that means for fish. Perhaps we have missed this information in the Application or supplementary memos that you could point us to?	The response is provided in memo **20161128 KUG Comments EAO-006 Fish Assessment Memo**.	30-Nov-2016
EAO-007	24-Oct-2016	EAO	CEAA 5(1)(b) requirement	As a follow up from our Oct 19th meeting, can AuRico please produce a map for EAO's technical report related to the CEAA 5(1)(b) requirement that shows any overlap between assessment boundaries and federal lands (including Indian reserves). Also, please include a short assessment on any predicted impacts to those lands – the Application currently states that there will be no impacts because the Project is solely on provincial crown land. The assessment needs to consider "downstream" effects as well (i.e. those effects within RSAs). More information on the 5(1)(b) assessment can be found on pages 6-7 of the guidance document "Meeting Statutory Requirement under CEAA Paragraphs 5(1)(a), 5(1)(b), 5(2)(a), and 5(2)(b)" on EAO's website here: http://www.eao.gov.bc.ca/substitution.html	Federal lands in the region of Kemess Underground were identified in Section 1.6 of the Application. The attached map shows the Indian Reserves listed in Table 1.6-1 in relation to the wildlife regional study areas used in the EA; all other RSAs used for other VCs lie within the wildlife RSAs. Three of the Indian Reserves (and associated Aboriginal communities) are identified in the assessment as Potentially Affected Communities (PACs) considered in the for social and economic effects. None of the other federal lands identified in Section 1.1 are located within the extents of the attached map. All Indian Reserves fall outside of the general wildlife RSA, the caribou RSA, and all other biophysical VC RSAs. There are several Indian Reserves that fall within the grizzly bear RSA. The effects assessment of grizzly bear did identify residual effects (Section 15.6.5 of the Application), however, the residual effects are characterized to be local in scale and thus not expected to impact grizzly bears that may be located in or proximal to any Indian Reserve (located ~100 km from the Project. Thus, all Indian Reserves identified in Table 1.6-1 and the attached map are located outside the area where measurable Project effects are expected to occur. Thus, no federal lands will be experience biophysical effects associated with the Project. Three of the Indian Reserves (and associated Aboriginal communities) are identified in the assessment as Potentially Affected Communities (PACs). These are the Aboriginal communities of Kwadacha (Fort Ware IR 1; Kwadacha Nation), Takla Landing (North Tacla Lake IR 7/7a; Takla Lake First Nation), and Tsay Keh (formerly Ingenika Settlement No. 08368, which is federally designated Indian Settlement land, being converted to a reserve; Tsay Keh Dene Nation). Each of the social and economic VCs considered potential effects on both Aboriginal and Non-Aboriginal populations. No adverse residual effects were identified for the Social VC of "Aboriginal Community Well-being" (see Section 17.6 of the Application) . For the Economic VC of "Aboriginal Labour Market Conditions", two potential residual effects were identified as described in section 16.6 of the EAC Application and summarized below: i. During construction and operation phases, increased demand for skilled workers may result in Aboriginal businesses (including on-reserve businesses in the Aboriginal PACs) may have a more difficult time retaining workers in the face of increased demand and potentially higher wages offered by the Project. The effect is expected to be short term and reversible, and limited effects on on-reserve businesses are expected (as most of the known on-reserve businesses do not have the same demand for skilled workers as the Project). However, it is possible that some skilled workers on reserve may be hired by the Project and therefore leave positions in the community. AuRico plans to maintain engagement with the TKN to proactively identify and address issues. A significant residual effect is not expected, for First Nations living on or off reserve. ii. There will be a loss of employment as the workforce is downsized throughout the closure phase. The Proponent will put in place measures to enhance Aboriginal hiring and support Aboriginal workers; however, not all Aboriginal workers will be members of the TKN First Nations (including TKDN, TLFN, and KwN), and not all TKN workers will live on reserve. AuRico cannot predict how many workers will live on-reserve in the Aboriginal PACs at the time of closure. However, the mitigation measures identified in the Application (including workforce transition plan) will apply to all workers. The magnitude of the effect will depend on the prevailing economic conditions at the time, but in general the effect is expected to be short-term and reversible as workers will benefit from work experience and skills development gained through employment with the project. A significant residual effect is not expected, for First Nations living on or off reserve.	3-Nov-2016
MEM-001	21-Apr-2016	Sean Shaw, MEM	Tailings and Waste Rock Management	No information provided on source or geochemical characterization of NAG tailings used to cap TSF tailings beach prior to closure	Additional information regarding the geochemical characterization of the final tailings sand for beach construction (above water beach tails) will be provided on May 31'16.	6-Jul-2016
MEM-002	21-Apr-2016	Sean Shaw, MEM	Geochemistry	Please provide Decline ABA results by rock type in Appendix 7-E, A-33	Appendix 7-E *Kemess Underground Project - Geochemical Characterization Source Term Development and Water Quality Predictions for Underground Contact Waters* was updated in response to this information request. Specifically, pages A-34 and A-35 of Appendix A (in Appendix 7-E) have been updated.	6-Jul-2016
MEM-003	21-Apr-2016	Hugh McCreadie, MEM	Water (Ground)	- recharge distribution did not seem to be varied - hydraulic conductivity did not seem to be adjusted to accommodate the change in recharge - MEM-Groundwater requests parameters varied same way for baseline and predictive model	Recharge and hydraulic conductivity were varied independently in the baseline model, See App. 9-B, Section 4.4 for a detailed discussion. Additional hydraulic conductivity and recharge sensitivities were performed on the predictive model and are discussed in App 9-B, Sections 7.1.2, 7.2.2, 7.3.1.	6-Jul-2016
MEM-003.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	This comment was marked closed but it actually remains open. The fundamental assumption underlying the geographical distribution of recharge has not been varied as part of the sensitivity analysis. Specifically, recharges seems to be increased at a rate of 200% per 100 m, which is about 40 times greater than the proposed 5% per 100 m for precipitation. This orographic effect on recharge was increased in the sensitivity analyses rather than decreased. Please provide a thorough justification for this large gradient, including quantitative water balance calculations, available information on snow accumulation along the ridges above the elevation of the subsidence zone, the expected influence of topographic gradient on recharge, the expected influence of permeability on recharge, and the potential for ground freezing at high elevations to limit recharge of snowmelt. Please present the precipitation and snowpack data in summary tables for overlapping years at the two site stations and discuss how these data support the orographic influence on precipitation estimated from the regional data. Please present the best possible model calibration using an orographic gradient for recharge that is consistent with the proposed orographic gradient for precipitation.	The response is provided in the memo **20161102_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater2**	4-Nov-2016

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MEM-003.2	30-Oct-2016	Hugh McCreadie, MEM	Water (Ground)	The slope of the recharge vs. elevation line is similar to the SWE line. However, that is distinct from gradient, which is calculated as a percentage change between elevation bands. The recharge gradient is considerably larger than the SWE gradient as originally noted. Additional work will be required during operations. Comment from E. Rainey of MOE re: precipitation orographic gradient: "The project site precipitation data correlation is weak due to the limited concurrent measured data. However the seasonal orographic factors that were used in the water modelling (i.e. 8%/100 m for winter and 5%/100 m for summer) are reasonable for the site and are consistent with regional estimates. Ongoing collection of concurrent climate information (rainfall and snow water equivalent) at the Kemess North station (el. 1600) and the Kemess South stations (Pit site el. 1470 m and TSF Dam el. 1410 m) will be required to verify the orographic gradient at the site and to support future water modelling in permitting."	AuRico acknowledges further discussion on the comment is deferred to permitting.	21-Dec-2016
MEM-004a	21-Apr-2016	Hugh McCreadie, MEM	Water (Ground)	Figures illustrating the distribution of boundary conditions and hydraulic conductivity were not provided.	Chapter 9 *Hydrogeology Effects Assessment* was updated in response to this comment. Specifically, two new figures have been added (9.6-1 and 9.6-2) to show the distribution of recharge in the baseline model and to show the distribution of hydraulic conductivity zones in layer 1 of the baseline model. (Note that all maps from the screening version of the Application now appear subsequent to the two new maps, starting at Figure 9.6-3.)	6-Jul-2016
MEM-004a.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	(Also augmenting MEM-138) The general approach to applying recharge to each elevation band has been presented but further information is required so that the approach to applying recharge can be properly reviewed. The recharge rate is applied as a percentage of mean annual precipitation. A mean annual precipitation of 800 mm/yr seems to have been used based on a reference elevation of 1600 m. The recharge for each elevation band seems to be based on a percentage of this value. This percentage ranges from 5% to 15%, which results in recharge rates that range from 40 mm/yr (0.05 x 800) in low-lying areas to 120 mm/yr (0.15 x 800) at high elevations (Section 4.6 of Appendix 9-B). Figure 9.6-1 seems to indicate that recharge ranges from 0 to 150 mm/yr. The resulting increase in annual recharge with elevation is about 200% per 100 m, which is about 40 times greater than the orographic factor of 5% per 100 m increase in elevation that was proposed for annual precipitation itself. 1. Please provide two tables (for KEM-03 and KEM-07, respectively) that summarize the following items for each elevation band : • Area within the catchment • Mean annual evapotranspiration (mm/yr) • Mean annual evapotranspiration (L/s) • Mean annual snowmelt (mm/yr) • Mean annual snowmelt (L/s) • Mean annual precipitation (mm/yr) • Mean annual precipitation (L/s) • Percent of mean annual precipitation applied as recharge • Recharge (mm/yr) • Recharge (L/s) 2. Please clarify if a uniform recharge rate was applied to each 100 m elevation band. The legend in Figure 9.6-1 indicates a range of recharge rates for each elevation band.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-004a.2	30-Oct-2016	Hugh McCreadie, MEM	Water (Ground)	The large recharge gradient with elevation is caused by the relatively arbitary distribution of precipitation increases between runoff and recharge as the elevation increases. The results will be accepted for the EA because they appear to result in a conservative estimate of mine inflow. However, further work will be required on the water balance during operations.	AuRico acknowledges the comment.	21-Dec-2016
MEM-004b	21-Apr-2016	Hugh McCreadie, MEM	Water (Ground)	The decline plug is one of the primary mitigation measures related to groundwater. The Application seems to be assume that the plug will have zero leakage, which is not realistic. If a plug is properly designed and constructed, it can be highly effective. However, the plug should be incorporated into post-closure simulations of the groundwater system. These simulations should incllude a scenario where the plug fails. A contingency plan should be developed for plug failure.	The level of detail being requested is more appropriate and relevant to the Permit Application Phase, as the request is for additional failure scenarios, of a proposed mitigation strategy. The proposed mitigation is a common industry application with substantial technology and practical experience to support its application as a reasonable proposed mitigation. In addition a number of important considerations for the proposal are: (a) the objective of the plug(s), at the designated position within the declines, is to achieve a preferential ground water flow path, therefore, flow of groundwater from the underground workings to East Cirque Creek is expected, (b) as such the plug(s) is not expected to prevent the loss or movement of groundwater, but is positioned to create a preferential flow direction. Regarding potential leakage at the plug(s) there are industry standard techniques, such installation of cement grout curtains, to address this. If deemed necessary, additional support for the plugs can be achieved during final design regarding the concrete composition, its thickness, and additional support such as waste rock backfill. Consistent with our overall water management strategy, any water that accumulates upslope of the plugs will be pumped to the KUG TSF for water treatment if unacceptable for discharge to the local receiving environment.	6-Jul-2016
MEM-004b.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	The comment was marked closed but actually remains open. Simulations of plug leakage and plug failure have been completed. Please provide the cross section of modelling results along the alignment of the decline for the following scenarios (as discussed during the September 12 hydrogeology meeting): 1. complete failure of decline plug; and 2. fully operational decline plug. Please include the piezometric contours, an outline showing the high-K zone that represents the decline, the portal location and the water table.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MOE-001	21-Apr-2016	Bruce Carmichael, MOE	Water (Quality and Treatment)	The Application refers to Appendix 11.A for Surface Water Quality Baseline. 800 pages of data are inaccessible to digital searches, are not of use in a practical sense and will be an issue at EA Review.	All appendices provided in a report format are now bookmarked to at least the chapter level.	6-Jul-2016
NH-001	22-Apr-2016	Melissa Aalhus, Northern Health	Social	The AIR stated that for the socio-economic baseline, "*analysis and trends will be based on the most up-to-date federal, provincial, and local data available* ." We note that much of the socio-economic baseline is based heavily upon outdated and aggregated census data (e.g. BC Stats or Statistics Canada data from 2010 or 2011). Accordingly, we expect that additional data sources are referenced to accurately capture current socio-economic conditions, including local knowledge, obtained from Focus Groups, Surveys and/or interviews. We note that local knowledge was incorporated into the socio-economic baseline information for First Nations communities, but not for other communities in the region. Further, we advise that the following data sources are incorporated to fill data gaps: - "Contrasting Pathways with Long Distance Labour Commuting in Mackenzie, BC" (2012) completed by the UNBC Community Development Institute. We ask that the findings of this study are incorporated into the socio-economic baseline, and also inform the social effects assessment and proposed mitigations. - "Summary Report for the Regional Health Forum on Community Health and Extractive Industry Development" (Shandro et al., 2014) - "Opportunities to meet the Health Needs of the Stuart Lake/Na'kal Bun Area" (Shandro et al., 2012) *Continued below*	Chapter 17 *Social Effects Assessment* has been updated in response to this information request. Additional information and references have been incorporated into the chapter. Please see the red line version of the appropriate word document.	6-Jul-2016

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NH-001	22-Apr-2016	Melissa Aalhus, Northern Health	Social	*Continued from above* - "Community Health and Safety in the Nak'al Bun/Stuart Lake Region During the Construction Phase of the Mount Milligan Mine" (Shandro et al., 2014) - "Perspectives on Community Health Issues and the Mining Boom-Bust Cycle" (Shandro et al., 2010) - Northern Health Community Health Information Portal – Community Profiles (available online at: https://chip.northernhealth.ca/CommunityHealthInformationPortal/NorthernTopics/CommunityProfiles.aspx and https://northernhealth.ca/YourHealth/HealthyLivingCommunities/HealthyCommunityDevelopment/HealthyCommunitiesToolkit.aspx). Please find enclosed also an additional list of data sources that may also be referenced to better characterize current socio-economic conditions and health outcomes.	Response provided in previous row (NH-001)	6-Jul-2016
NH-001.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	See attached memo (see proponent sharepoint – round 2 comments NH).	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**.	7-Oct-2016
NH-002	22-Apr-2016	Melissa Aalhus, Northern Health	Social	We are of the opinion that the Application did not fully/adequately discuss, quantify and categorize the potential socio-economic determinant of health impacts that may be associated with the project, especially when considering the entire and cumulative boom/bust cycle of resource developments. Additionally, risks to specific vulnerable populations were not adequately addressed in the Application (as was requested in our previous comments; tracking #39, 40 and 42) . As noted in our Standard Comments document, we ask that the full range of effects to Community Health are considered, including the potential for impacts to crime rates, the cost of living, communicable disease rates (including STIs), housing, community cohesion, educational attainment, traffic-related injury rates, the availability and cost of child care services, illicit drug accessibility, teenage pregnancies, etc. We ask that this includes a more detailed discussion of the experiences of communities in the region with the Kemess South Project, as well as a review of literature from similar resource-development projects (from within Canada and internationally). *Continued below*	In-migration or population influx, as a result of the Project is expected to be limited due the fly-in/fly-out (FIFO) operation of the Project, on-site accommodation, and workforce size. The Project will operate on a fly-in/fly-out basis from a number of regional centres including Smithers and Prince George, as well as other communities in BC (depending on the residency locations of workers). In general, in-migration during the Construction phase is not expected as relocation for short term employment in unlikely and is not typical of the construction industry. During Operation the Project will employ 450 workers based on a two-week on and two-week off schedule. Based on experience with the past KS mine, northern BC residents are expected to comprise around 50% of the workforce (225 people). Other employees may be residents of other parts of BC (including Lower Mainland and Vancouver Island), or outside of BC. Based on the experience of the KS mine, and city's population, the highest concentration of workers is expected to be sourced from Prince George and the surrounding areas. For example, during one year of operation of the KS mine (2010), approximately 120 Project employees were residents of the Prince George area, which hosts approximately 20% of northern BC's employment in the mining sector (City of Prince George 2016). In 2011, the population of Prince George was 84,232 individuals (Statistics Canada 2012). Given the education and experience profile of the Prince George area, it is likely that a majority of potential Project employees are already residents of the Prince George area. Even if all of the 120 Project employees who are anticipated to be residents of Prince George were individuals who relocated to Prince George (a scenario that is not anticipated), the addition of 120 individuals in Prince George represents an increase in population of 0.14% (approximately one- eighth of the population growth that occurred between 2006 and 2011). Even considering potential employees' families, this would represent around 0.5% of the population. Additional text has been added to Chapter 17 to indicate this, see the red line version of the appropriate word document. Employees of the previously operational KS mine were also from the Bulkley Valley (approximately 65 workers) and Terrace (approximately 20 workers). It is similarly expected that future Project employees from Smithers and Terrace are already residents of these locations. Population influx is a concern typically associated with Projects promoting resettlement to local areas. The Project will not require or support resettlement as the workforce will be housed in a 300-person accommodation camp at site (while on rotation), and will return to their home communities after the rotation ends. Therefore, there is no incentive for workers to migrate to the smaller PACs; in-migration is not expected, and nor are the effects commonly associated with in-migration. Finally, in-migration to transportation hubs is also not expected (again, due to the relatively small number of operational jobs and the existing availability of labour in these communities). There are also no plans to accommodate workers during their commute (as transportation will be arranged to facilitate onward travel), so no effects on housing and accommodations are identified. *Continued below*	6-Jul-2016
NH-002	22-Apr-2016	Melissa Aalhus, Northern Health	Social	*Continued from above* Please clarify if lay-offs and shutdowns may occur during periods of economic decline. If these may occur, we ask that effects to Community Well-being are assessed during these closure periods. Please indicate why impacts to community health associated with the influx of workers into transportation hubs were not considered. Specifically, please clarify why the potential impact on housing and temporary accommodations at transportation hubs due to commuting workers (and indirect and induced workers) was not considered? Our concern would be that increased demand on housing and temporary accommodations may affect access to affordable housing and short-term rentals for vulnerable individuals. Please provide a more detailed rationale that "in-migration to northern communities is not expected". As the social effects assessment relies heavily on this assumption, we ask for additional justification for this statement, or that project effects associated with in-migration are assessed. We also ask for justification that indirect/induced employment will not result in migration into communities.	*Continued from above* Since in-migration or population influx is not expected, the indirect effects associated with influx are similarly not expected (e.g., housing constraints including temporary accommodation, crime rates, the cost of living, communicable disease rates (including STIs), housing, community cohesion, educational attainment, traffic-related injury rates, the availability and cost of child care services, illicit drug accessibility, teenage pregnancies, etc.). Similarly, in-migration or population influx as a result of indirect and induced Project employment is not anticipated. As estimated by the BCIOM (see Section 16.5), the Project is expected to create 177 indirect and induced jobs annually within the RSA (e.g., including the RDFFG, PRRD, RDBN, and RDKS; Section 16.5.1). Some of these jobs are expected to represent the expansion of businesses currently servicing the mining industry, while others (particularly induced employment) are likely to consist of opportunities in the service industry that emerge as a result of Project employee spending). Specifically, 177 jobs annually spread across four regional districts is not expected to amount to a noticeable level of influx in any given community, nor any of the indirect effects associated with influx. Lay-offs or temporary shut down during periods of economic decline are always a possibility. Section 17.5.2.1 describes stress within mine employment associated with job uncertainty due to potential economic downturn and related reductions in workforce. Sections 17.5.2.1 and 17.5.2.2 describe effects to CWB as a result of loss of employment at Closure. The effects of a temporary closure are expected to similar to (though perhaps reduced in scale, depending on the timing and duration) effects as a result of the loss employment at Closure. During a temporary Closure of the Project, the loss of employment would be temporary, and should lay-offs be required, fewer workers would be affected. A number of the mitigation measures proposed the Closure phase (Section 17.5.3.1) could be implemented during a temporary closure of the Project to communicate with, support, and assist workers and their families during the closure period. In regard to potential effects on vulnerable populations, these are considered and addressed in the EA in relation to the expected effects of the Project. There are many aspects of Aboriginal populations that may experience increased vulnerability compared to non-Aboriginal populations, and these are clearly identified, and specific mitigation measures are identified. In addition, the EA notes that workers (and their families) who are unfamiliar with mining employment and/or FIFO work rotations may also be particularly vulnerable to certain impacts. These are also discussed and mitigated in Chapter 17. City of Prince George. 2016. A growing labour market. http://moveupprincegeorge.ca/about/industries-employers/ [accessed April 28, 2016].	6-Jul-2016
NH-002.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	See attached memo (see proponent sharepoint – round 2 comments NH).	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-003				Error during the entries. The comments was from PRRD and was transferred to be PRRD-002.		6-Jul-2016
NH-004	22-Apr-2016	Melissa Aalhus, Northern Health	Human Health	Additional justification should be included for the usage of "median" sampling concentrations for the baseline HHRA (including the soil ingestion/dermal exposure, surface water and country foods assessments). According to Health Canada's guidance, it is advised that point estimates should be based on "the arithmetic mean, upper 95% confidence interval of the mean, 95th percentile of the data distribution, or some other statistic depending on the quality and quantity of data available" (HC Guidance on Human Health Detailed Quantitative Risk Assessment for Chemicals, 2010). We note that in Appendix 12-B (and Appendix 18-A Table 4.5-1), soil sampling data observed concentrations of arsenic and cadmium as high as 48.9 and 34.4 mg/kg respectively, which is significantly higher than the median concentrations of 5.93 and 0.378 respectively that were utilized for the HHRA. Similar, we note that soil sampling data included a maximum concentration of vanadium of 334 versus median of 79.8 mg/kg; maximum selenium of 6.39 versus median 0.250 mg/kg; and maximum molybdenum of 47.1 versus median 2.00 mg/kg. Accordingly, we stress that further justification should be provided that the use of median baseline concentrations allows a conservative estimate of risk; we ask that this reference information on the distribution of sampling data. We advise that alternative statistical methodologies (that are consistent with HC's guidance) should be used to characterize potential risks to human health.	Health Canada (2010) advises that the statistic used for point estimates depends on the quality and quantity of data available. Since there were sufficient sample sizes of surface water (n = 626), soil (n = 56), fish (Bull Trout n = 36; Dolly Varden n = 216; Mountain Whitefish n =37; Rainbow Trout n = 87), and berries (n = 17) available from the baseline sampling program, median concentrations of contaminants of potential concern (COPCs) were used in the human health risk assessment (HHRA) calculations. Furthermore, medians are considered better measures of the midpoint of the data as mean values can be affected by outliers. The distribution of the baseline sampling data was not determined; however, environmental data does not typically have a normal distribution. Therefore, the use of non-parametric statistics, such as medians, is warranted.	6-Jul-2016
NH-004.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	We continue to have outstanding concerns with the statistical methodology. The statistical methods used in the HHRA do not allow an estimate of worst case scenario effects to human health. Health Canada has raised the same concerns; please refer to Health Canada's Second Round comments (including HC-016.1). Health Canada's guidance documents for HHRAs are intended for the consideration of environmental data. Thus we question the rationale that "mean values (as recommended by Health Canada) were not used as environmental data does not typically have a normal distribution and instead a non-parametric statistic (median) was used instead". Using median values does not allow a conservative estimate of effects to human health. Further, best practices for HHRAs are not necessarily the same as those employed for the assessment of other VCs (e.g. fish). The conclusions of the HHRA may be meaningfully impacted if different statistics were used. We continue to feel this is of concern.	Please see the response to Health Canada's 2nd round comment #HC-016.1, provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memoo.**	7-Oct-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
NH-005	22-Apr-2016	Melissa Aalhus, Northern Health	Human Health	Provide further justification for the exclusion of potential contaminants from the assessment (e.g. PAHs, VOCs, cyanides, etc.). We advise that "experience from other projects and professional knowledge" (without additional detail) is not sufficient justification for excluding contaminants. Please also provide additional justification for the exclusion of radiological exposures as an operable pathway for impacts to human health (e.g. what are the background radiation levels?) . Please indicate if cyanides will be utilized for mineral processing or other mining activities. *We are aware of PM baseline monitoring data that was completed at the Blackwater Gold Mine site, which is located 110 km south of Vanderhoof. Please clarify if this was considered, given that it may be more representative of the geographical location than the monitoring sites included.*	It is difficult to assess impacts on VOCs as there are currently no standards for VOCs. In BC, there is an objective for formaldehyde which was stimulated by the need to manage the emissions from fibreboard plants that use formaldehyde-based adhesives. Since the Project does not plan to use any formaldehyde-based raw materials, the assessment is not required. The amount of VOC emissions from fuel combustions can be quantified; however, due to the lack of available criteria and low potential impact, actual assessment of VOCs is not warranted. PAHs, VOCs, and cyanides are not a concern related to the project as there will be no major source of emission for these parameters. Accordingly, neither the Application Information Requirements (AIR; EAO 2016) nor the detailed Air Quality Model Plan (Appendix 7-a) for the Project required consideration of PAHs, VOCs, cyanides, etc. be included in the air quality modelling for the Project. The AIR was approved by the EAO following several rounds of review by the Working Group, and the Air Quality Model Plan was approved by the MOE. Therefore, those air contaminants were not included in the HHRA as no baseline or predicted data were available. As stated in the AIR for the Project, Health Canada (2010) recommends the assessment of radiological and electromagnetic field (EMF) effects; however, those types of exposures are not anticipated for this Project. The baseline HHRA (Appendix 18-A, Section 4.4.1) adopted the baseline 24-hour PM10 concentration (3.4 µg/m3) from the Galore Creek Copper-Gold-Silver Mine Project located 280 km west of the Project. As shown in Table 3.3-1 of the Project-related HHRA (Appendix 18-B, Section 3.3.1), the Construction and Operations phase (Project + background) PM10 concentrations are 10.1 and 6.65 µg/m3, respectively. Therefore, the Construction and Operations phase (Project only) PM10 concentrations are 6.7 and 3.45 µg/m3, respectively. If the Blackwater Project baseline 24-hour PM10 concentration of 9 µg/m3 (Section 5.2.4 of the EA) is adopted instead of Galore's, the predicted Construction and Operations phase (Project + background) PM10 concentrations are 15.7 and 12.45 µg/m3, respectively. Both of these concentrations are well below the BC MOE ambient air quality criteria for PM10 (24-hour averaging period) of 50 µg/m3.	6-Jul-2016
NH-005.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	The lack of clear standards for VOCs is not sufficient rationale for its exclusion from the assessment; at minimum, some level of qualitative assessment should be completed. Please refer to Health Canada's second round response (HC-004.1) regarding diesel emissions. Information in the AIR on the Human Health Risk Assessment did not stipulate specific contaminants for consideration. It stated that the Application would include the "identification of potential Project-related noise and contaminant sources during all Project phases" (S. 6.10.5.1). Accordingly, we expect additional detail on potential contaminant sources. Will cyanides be utilized for mineral processing or other mining activities? Will other chemicals be utilized in mine processing activities that may be released to the environment? Why were "flocculants, anti-scalant and flux for mineral processing" (as included in Types of Hazardous Materials in section 24.6.4.1) not considered in the assessment of potential risks to human health? In section 24.6.4.1 it is stated that "ore concentrate such as copper concentrate, considered toxic when heated strongly, releasing toxic and irritating sulphur dioxide gas, as well as possible copper and iron oxide fumes". Were these potential contaminants considered (copper and iron oxides and/or sulphur dioxide gas released during mineral processing)? PM baseline data: If the Blackwater Gold PM data is used instead and if predicted PM 10 concentrations (Project + background) would be 15.7 ug/m^3 for construction and 12.45 ug/m^3 for Operations (as was stated in the Proponent's response to NH-005), we acknowledge that this is below the BC MOE ambient air quality criteria. However, it should be recognized that there is no safe threshold for effects due to PM. Further, how would these predicted concentrations affect the assessment of metals contained in PM10? What if Blackwater Gold baseline annual PM2.5 data was used (background of 4 µg/m^3) rather than that for Galore (annual concentration of 1.3 ug/m^3) which was used in the assessment? As noted in the Application, the BC annual planning goal objective for PM2.5 is 6 ug/m^3. Efforts should be made to implement all technically and economically feasible measures to reduce impacts to as low as reasonably achievable. (Additionally, please clarify that the Blackwater PM values included in the Proponent's response are indeed from the Blackwater Gold PM monitoring data? It seems that the concentrations presented represent averaged values with other data sources ("For substances where multiple data sources were used, the averaged values of the data sources were used")? Appendix 5.1.1.2A of the Blackwater EA Certificate Application indicates that Project-specific PM data showed average (annual?) PM2.5 concentrations of 6.3 ug/m^3 and PM10 of 10.6 ug/m^3.)	Please see the response to Health Canada's 2nd round comment #HC-004.1, provided in the **memo 20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.** The AIR for the KUG Project does not explicitly state that diesel exhaust or VOCs were excluded from consideration in the Human Health Effects Assessment for the Project; however, the Working Group Comments on Draft AIR and AuRico Responses (July 7, 2015) states that a comment #47 from Health Canada regarding VOCs (in which Health Canada included diesel exhaust) was received and resolved ("due to the lack of available criteria and low potential impact, actual assessment of VOCs is not warranted"), with no additional changes to the scope of the AIR. Therefore, assessment of VOCs and diesel exhaust was not required for this Project. As stated in Section 6.10.5.1 of the AIR: "The assessment will not focus on on-site worker health and safety as the mine will be operated in accordance with the Health, Safety and Reclamation Code for Mines in British Columbia (BC MEMPR 2008) and other relevant legislation/regulations." Handling of hazardous chemicals, such as flocculants, would be conducted in a manner consistent with the conceptual Environmental Emergency, Spill, and Hazardous Materials Plan presented in Section 24.6 of the Application. Cyanide will not be used for project nor be stored on-site. It is acknowledged that there is no safe threshold for effects due to particulate matter (PM); however, even if Blackwater Gold PM data were used instead of data from the Galore project, it is the incremental change which is of interest in the assessment, and the incremental change would not be affected by using different baseline concentrations. Therefore, the conclusions of the assessment of metals bound to PM10 would be unchanged. This same reasoning applies to the baseline PM2.5 data used in the assessment. Please note that the Blackwater air quality data that was included in the previous Proponent response was obtained from Table 3.1-1 of Appendix 5.2.4A (Air Quality Modelling Report) of the Blackwater EA. As shown in Table 3.3-1 of the KUG Project-related HHRA (Appendix 18-B, Section 3.3.1), the Construction and Operations phase (Project + background) PM10 concentrations are 10.1 and 6.65 µg/m3, respectively. Therefore, the Construction and Operations phase (Project only) PM10 concentrations are 6.7 and 3.45 µg/m3, respectively. If a Blackwater Project baseline 24-hour PM10 concentration of 10.6 µg/m3 (from Appendix 5.1.1.2A of the Blackwater EA) is adopted instead of 9 µg/m3 (from Table 3.1-1 of Appendix 5.2.4A of the Blackwater EA), the predicted Construction and Operations phase (Project + background) PM10 concentrations are 17.3 and 14.1 µg/m3, respectively. Again, both of these concentrations are well below the BC MOE ambient air quality criteria for PM10 (24-hour averaging period) of 50 µg/m3. Standard best management practices will be used to mitigate atmospheric emissions from the Project (including PM), which are described in the Air Quality Management Plan for the Project (Section 24.3 of the Application). Examples of the mitigation measures include: implementation of energy efficiency measures; procurement policies to identify fuel and equipment specifications; regular servicing of all mobile and stationary equipment to maintain efficiency; training and instruction for on-site staff with duties related to the operation of equipment that emit air pollutants or controls air emissions (e.g., the required measures to be implemented during start-up, shut down, and emergency conditions); retrofitting of older engines, as required in BC for models manufactured between 1989 and 1993 that weigh over 8,200 kilograms; se of low-sulphur diesel in all equipment, as required by law; and minimization of vehicle and equipment idling, when not in use, taking account of differing operational requirements in summer and winter.	7-Oct-2016
NH-006	22-Apr-2016	Melissa Aalhus, Northern Health	Human Health	NH feels that the Human Health Risk Assessment for the inhalation of metals bound to PM10 lacked sufficient detail (and robustness) to adequately assess potential impacts to human health. It is the reviewers understanding that the predicted concentrations of "project-related metal concentrations bound to PM10" were calculated based upon metal concentrations in "soil samples obtained from within 175 m of the roads", as well as "one ore metals sample". Please provide a rationale as to why this methodology was utilized for the Effects Assessment: - Metals Due to Ore Dust: Please justify why the metal concentrations within this single ore sample are considered representative of the various types of rock (and dust that may be emitted from mining activities). Were variations in metal composition in different types of rock considered (given that fugitive dust emissions were predicted to occur due to the material handling of "waste rock, ore, crushed ore and stripped organics" such as due to "material drop onto stockpiles"; "mining activities, such as bulldozing, grinding, drilling and blasting"; and "wind erosion" of stockpiles, (S. 7.1.5 Predictive Study Methods for Air Quality). Please justify that this allows a conservative estimate of the metal composition of dust. - Metals Due to Road Dust: o Please clarify how many samples were included? We note that Health Canada's guidance advises that "maximum on-site concentration of each COPC" are used to "quantify potential risks" *Continued below*	The contributors to fugitive dust at the Project site during the Construction and Operations phases include unpaved road dust and mining activities (Section 7.1.5.1 of the EA). Thus the reviewer understands correctly that the predicted concentrations of "project-related metal concentrations bound to PM_{10}" were calculated based upon metal concentrations in "soil samples obtained from within 175 m of the roads" (n = 15), as well as "one ore metals sample". At certain soil and vegetation sampling locations, the dustfall was primarily attributed to roads (Figures 3.4-1 and 4.6-1). At these locations, the 95th UCLM baseline metal concentration in soil from samples located near roads were used to calculate the proportion of metal in soil (Table 3.4-1 of Appendix 18-B). This proportion was then multiplied by the total predicted dustfall at that location to obtain the metal concentration in the dustfall due to road dust (Appendices A and B of Appendix 18-B). This metal concentration in dustfall was summed with the background metal concentration in soil at that location to obtain predicted metal concentrations in soil due to road dust during the Construction and Operations phases (Appendices C and D of Appendix 18-B). Vegetation calculations included root uptake from soil and direct deposition to plant leaves (Appendices E and F of Appendix 18-B). At other soil and vegetation sampling locations, the dustfall was primarily attributed to mining activities (Figures 3.4-1 and 4.6-1). At these locations, the metal concentrations in the ore sample were used to calculate the proportion of metal in soil (Table 3.4-1 of Appendix 18-B). This proportion was then multiplied by the total predicted dustfall at that location to obtain the metal concentration in the dustfall due to mining activities (Appendices A and B of Appendix 18-B). This metal concentration in dustfall was summed with the background metal concentration in soil at that location to obtain predicted metal concentrations in soil due to mining activities during the Construction and Operations phases (Appendices C and D of Appendix 18-B). Vegetation calculations included root uptake from soil and direct deposition to plant leaves (Appendices E and F of Appendix 18-B). In the baseline HHRA (Appendix 18-A), the concentrations of metals bound to PM10 were obtained by multiplying the 95th UCLM metal concentration in soil samples (n = 56), with the baseline 24-hour PM10 concentration. This allowed quantification of human exposure to metals via the inhalation pathway under baseline conditions. Since there is a robust dataset with 56 samples that formed the basis for the soil metal concentration, a 95th UCLM is considered a reasonable upper estimate of concentrations across the Project area. Similar methods were used to determine the concentration of metals bound to PM10 in the Project-related HHRA (Appendix 18-B), to allow direct comparison of baseline with Construction and Operations phases. Since the critical outcome of an environmental assessment is to identify incremental changes on the VC (in this case human health) that result in residual effects due to the Project, it is important to use equivalent methods in the baseline and Project-related assessments (i.e., the HHRAs for baseline and Project should use equivalent methods and statistics). In the Project-related HHRA, the baseline 95th UCLM metal concentrations in soil samples located near roads were multiplied by the predicted PM10 concentration at the camp bunkhouse during the Construction and Operations phases. The highest predicted metal concentration bound to PM10 at the camp bunkhouse from either from road or ore dust (Table 3.3-2 in Appendix 18-B) was used to calculate the estimated daily intake of metals via inhalation (see Table 4.2-1 in Appendix 18-B). Since the higher of the two values were used, this is considered a conservative assessment. Lorax provided a composite sample of ore for inclusion in the HHRA calculations. Utilizing the ore sample was considered conservative as metal concentrations in ore are higher than metal concentrations in waste rock and overburden. Despite the fact that the 95th UCLM metal concentrations in soil samples located near roads were used to determine metals bound to PM10, the predicted soil concentrations are almost identical to the baseline concentrations. The largest percent change relative to baseline concentrations was only 1.25% (for molybdenum) in the Construction Phase and 0.880% (for copper) in the Operations Phase (see Appendices C and D). A change in soil concentrations of less than 2% compared to existing background levels is not measurable and is not likely to translate into a measurable change in air quality.	6-Jul-2016
NH-006	22-Apr-2016	Melissa Aalhus, Northern Health	Human Health	*Continued from above* '(Health Canada Guidance on Human Health Preliminary Quantitative Risk Assessment, 2012). HC states that "as a result of the biased and limited nature of sampling plan[s]…only the maximum measured concentration for each COPC should be employed for purposes of estimating human health risks". Please provide a rationale for the use of the 95th upper confidence limit of the mean for screening rather than the maximum concentration. HC notes that data should be "sufficiently numerous and rigorous to warrant an alternate statistical treatment" . o Project activities were predicted to result in changes to soil metal concentrations (Appendix 18-B S. 3.4 Soil Quality). Given that this soil may be resuspended due to road traffic, we ask why baseline soil quality levels were used for the road dust assessment? Why were predicted changes to soil quality not included in this assessment of road dust? We advise that these modelled soil quality concentrations should be used instead to form a conservative assessment. - For the purposes of the metals in PM10 assessment, the camp location is considered to be representative of temporary receptor locations (and is the only receptor location assessed). We advise that the maximum PM10 concentration is instead utilized to ensure that potential impacts at all potential receptor locations are considered. In S. 7 Table 7.1-20 it is noted that the maximum predicted PM10 concentration during Construction and Operations is 16.2 and 8.5 ug/m^3 respectively. This is notably different than that at predicted at the camp (Construction 10.1 ug/m^3 and Operations 6.65 ug/m^3).	Response provide in previous row (NH-006)	6-Jul-2016

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NH-006.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	It is not clear whether the metal concentrations in the one ore metal sample would be representative of worst case scenario concentrations in all mined ore. How are metal concentrations expected to vary amongst ore collected across the mine site? Further, we understand this is just an estimate, but it also needs to be recognized that the metal concentration observed in ore will not necessarily represent the metal concentration of dust. Metal concentrations in air will also depend on the weight of the metal constituents, how the rock is fractured, etc. It is important that this is recognized. This is one of many limitations and sources of uncertainty in the assessment that have not been noted. The reviewers concern was not around the comparison of PM10 concentrations to BC MOE ambient air quality criteria for PM10 (it was stated in the Proponent's response: "However, even if the maximum predicted PM10 concentrations were considered in the assessment, they are both well below the BC MOE ambient air quality criteria for PM10 (24-hour averaging period) of 50 µg/m3 so no risk would be identified to human health"). Rather, the reviewer was referring to the importance of using maximum PM10 concentrations to assess the potential for the inhalation of metal contaminants bound to PM10. According to Appedix-C CALPUFF Contour Plots – it appears the maximum PM10 24-hour concentrations may extend beyond the project fenceline? Are there other areas that off-duty workers may be expected to spend time other than the accommodation camp (e.g. airstrip, outdoor recreation areas?). Given that there is a potential for health effects due to acute exposure to metals in dust, we ask that further information is provided on this.	It is acknowledged that metal concentrations in one ore sample may not be representative of worst case scenario concentrations in all mined ore; however, only the one ore sample was available at the time of writing the EA Application. It is also acknowledged that metal concentrations in the ore sample may not represent metal concentrations in dust. The assessment of the inhalation of metals bound to PM10 adopted the worst case PM10 concentrations predicted by the air quality model during the Construction and Operations phases at the camp bunkhouses (10.1 and 6.65 µg/m3, respectivley). Thus these values can be considered as maximums, which were used in the assessment of metals bound to PM10. While it is expected that off-duty workers may spend time in other areas of the mine site during the 12 hours of the day that they are not working, it is assumed that the majority of their off-duty time will be spent in the camp bunkhouses where they will be sleeping (approximately 8 hours), eating (approximately 2 hours), and conducting other activities (e.g., socializing, showering, etc.). Thus the time spent in other locations of the mine site will be minor/negligible compared to time spent at the camp bunkhouses. Due to the high level of uncertainty regarding the possible amount of time spent in other locations and the wide range of other locations off-duty workers could possibly be, only the camp bunkhouses were considered in the Application. Modelling scenarios provide an approximation of an individual's activities and do not fully represent every possible activity for off-duty workers, thus there is uncertainty around the estimates of risk due to the assumptions involved in the calculations. However, assuming an off-duty worker spends all of their time on-site (i.e., during the 5 years of the Construction phase and 13 years of the Operations phase) is a conservative assumption as it is likely that off-duty workers will leave the site when not on active rotation (typically 2 weeks on and 2 weeks off).	7-Oct-2016
NH-007	22-Apr-2016	Melissa Aalhus, Northern Health	Human Health	Please provide justification as to why the selected terrestrial wildlife species (moose, hare and ruffled grouse) were considered representative species (i.e. assumed to have the "highest rate of exposure"). According to Health Canada's guidance documents, secondary and tertiary consumers should be included given the added potential for the biomagnification of contaminants through food chain transfer (Health Canada's Supplemental Guidance on Human Health Risk Assessment for Country Foods, 2010). Given that it is stated that grizzly and black bear are hunted in the area, we ask why these were not included (given the higher potential for biomagnification for tertiary consumers)?	Only commonly consumed country foods were included in the food chain model. Carnivores are typically hunted for their fur and, although they may be consumed, are usually not common diet items. For example, Chan et al. (2011) indicate that the BC First Nations 95th percentile consumption rate of moose meat, hare, and grouse are 105, 2.9, 1.6 grams/person/day, while the only country food item from a carnivore is black bear fat at 0.57 grams/person/day.	6-Jul-2016
NH-007.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Thank you for the additional information. While there may be a lower predicted consumption rate of tertiary consumers (e.g. 0.57 grams of black bear fat per person per day), they also have a higher bioaccumulation potential for environmental contaminants (due to biomagnification in the food chain). We ask how this could potentially impact human health. We defer to HC's comment HC-007.1 for more information on the use of tissue-specific food chain modelling; we agree with HC's response.	Please see the response to Health Canada's 2nd round comment #HC-007.1, provided in the **memo 20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
NH-008	22-Apr-2016	Melissa Aalhus, Northern Health	Human Health	We note that the baseline assessment of metals contained in PM10 was completed using dust samples collected from along roads. Please clarify whether impacts resulting from the Kemess South Mine site were considered (e.g. fugitive dust emissions from waste stockpiles and/or the open-mine site); please provide additional detail on the existing disturbance from the KS site (i.e. any stockpiles, etc.) or provide linkage to this information elsewhere in the application. Were samples from potential receptor sites near the KS Mine site included?	Any impacts to baseline soil quality resulting from the Kemess South Mine site would have been captured with the KUG baseline soil sampling program, which included 56 samples collected in 2003 and 2014 (see Figure 4.5-1 of Appendix 18-A for soil sampling locations). These samples were collected from a variety of sites throughout the KUG LSA. These data are considered to represent the current conditions within the KUG LSA and were used in the baseline HHRA. The only human receptor identified in the LSA (which includes the KS Mine) was the camp bunkhouse, located in the Project footprint.	6-Jul-2016
NH-009	22-Apr-2016	Melissa Aalhus, Northern Health	Human Health	As noted in above comments (reference to screening comments), we request that isopleth maps of predicted concentrations are provided with receptor locations clearly identified to inform the HHRA.	Receptor locations have been added as point features to all dispersion model results contained in Appendix 7-C.	6-Jul-2016
NH-009.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Thank you; NH is satisfied with this response. However, we ask that additional detail is provided on expected temporary receptor locations (e.g. meeting grounds at North end of Thutade Lake), and that this information is consideration in the development of mitigation strategies.	Additional detail on temporary receptor locations is provided in the Tse Keh Nay Kemess Underground Project Traditional Knowledge and Land Use Study (Appendix 20-A of the Application). If temporary receptor locations are identified as being frequently used and located geographically within an area predicted to be exposed to elevated levels of criteria air contaminants that would pose a risk to human health, these locations will be considered in development of a more detailed air quality management plan to support the Mines Act permitting process.	7-Oct-2016
NH-010	21-Apr-2016	Melissa Aalhus, Northern Health	Human Health	It was indicated in the AIR that changes in "drinking water quality" would be included as an indicator for Human Health impacts. While we note that the potential for human consumption of contaminated surface water was assessed, please justify why the potential for changes in groundwater quality to impact human health was not included in the assessment. Please identify any groundwater drinking water sources in the area. We feel that this is a significant oversight. It is noted that potable water for the camp is sourced from two groundwater wells within the project area. Specifically, please provide justification that the water quality of this drinking water source will not be impacted. Further, what are the baseline trace metal levels in the drinking water source for workers and how will the water be treated? Additionally, we note that the project area ultimately drains to the Peace River watershed; please indicate if downstream receptors could be impacted?	There are three known potable water wells within the groundwater (Figure 9.3-1, 9.4-2) or Human Health (Figure 18.3-2) local study area which was used to identify project related groundwater related effects. All wells are associated with Kemess South. As these will be operated by the proponent in accordance with existing potable water permits, including on-going monitoring and installation of treatment if needed, these were not considered in the human health assessment. Chapter 18 Human Health Effects Assessment has been updated in response to this information request, see the red line version of the appropriate word document. Water quality in the potable water wells meet all criteria for potable water. The camp potable water supply has a continuous automated chlorination treatment system in place, and monitoring is conducted as per relevant permit requirements. As there are no residual effects predicted within the human health Project local and regional study areas, there are no downstream effects predicted for receptors in the Peace River watershed.	6-Jul-2016
NH-010.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Please see attached memo for comments on water quality (see proponent sharepoint – round 2 comments NH).	It is acknowledged that groundwater used as a drinking water source will require monitoring and management to ensure human health is protected. As described in Section 18.2.3 of the Application, the Drinking Water Protection Act (2001) and Drinking Water Protection Regulation (B.C. Reg. 200/2003) require that all water systems meet minimum water treatment standards, monitoring type and frequency, and specific water quality standards. AuRico currently holds an active permit for drinking water from wells that could be influenced by changes in groundwater quality due to KUG TSF. The existing permit requires potable wells to be sampled every five years; however, the proponent currently samples the wells on a quaterly basis and will continue to do so. A core value of AuRico is to provide workers with a safe and healthy working environment. AuRico understands the responsibility to remain in compliance with existing permits and will engage with the relevant permitting officer at Northern Health before December 31, 2016 regarding the project and discuss potential implications to the existing health permit, outside of the EA process. Potential changes to groundwater quality related to the KUG TSF would be limited to the area extending east and south to Kemess Creek and south west to Waste Rock Creek. This area all lies within AuRico's mineral lease or mineral claims. There are no other groundwater users within this area and no additional users would establish new wells without communication and knowledge of AuRico.	7-Oct-2016
NH-011	22-Apr-2016	Melissa Aalhus, Northern Health	Accidents and Malfunctions	In S. 7 of the AIR, it is stated that the Application will evaluate the "potential consequences (effects) of [a] failure on the selected VCs". However, we find that the Application did not sufficiently assess the potential effects of these events on the 'human health' VC: - It is stated in the Application that "all risk events with moderate or high human health risk were related to Project personnel. While AuRico will continue to maintain health and safety as a core value of its overall operations, the remainder of this chapter will focus on the potential environmental effects". Accordingly, for the detailed assessment, it is stated that "risk events exclusive to the "Environment" category were filtered from the FMEA worksheet". We ask whether there is a also a potential for the health of the public to be impacted (given the proximity of potential temporary receptor locations, including the off-duty worker camp, to the mine site, and the potential for downstream impacts to watersheds). Please provide a rationale that there is no moderate or high risk to the health of non-worker receptors (including off-duty personnel), and hence, provide additional justification for limiting the assessment of human health impacts to the Failure Mode and Effects Analysis (FMEA) . *Continued below*	Chapter 22 *Accidents and Malfunctions* was updated in response to this information request. Please see the red line version of the appropriate word document.	6-Jul-2016
NH-011	22-Apr-2016	Melissa Aalhus, Northern Health	Accidents and Malfunctions	*Continued from above* - Further, it should be recognized that "environmental effects" can impact human health (e.g. changes to water quality, air quality, soil quality, country food quality, etc.). Appropriate linkages should be made, and we ask that the "Evaluation of Environmental Failure Modes and Risk Events" section (22.6.2) acknowledges this (e.g. Human Health effects should be included in the 'Potential Environmental Effect(s)' column of Table 22.6-6 when there is a potential for health to be impacted). Further, in Table 22.7-1, Human Health should be recognized as a VC potentially interacting with the listed events, or a rationale should be provided that there is "no potential for interaction" (particularly given that in various instances, toxic compounds are predicted to be released, such as metals, benzene, toluene, etc.). Accordingly, we ask that the following information is provided to adequately assess the potential for public health to be impacted in the event of an Accident/Malfunction: - Receptor locations: Human receptors that may be impacted are identified (including information on ground and surface water usage, and consideration of downstream watersheds that may be impacted). This should also include any receptor locations that may be impacted by an explosion or fire. *Continued below*	Comment responded to in previous row (NH-011)	6-Jul-2016
NH-011	22-Apr-2016	Melissa Aalhus, Northern Health	Accidents and Malfunctions	*Continued from above* -Toxicity/persistence: The application should identify all hazardous materials and their constituents that may be emitted to air, soil and water during a spill, fire, explosion or tailings dam breach. We ask that the application includes information on the toxicity and persistence of contaminants that may be released (e.g. VOCs, PAHs, cyanides). It should be acknowledged that there may be risks associated with even trace amounts of some contaminants. Also, it should be noted that some contaminants may cause chronic health effects, and that in the event that contaminants cannot be completely remediated and are persistent, long-term health impacts could occur. Given that in the event of a tailings dam breach the assessment predicts "significant" residual effects to surface water, soil, harvestable plants, fish, wildlife, etc., we feel this is of particular concern. Experience from Mount Polley suggests that the effects of accidents and malfunctions can be far-reaching. Further, given that the project area drains into the Peace River watershed, in the event of an accident, downstream impacts to human health could be catastrophic. Accordingly, we feel that further assessment is required.	Comment responded to in previous row (NH-011)	6-Jul-2016
NH-011.1	18-Aug-2016	Melissa Aalhus, Northern Health	Accidents and Malfunctions	We stand by our original comments. Please see response to NH-059	Please see response to NH-059.1.	7-Oct-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
PRRD-001	21-Apr-2016	Karen Goodings, PRRD	Social	Under the available health care facilities the hospital in Fort St John was not included.	Hospital facilities in Fort St John were not included Fort St John is not a PAC (as it is not expected to be a significant source of labour or procurement for the Project, or subject to other significant socio-economic impacts). The Project is unlikely to utilize medical services in Fort St John, and the workforce is otherwise expected to utilize services in their home communities. Travel by road from each of the TKN communities is through Mackenzie which has emergency services, with transfers to the hospital in Prince George as needed. Travel from Mackenzie to Fort St John is approx. 3.5 hours, while Prince George is only 2 hours from Mackenzie. Therefore, no adverse effects on health services or facilities in Fort St John are expected and the Fort St John hospital was not included in the assessment. AuRico does not believe any revisions to the Application is necessary.	6-Jul-2016
PRRD-002	21-Apr-2016	Karen Goodings, PRRD	Social	Please justify why you think stress on families during FIFO won't create residual effects	FIFO employment is well established in the BC and Canadian mining industry. The proportion of Project employees (and their families) who experience stress as a result of FIFO is expected to be largely limited to a small portion of those employees without previous experience with FIFO employment. Research literature indicates that it is a minority of workers engaged in FIFO that experience stress effecting family relationships (see Taylor, Simmonds & Simmonds 2009). Therefore, a small portion of the workforce may experience stress related to FIFO. However, all workers including this smaller group that experience stress will also experience a number of benefits associated with Project employment. In some cases, the benefits may offset other life stressors, creating positive effects (see Section 17.5.3.2). In addition, a number of mitigation measures have been established to further limit and reduce the potential adverse effects associated with FIFO employment (see Section 17.5.3). The mitigation measures proposed are those that represent best practices in the mining industry, including support for families as well as employees, and are expected to reduce stress associated with by FIFO. As a result of this mitigation, and the industry's experience with FIFO schedules, no residual adverse effects on families are expected.	6-Jul-2016
PRRD-002	22-Apr-2016	Karen Goodings, PRRD	Social	Acceptable for screening To be addressed at start of Application review	FIFO employment is well established in the BC and Canadian mining industry. The proportion of Project employees (and their families) who experience stress as a result of FIFO is expected to be largely limited to a small portion of those employees without previous experience with FIFO employment. Research literature indicates that it is a minority of workers engaged in FIFO that experience stress effecting family relationships (see Taylor, Simmonds & Simmonds 2009). Therefore, a small portion of the workforce may experience stress related to FIFO. However, all workers including this smaller group that experience stress will also experience a number of benefits associated with Project employment. In some cases, the benefits may offset other life stressors, creating positive effects (see Section 17.5.3.2). In addition, a number of mitigation measures have been established to further limit and reduce the potential adverse effects associated with FIFO employment (see Section 17.5.3). The mitigation measures proposed are those that represent best practices in the mining industry, including support for families as well as employees, and are expected to reduce stress associated with by FIFO. As a result of this mitigation, and the industry's experience with FIFO schedules, no residual adverse effects on families are expected. Taylor, Simmonds & Simmonds 2009. Family Stress and Coping in the Fly-in Fly-out Workforce. https://www.academia.edu/867172/Family_Stress_and_Coping_in_the_Fly-in_Fly-out_Workforce [accessed April 27, 2016]. Additionally, Chapter 17 *Social Effects Assessment* was updated with additional text in regards to FIFO; please see the red line version of the appropriate word document.	6-Jul-2016
NH-012	15-Jun-2016	Melissa Aalhus, Northern Health	Social	Please provide additional detail on the rationale for the exclusion of Community Infrastructure, Services and Housing from the assessment of project effects (beyond that which is provided in Section 17.3.1.2). As noted in our previous comments on the VC document (including: comment tracking #43; correspondence dated July 24 and 30, 2014 and August 11, 2014), as well as in our Standard Comments document, we feel that the exclusion of these impacts from the assessment is a substantial oversight. We appreciate that additional information was provided on this, but maintain that insufficient justification has been provided that infrastructure, services and housing will not be impacted due to a population influx into communities (including transit hubs) and/or "flyover" effects at transit hubs (e.g. Prince George and Smithers). Please note that it has been reported that Prince George is currently experiencing vacancy rates of around 1% for rental units, resulting in pressures for vulnerable populations. We expect detailed evidence that "past experience with the KS Mine" would suggest that demand on infrastructure and services can be expected to be "negligible". Further, given the uncertainties in the conclusions of the assessment, we ask for a commitment to monitor for and manage impacts to community infrastructure, services and housing if they arise.	Direct Project employees will be housed in work camps during the Construction and Operations phases of the Project. During Construction, the majority of workers will be contracted through an EPC (engineering, procurement, construction) contractor and will be transported to and accommodated at the mine site. Although local (Northern BC) hiring and procurement will be targeted during construction, the specialised and technical skills associated with underground mine construction will require a large proportion of the workforce to be drawn from other labour markets. During Operations, AuRico is committed to local hiring from northern BC (including the 4 regional districts of the RSA). The use of a FIFO work rotation, operated in accordance with good practice and based from multiple hubs, will effectively avoid the drive for influx to northern communities. The transit hubs of Smithers and Prince George are provided as examples due to their role as the primary mining service centres in northern BC; however, in line with AuRico's commitment to northern hiring, additional hubs will be evaluated once further information about the workforce is available. Workers will not need to move to Smithers or Prince George in order to obtain employment. As such, population influx is not expected. AuRico is committed to conducting FIFO operations in line with good industry practice, including scheduling of workforce rotation flights to allow time for connections/additional travel. Recruitment efforts will include a variety of communities (including Aboriginal) throughout northern BC. The Project's workforce during operations is modest and it is reasonable to expect that the majority of positions can be filled by existing northern BC residents, particularly considering the recent closure of other mines, the downturn in other industries (oil-and-gas, forestry), and the availability of mining-related education and training programs at local post-secondary institutions. AuRico does not believe monitoring of potential effects is warranted. However, AuRico will maintain communication and information sharing with health and social service providers in Aboriginal and non-Aboriginal PACs, and the RSA (via Northern Health and other relevant agencies), in order to proactively identify and address issues and concerns related to community well-being and service provision. Finally, experience with the KS mine indicates that population influx is unlikely. Additional information to support this conclusion is provided in memo **20160706 KUG Comments NH-012, 014, 015, 017, 020, 021, 030 Population Influx_Memo.**	6-Jul-2016
NH-012.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-013	15-Jun-2016	Melissa Aalhus, Northern Health	Social	Additionally, we ask that the fragility of the health care system in the region is recognized, and that any impacts to health services are carefully managed. We stress that health services in the region are often operating near or at capacity, including those located in Prince George and Smithers. Any increases in health services demand associated with the non-resident workforce will not be within the health services capacity. The extent that health services may be impacted would depend on the level of health and medical services provided on site.	Any workers who are not residents of northern BC will be transported directly to/from the site on a FIFO rotation. Stays in Smithers, Prince George, or other communities are not expected during transit. Whilst at the site, medical services will be provided by on-site medical practitioners. Use of health services in the region is not expected, except in the rare event of an emergency/trauma requiring urgent care. The Project will operate under strict health and safety standards (and training) in order to reduce the risk of emergency situations. The on-site medical services will include two health advisors/nurse practitioners that will cross-shift, making sure there is always one at site. In addition, AuRico will support the health and well-being of workers (and thus reduce demands on Northern Health resources) through the Employee and Family Assistance Program (which provides for counselling, mental health, substance abuse, and other issues), and Health and Wellness Management Plan (which encompasses various aspects of wellbeing including fit-for-work, substance abuse, health eating, physical activity, sexual health, stress management, and other physical/mental health resources).	6-Jul-2016
NH-013.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-014	15-Jun-2016	Melissa Aalhus, Northern Health	Social	Further, even if the Proponents commits to managing the non-urgent care needs of their workforce, increases in demand due to trauma and secondary care (and services not provided on site) should still be recognized in the assessment.	Of the 21 operational mines in BC in 2014, the number of persons injured in an incident (including both minor and major injuries) was 24. The average of one minor or major injury per year per mine, which may or may not involve a worker who is currently a client of Northern Health, is not expected to place an unacceptable burden on northern health. (See the Annual Report of the Chief Inspector of Mines - 2014). As described above, the Project will provide on-site health services for non-urgent situations, and will reduce risk of trauma/emergency through the application of strict health and safety standards and training. Secondary care, when needed, is expected to be provided by health professionals in the worker's home community (whether in the jurisdiction of Northern Health or other parts of BC, depending on the worker); as notable worker influx is not expected, a significant impact on Northern Health caseloads is not anticipated. Additional information to support this conclusion is provided in memo **20160706_KUG Comments NH-012, 014, 015, 017, 020, 021, 030 Population Influx_Memo.**	6-Jul-2016
NH-014.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-015	15-Jun-2016	Melissa Aalhus, Northern Health	Social	Effects Assessment: As was noted in our comments on the VC document (comment tracking #43) and in our Standard Comments document, we advise that indicators for available medical services should include: • Change in health services demand • Change in service level requirements (including type, amount, location, timing, etc.) for the shadow/temporary workforce and the resident workforce - Please note that in the effects assessment for this section we would expect a discussion of: • The types of health services that these workers would access, how often these workers would access these services and whether these would be provided by the proponent or Northern Health.	The Social Effects Assessment was scoped (as described in the VC Scoping Document and AIR) to focus on community health and wellbeing; effects to health services are typically address in relation to community infrastructure/services, which were excluded from the assessment on the basis of the reasons provided above including the expectation of minimal influx to northern communities (further discussion and rationale for this conclusion is provided in the memo **20160706 KUG Comments NH-012, 014, 015, 017, 020, 021, 030 Population Influx_Memo**. Thus, the Social Effects Assessment does not assess effects to medical services or identify medical services indicators. However, AuRico is committed to the health and wellbeing of workers, and will support this through the Employment and Family Assistance Program and Health and Wellness Management Plan. AuRico is also committed to ongoing engagement with community and regional authorities including service providers such as Northern Health, in order to identify and address potential concerns and issues. Additionally, the provision of on-site medical care, and operation of a FIFO work rotation that supports workers returning home between shifts, will reduce workers' use of local health services.	6-Jul-2016
NH-015.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-016	15-Jun-2016	Melissa Aalhus, Northern Health	Social	It is stated in the Application that "primary health and medical services will be provided on-site by qualified practitioners." We are very pleased with this commitment but ask that further information is provided on the level of care that will be included, and that this is included in a Health and Medical Services Plan (HMSP) as per our guidance document (available online at: https://northernhealth.ca/Portals/0/Your_Health/Programs/Public%20Health/OfficeHealthResourceDevelopment/2015-03-HMSP.pdf). Please note Northern Health expects that on-site medical services meet both the preventative care and non-urgent care needs (for both physical and mental health) of the camp workers (e.g. including first line antibiotics, suturing, immunizations, health programs, communicable disease management, etc.). We note that the development of a HMSP has been included as a condition in all recently certified mining projects in the region and is considered a best practice.	AuRico will comply with the requirements of the EA Certificate regarding additional plans or programs required by the proponent. AuRico can also provide further detail about the scope and implementation of on-site medical services when this information is further developed. The on-site medical services will include two health advisors/nurse practitioners that will cross-shift, making sure there is always one at site.	6-Jul-2016
NH-016.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-017	15-Jun-2016	Melissa Aalhus, Northern Health	Social	We note that in the updated Application, it is stated that "the high number of emergency department visits likely reflects the catchment area and rural population utilizing hospitals in each of these PAC, as each are hub locations for a variety of smaller communities" (S. 17 p. 29). We are of the opinion that the issue is much more complex than this (including population demographics and health status of the population, upstream risk factors and industry and economic drivers); it should be recognized that the cumulative impacts of temporary workforces can put significant pressures on health services in these communities (which already experience the challenges of rural and remote service delivery).	The Project is not expected to result in the development of a temporary (construction phase) workforce in the local communities; construction workers will be contracted through an EPC contractor, will be transported by the contractor to/from the site, and will stay in the on-site camp. There will be no need for construction workers to relocate (temporarily or otherwise) to the local communities, and due to the specialised skills required for underground mine construction these workers are expected to be drawn from various locations in BC/Canada. Additional information to support this conclusion is provided in memo **20160706 A.1 - KUG Comments NH-012, 014, 015, 017, 020, 021, 030 Population Influx_Memo**	6-Jul-2016
NH-017.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **220161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-018	15-Jun-2016	Melissa Aalhus, Northern Health	Social	Additionally, it is stated that "Hypertension and depression affect more than 1% of the population in each of the PACs, and osteoarthritis affects more than 1% of the Smithers population, perhaps indicative of the higher proportion of seniors". We would recommend that the proponent abstain from speculating about cause and effect unless there is literature or information available to support these assumptions. Overall, it should be recognized that there are significant physical and mental health vulnerabilities in the region. Any impacts to physical and mental health will need to be carefully managed.	While there are a number of risk factors for hypertension, age is a key factor as the prevalence of hypertension increases as people age (CDC 2015). Similarly, most people over age 60 have osteoarthritis to some degree (WebMD 2016). Thus, populations with a higher proportion of older people can be expected to have higher rates of hypertension and osteoarthritis. While the proponent acknowledges the presence of health vulnerabilities in all populations, there is no pathway of effect between the Project and effects to physical health. Societal elements acting on mental health are numerous. Those that are somewhat related to the current discussion include employment and job security (as described in the Application). While a minority may experience challenges related to mental health (including stress and other factors), AuRico will support positive mental (and physical) health through a Health and Wellness Management Plan and Employment and Family Assistance Program. In addition, related to the eventual closure of the Project (which can also contribute to stress), AuRico experienced tremendous success with the Workforce Transition Plan implemented at the closure of the KS mine (as described in Chapter 17 of the Application). AuRico plans to establish a similar transition program for the KUG Project.	6-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
NH-018.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-019	15-Jun-2016	Melissa Aalhus, Northern Health	Social	In section 17.4.4.8 Health Status, it is stated that "Overall, PYLL due to natural causes, accidental causes, and suicides/homicides in Prince George LHA is similar to the province". Please provide evidence to support this claim; this is inconsistent with data presented in in Table 4.11-5. of Appendix 16-A, where PYLL due to natural causes, accidental causes and suicides are all higher than provincial averages. Further, we do not agree that the differences in life expectancy in Prince George compared to the province are "slight" (as was noted in S. 17.4.4.8). A life expectancy difference of 2.5 years is significant. We also note that this applies to many other uses of the word "slight" in this section.	The statement "Overall, PYLL due to natural causes, accidental causes, and suicides/homicides in Prince George LHA is similar to the province" is preceded by recognition that the rate of PYLL due to natural causes is higher than average. The statement referred to is referencing the three causes of PYLL collectively and in comparison to other LHAs in the province. For example, while rates of PYLL due to suicide/homicide are 1.1 higher in the Prince George LHA in comparison to the provincial average, the Prince George LHA ranks 39 of 84 LHAs in the province, placing the Prince George LHA near the provincial median particularly in comparison to LHAs with extreme PYLL due to suicide/homicide in the range of 14.3 and 41.5. Similarly, comparison to the province account for the position of the Prince George LHA in relation to all LHAs in the Province. Life expectancy in the Prince George LHA is more similar to the provincial average in comparison other LHAs in the province.	6-Jul-2016
NH-019.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-020	15-Jun-2016	Melissa Aalhus, Northern Health	Social	As noted in our Standard Comments document, we ask that additional information on the "regional and historical setting of the Project area" (as required by the AIR S. 6.9.3.1) is provided. We ask that it is recognized if/where existing vulnerabilities, legacies and inequities may have arisen from past or current resource development projects (including the Kemess South Project), and how these have (and may continue to) impact health outcomes. We feel that such a discussion would be essential to understanding current dynamics and how they may fluctuate over time, and further, how Community Health may be impacted by this project. For resource development projects in the North, we expect that this will likely require an evidence-based discussion on the boom-bust cycles and impacts that have been experienced in the region and the legacy vulnerabilities and impacts that may exist and arise in the affected community as a result of these. We ask that Northern Health's "Understanding Resource and Community Development in Northern British Columbia" and "Understanding the State of Industrial Camps in Northern BC" reports are referenced (available online at: https://northernhealth.ca/AboutUs/PositionStatementsAddressingRiskFactors.aspx#It-532438-additional-research-papers).	The socio-economic effects assessment is focused on topics related specifically to the anticipated effects of the Project. As such, an in-depth review of all past and current development projects in northern BC is not warranted. While literature describing boom-bust cycles is plentiful, the specific economic conditions that comprise a boom-bust cycle in mining are premised on a substantial influx of population and capital. The Project is not expected to result in population influx and does not represent the conditions of a boom-bust cycle (see memo **20160706 KUG Comments NH-012, 014, 015, 017, 020, 021, 030 Population Influx_Memo**). While the Project is expected to make notable contributions to economic conditions in the RSA, Province, and Country, the contribution is not so substantial that its removal might devastate the economies of the PACs or RSA –the locations expected to benefit the most from Project employment and spending. The contributions of the Project will be balanced by other resource developments in the RSA, and the labour force of the Project will be spread over the RSA and other parts of the province. AuRico will consider the references provided in the development of ongoing management plans and engagement with communities and First Nations.	6-Jul-2016
NH-020.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-021	15-Jun-2016	Melissa Aalhus, Northern Health	Social	Please further identify how Community Health indicators (as described in Table 17.4-1) were chosen and eliminated. It is our opinion that the full range of potential quality of life indicators were not assessed and/or identified. We feel that by excluding a number of Community Health indicators, the Application does not capture current conditions and vulnerabilities. Specific comments include the following: - We note that crime rates were not compared to provincial averages, and that the rates of specific crimes were not included. This information is essential to the assessment and identification of vulnerabilities, and we request that the following crime rates are included: intimate partner violence, sexual assault, sex trade-related and drug-related offenses, violent crime, crimes committed by young offenders, etc. - As per our Standard Comments document, we advise that the following are also important indicators of Community Well-being, and should be included (or a rationale should be included for their exclusion): • Family health: divorce rates, existing rates of parents working away from home • Community cohesion: volunteer rates, population mobility • Poverty/economics: Rate of single/lone parent families, cost of living, number of low income housing units, vacancy rates, number of people using food programs • Early childhood development: Day care availability, children vulnerable based on EDI • Other: STI/communicable disease rates, teenage pregnancy rates Based on our understanding of impacts associated with resource development projects occurring throughout the North, we note that the cumulative impacts on social conditions (e.g. housing, cost of living, poverty, sexual exploitation, drug and alcohol abuse, crime rates, mental health issues, etc.), especially on vulnerable populations, may be substantial. Thus, we note that the above indicators may be impacted by the project, and emphasize that they should be included in the baseline.	The socio-economic effects assessment follows the approved VC Scoping Document and Application Information Requirements for the Project, is focused on topics relevant to the expected effects of the Project and are not intended to cover all possible indicators related to community health. It is acknowledged that there are existing community health challenges in all communities within the RSA and elsewhere in BC and Canada, as well as a variety of societal and other factors that influence community health outcomes. The range of community health indicators described by the reviewer would be more relevant for Projects expected to generate substantial population influx or lead to demographic changes within smaller communities. This is not the case for the KUG Project and as a result the effects assessment is focused to a level of analysis that matches the potential effects of the Project. Resource development projects, and their associated impacts, vary widely depending on the type of operation, size of the workforce, worker accommodation arrangements, transportation arrangements, and other factors. Establishing a firm understanding of an individual Project is essential in understanding its potential effects. Additionally, many of the indicators identified are influenced by complex and interacting factors, and discerning a link to a particular project is often not possible. However, AuRico recognizes the correlation that can be seen between resource developments, FIFO workforces, and many of the identified indicators, and these are discussed in the social effects assessment as potential pathways for effects on community well-being. Although quantitative predictions for changes in these indicators are not made (and could not be made with any confidence), the challenges are addressed through management programs such as the HWMP and EFAP. Additional information to support this conclusion is provided in memo **20160706 KUG Comments NH-012, 014, 015, 017, 020, 021, 030 Population Influx_Memo.**	6-Jul-2016
NH-021.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-022	15-Jun-2016	Melissa Aalhus, Northern Health	Social	The AIR stated that for the socio-economic baseline, "analysis and trends will be based on the most up-to-date federal, provincial, and local data available." We note that much of the socio-economic baseline is based heavily upon outdated and aggregated census data (e.g. BC Stats or Statistics Canada data from 2010 or 2011). Accordingly, we expect that additional data sources are referenced to accurately capture current socio-economic conditions, including local knowledge, obtained from Focus Groups, Surveys and/or interviews. We note that local knowledge was incorporated into the socio-economic baseline information for First Nations communities, but not for other communities in the region. We appreciate the incorporation of additional information on health baselines into the Application (following screening) but ask that these be put into context to allow for the identification of vulnerabilities.	The information provided in baseline reports is tailored to the potential effects of the Project, rather than including a catch all of socio-economic topics in general. AuRico notes that data provided in the baseline report remains the most current statistical information available and that additional data collection was undertaken to fill gaps in data where warranted. In particular, Aboriginal PACs were identified as potentially vulnerable populations and thus additional research and data collection was undertaken for the Aboriginal PACs.	6-Jul-2016
NH-022.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-023	15-Jun-2016	Melissa Aalhus, Northern Health	Social	While we recognize that these (different information sources) were developed for different areas/projects, we expect that the learnings, recommendations and information contained in these are transferable to other mining projects in Northern BC. We advise that the recommendations of these reports are considered in the development of mitigation strategies: - "Contrasting Pathways with Long Distance Labour Commuting in Mackenzie, BC" (2012) completed by the UNBC Community Development Institute. We ask that the findings of this study are considered for incorporation into the socio-economic baseline, and also inform the social effects assessment and proposed mitigations. - "Summary Report for the Regional Health Forum on Community Health and Extractive Industry Development" (Shandro et al., 2014) - "Opportunities to meet the Health Needs of the Stuart Lake/Na'kal Bun Area" (Shandro et al., 2012) - "Community Health and Safety in the Nak'al Bun/Stuart Lake Region During the Construction Phase of the Mount Milligan Mine" (Shandro et al., 2014) - "Perspectives on Community Health Issues and the Mining Boom-Bust Cycle" (Shandro et al., 2010) - PHSA Community Health Profiles (http://www.phsa.ca/our-services/programs-services/population-public-health/community-health-data/bc-community-health-profiles) Please see the list of additional data sources that was forwarded during screening, which may also be referenced to better characterize current socio-economic conditions and health outcomes.	Chapter 17 (Social Effects Assessment) of the Application was updated in response to this information request during the screening review process. Additional information and references have been incorporated into the chapter submitted for formal review.	6-Jul-2016
NH-023.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-024	15-Jun-2016	Melissa Aalhus, Northern Health	Social	We are of the opinion that the Application did not fully/adequately discuss, quantify and categorize the potential socio-economic determinant of health impacts that may be associated with the project, especially when considering the entire and cumulative boom/bust cycle of resource developments. Additionally, risks to specific vulnerable populations were not adequately addressed in the Application (as was requested in our previous comments; tracking #39, 40 and 42) . As noted in our Standard Comments document, we ask that the full range of effects to Community Health are considered, including the potential for impacts to crime rates, the cost of living, communicable disease rates (including STIs), housing, community cohesion, educational attainment, traffic-related injury rates, the availability and cost of child care services, illicit drug accessibility, teenage pregnancies, etc. We ask that this includes a more detailed discussion of the experiences of communities in the region with the Kemess South Project, as well as a review of literature from similar resource-development projects (from within Canada and internationally).	Please see response to NH-02 submitted May 6	6-Jul-2016
NH-024.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-025	15-Jun-2016	Melissa Aalhus, Northern Health	Social	Please clarify if lay-offs and shutdowns may occur during periods of economic decline. If these may occur, we ask that effects to Community Well-being are assessed during these closure periods.	Please see response to NH-02 submitted May 6	6-Jul-2016
NH-025.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-026	15-Jun-2016	Melissa Aalhus, Northern Health	Social	Please indicate why impacts to community health associated with the influx of workers into transportation hubs were not considered. Specifically, please clarify why the potential impact on housing and temporary accommodations at transportation hubs due to commuting workers (and indirect and induced workers) was not considered? Our concern would be that increased demand on housing and temporary accommodations may affect access to affordable housing and short-term rentals for vulnerable individuals.	Please see response to NH-02 submitted May 6	6-Jul-2016
NH-026.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-027	15-Jun-2016	Melissa Aalhus, Northern Health	Social	Please provide a more detailed rationale that "in-migration to northern communities is not expected". As the social effects assessment relies heavily on this assumption, we ask for additional justification for this statement, or that project effects associated with in-migration are assessed. We recommend that the assessment consider all potential scenarios and consider worst case scenarios when making conclusions. We also ask for justification that indirect/induced employment will not result in migration into communities.	Please see response to NH-02 submitted May 6	6-Jul-2016

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NH-027.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-028	15-Jun-2016	Melissa Aalhus, Northern Health	Social	We are very encouraged that the proponent intends to develop a Health and Wellness Management Plan. Please be advised that NH's "Position Statements" may be a useful resource for developing preventative programs (available online at: https://northernhealth.ca/AboutUs/PositionStatementsAddressingRiskFactors.aspx#532437-full-position-statements). See comments below regarding Community Well-being residual effects and mitigation. We ask that this Health and Wellness Plan form part of a larger Health and Medical Services Plan as per our HMSP guidance document.	AuRico will comply with the requirements of the EA Certificate regarding additional plans or programs required by the proponent, such as a HMSP. AuRico can also provide further detail regarding the HWMP and plans for on-site medical services when these details are further developed.	6-Jul-2016
NH-028.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-029	15-Jun-2016	Melissa Aalhus, Northern Health	Social	We expect that further evidence/justification is provided as to why the proposed mitigations were predicted to be "highly effective", resulting in "no" residual effect on Community Well-being. While we are encouraged by the proposed mitigation measures, we do not feel that the Application includes sufficient mitigation measures and/or evidence of their effectiveness to predict "no" residual adverse effects on Community Well-being.	The mitigation measures proposed are considered to be adequate for addressing the potential effects identified in the assessment. It should be emphasized that, as described in the Application, effects to community well-being are not expected for the majority of workers but rather are more relevant to a small proportion of the workforce (particularly those with limited experience in the mining industry). AuRico has established a program of mitigation that provides the resources available to promote the best possible outcomes for workers.	6-Jul-2016
NH-029.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-030	15-Jun-2016	Melissa Aalhus, Northern Health	Social	It does not appear that all technically and economically feasible mitigation measures were considered (e.g. how will impacts to marginalized populations be mitigated?); it is not clear how potential impacts to the following will be mitigated completely to result in no residual effects to community well-being: • family health, community cohesion, cost of living, crime, mental health and substance use problems, child care availability, traffic-related injuries, children at risk, communicable disease It is our understanding from engaging with communities that these effects are often associated with major projects. Accordingly, and given the proposed mitigations and the current socio-economic and health vulnerabilities in the region, we disagree that "no" residual effects would be expected. We ask if a Socio-Economic Effects Management Plan (SEEMP) or similar strategy could be considered. We note that this has been included as a condition for a number of recently certified projects. We recognize that Northern Health is only one stakeholder, and would promote this approach only with the support and collaboration of the local community, First Nations, service providers and others that may be impacted by such a strategy. We recommend that this mitigation strategy include: - Community level monitoring and surveillance of sustainability indictors and the socio-economic determinants of health such as (but not limited to) housing, economic conditions, mental health, communicable disease rates, health service impacts, community health and well-being, crime, etc. This should be focused especially on impacts to the most vulnerable populations. - A commitment to participate in a multi-sectoral partnership for mitigation (comprised of appropriate government and social agencies, community representatives, First Nation representatives, NGOs, public members and industry) where issues will be identified and discussed, through which surveillance and monitoring will be conducted and by which mitigation plans are developed and carried out. Mitigation plans would need to be action-oriented with clearly identified roles and responsibilities triggers for mitigation and associated budgets and timelines. The engagement with the group would be ongoing throughout the project's life. - A commitment on part of the proponent to help fund mitigation actions identified by this multi-sectoral partnership.	Mitigation is pursued as a means to reduce an effect that has been identified and assessed in the EA. Chapter 17 of the Application provides clear definitions of the potential effects that are relevant to the development of the Project. As noted as in previous responses, effects to community cohesion, cost of living, crime, child care availability, and communicable disease are typically associated with population influx. The project is not expected to result in population influx and as such there was no need to considered related effects in the Application. Other effects, including the potential for increased negative social behaviors (e.g., substance abuse), absence from home, stress, etc. are acknowledged and discussed in the Application. Considering the nature of the Project and expected affects, Aboriginal persons (as well as others who may be new to the mining industry) were identified as potentially vulnerable to certain impacts due to pre-existing social disparities. Additional or differential effects on Aboriginal persons are assessed in 17.5.2.2. AuRico believes that the mitigation of effects through the HWMP and EFAP will address the social, health and well-being issues that may be associated with the Project and support the development of a healthy workforce and communities. Additionally, AuRico will comply with the requirements of the EA Certificate regarding additional plans or programs required by the proponent. AuRico can also provide further detail about the scope and implementation of workforce programming when this information is further developed. Additional information to support this conclusion is provided in memo **20160706 KUG Comments NH-012, 014, 015, 017, 020, 021, 030 Population Influx_Memo.**	6-Jul-2016
NH-030.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-031	15-Jun-2016	Barbara Oke, Northern Health	Social	In regards to the sentence "Northern Health is the principle Health service provider In the RSA…." it should be recognized that while Northern Health provides much of the emergency and inpatient care services, primary care is provided largely In privately owned and operated physican offices, compensated through a fee for service model from Medical services Plan or private care. As well, the First Nation Health Authority, together with other partners, offer Health services In aboriginal communities Correction: Prince George Regional Hospital changed its name to the University Hospital of Northern BC (it is the same Hospital)	AuRico thanks Northern Health for the additional context describing the provision of health services in BC (public and private care model). While this is important context contributing to an understanding of the delivery of health care services in BC, the conclusions of the assessment remain valid. This content will be taken into account through ongoing planning and engagement. Section 17.4.4.9 of the Application does acknowledge that the First Nations Health Authority provides health services in Aboriginal communities.	6-Jul-2016
NH-031.1	18-Aug-2016	Melissa Aalhus, Northern Health	Social	Please see attached memo (see proponent sharepoint – round 2 comments NH)	The response is provided in the memo **20161007_KUG Comments NH-001.1 002.1 NH-012.1-031.1_Round 2_Social**	7-Oct-2016
NH-032	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	We advise that Table 18.2-1. Summary of Applicable Regulatory and Policy Framework for Human Health should also include the following: **Food – Operating Permit** Public Health Act, Food Premises Regulation (210/99) **Sewerage System – Record of Sewerage filing** Public Health Act, Sewerage System Regulation (326/2004) Applicable if sewage disposal system daily domestic sewage flow is less than 22,700 litres – Section 2, Sewerage System Regulation **Industrial Camp – Health Approval** Public Health Act, Industrial Camp Regulation **Tobacco** Tobacco Control Act (RSBC 1996, c.451) and associated Regulation (237/2007) It is the responsibility of the applicant to be familiar with the applicable legislation, and to ensure that all requirements are met. Note: Copies of the above legislation can be found at the B.C. Queen's Printer website: http://www.bclaws.ca/	AuRico Metals acknowledges the comment. AuRico Metals is committed to adhering to all regulatory requirements in the development of the KUG Project.	6-Jul-2016
NH-033	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	Please provide additional justification for the exclusion of radiological exposures as an operable pathway for impacts to human health. What are the background radiation levels? Bringing workers into an area with elevated radiation levels would be considered a project effect, and the fact that baseline levels are not expected to change is not sufficient rationale for the exclusion of radiation from the assessment. We are aware that radon is a potential concern in most areas within Northern Health and although, mostly present in dwelling and enclosed spaces, may pose a potential concern for workers in camps.	Section 6.10.1 of the Project's Application Information Requirements (AIR) states: "While Health Canada (2010)[1] also recommends the assessment of radiological and electromagnetic field (EMF) effects, those types of exposures are not anticipated for this Project, which is a proposed mine; thus, radiological and EMF effects will not be assessed." Therefore, background radiation levels were not measured and assessment of radiological effects is not required in the Application. (1) Health Canada. 2010. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA). Version 2.0. Revised 2012. Contaminated Sites Division, Safe Environments Directorate: Ottawa, ON.	6-Jul-2016
NH-033.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	We acknowledge that the AIR stated that "radiological and electromagnetic field (EMF) effects will not be assessed". However it is also stated in the AIR that "the rationale for choosing the corresponding indicators will also be presented in the Application" (S. 6.10.3.1). We expect additional detail on the rationale for excluding radiological exposures from the assessment. As per our Standard Comments and Health Canada's guidance documents, potential exposure pathways should not be excluded without a rationale (of sufficient detail). Is there a potential for radon exposure in camp buildings?	Radiological effects were not included in the human health effects assessment because the proposed mine is a gold-copper mine and radiation above background levels is not expected as Project activities (construction of the mine, underground mining, processing, and loading of ore) and infrastructure are not likely to generate radioactivity with the potential to affect human health. Radon concentrations in soil and rock across Canada are highly variable; however, radon concentrations tend to be elevated in locations where uranium concentrations are also elevated in the underlying rock and soil (1). The uranium concentrations in baseline soil samples collected for the Project were quite low, with a maximum concentration of 6.08 mg/kg, which is well below the CCME soil quality guideline for the protection of environmental and human health for agricultural land use (23 mg/kg)(2). Because uranium concentrations are low in the soil it is reasonable to expect that radon concentrations are also low and do not pose a risk to human health. This supports the exclusion of considering radon exposure as a pathway to human health effects. There are no other known radioactive materials on the Project site that would pose a risk to human health which would warrant an assessment for residual effects. (1) Health Canada. 2014. Environmental and Workplace Health: Radon Frequently Asked Questions. Accessed September 2016 from: http://www.hc-sc.gc.ca/ewh-semt/radiation/radon/faq_fq-eng.php (2) CCME. 2016. Canadian environmental quality guidelines - summary table. Canadian Council of Ministers of the Environment. http://st-ts.ccme.ca/en/index.html (accessed August 2016).	7-Oct-2016
NH-034	15-Jun-2016	Barbara Oke, Northern Health	Human Health	The Application notes that only soil samples up to a depth of 20 cms were included for the HHRA. Is it possible that deeper layers will be exposed during Site activities?	Health Canada (2010)[1] guidance indicates that humans are predominantly exposed to "surface" soil, which is typically at a depth of less than 5 cm. Since Health Canada (2010) guidance was followed in the HHRA, baseline soil samples from within the top 0 to 20 cm were included. While it is possible that soil deeper than 20 cm may be exposed during Project activities, the primary dust sources are from driving on (existing) unpaved roads and ore processing/handling. Samples from soil sampled near unpaved roads and ore were used in the HHRA and it is expected that the ore concentrations represent metal concentrations that may be present deeper than 20 cm. (1) Health Canada. 2010. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA). Version 2.0. Revised 2012. Contaminated Sites Division, Safe Environments Directorate: Ottawa, ON.	6-Jul-2016
NH-035	15-Jun-2016	Barbara Oke, Northern Health	Human Health	We are very pleased with the incorporation of receptor locations into the air quality Contour Plots. However, please ensure that all potential human receptor locations are identified in the air quality effects assessment. In response to NH screening comment (Final Working Group TOC, Row 1869), the Proponent stated that "There are no known temporary receptor locations within the air dispersion modelling domain". We expect justification that this is the case; given that the air dispersion modelling domain extends beyond the Project fence line. In Section 21, it is noted that Tse Keh Nay have traditional meeting grounds at the north end of Thutade Lake. This would fall into the air dispersion modelling domain (as stipulated in S. 7, Figure 7.1-1).	As described in Section 7.1.6 of the Application, all maximum predicted concentrations of SO_2, NO_2, CO, TSP, PM_{10}, $PM_{2.5}$, and dustfall deposition were below the air quality objectives at all locations modelled during both the Construction and Operations phases. Therefore, there are no anticipated impacts from changes in air quality on temporary or seasonally used human receptor locations.	6-Jul-2016
NH-035.1	18-Aug-2016	Barbara Oke, Northern Health	Human Health	We recognize that maximum predicted concentrations of criteria air contaminants were below air quality objectives at locations modelled. In the Proponent's response it is stated that "Therefore, there are no anticipated impacts from changes in air quality on temporary or seasonally used human receptor locations." We disagree with this statement. For non-threshold contaminants (such as PM), health effects can be observed at concentrations below criteria. We ask that this be recognized and that mitigations be implemented to reduce potential PM2.5 concentrations to as low as reasonably achievable as part of the Air Quality Management Plan.	Please see the response to Health Canada's 2nd round comment #HC-004.1, provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.** It is acknowledged that health effects from particulate matter (PM) can be observed at concentrations below the criteria, since it is a non-threshold contaminant. Worker health and safety is a core value for AuRico. Within the EAC Application (Section 7.1.7 and 24.3.4), AuRico have committed to several management and mitigation measures to limit the levels of particulate matter (PM) within and beyond the mine area. These are consistent with standard management measures implemented at other mine facilities in BC. While particulate matter emissions will be generated by project activity, ambient levels are expected to remain well below relevant established federal and provincial thresholds for PM10 and PM2.5. AuRico is required to comply with authorizations issued to the project and applicable regulations. This will include a Mines Act permit requiring compliance with the Health, Safety and Reclamation Code for Mines in British Columbia and operating the camp area in compliance with the Occupation Health and Safety Regulation of the Workers Compensation Act. Conditions of an Environmental Assessment Certificate are intended to address areas where there is potential for significant adverse effects; we firmly believe that management and mitigation measures already committed to by AuRico are sufficient to avoid significant adverse effects to human health associated with particulate matter.	7-Oct-2016

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NH-036	15-Jun-2016	Barbara Oke, Northern Health	Human Health	We recognize that modelled Criteria Air Contaminants fall below their corresponding objectives at all locations, but note that for non-threshold contaminants (including PM), there is no safe exposure level and the dose response curve recognizes that even at low concentrations, there is a potential for health impacts. It is best practice that exposure for these contaminants be minimize to as low as reasonably achievable. We ask for further discussion of how air quality at temporary receptor locations may be affected, and in particular, how individuals at these locations may be impacted by metals contained in dust.	Please see the response to comment #NH-035. The Air Quality Management Plan for the Project (Section 24.3 of the Application) describes the mitigation measures that will be in place to reduce NO2, SO2, CO, PM, and GHG emissions, as well as fugitive dust from the Project. Industry standard mitigation practices have been incorporated into the Air Quality Management Plan to ensure emissions are minimized for the Project. While there are known temporary use locations in the project area, access to the mine site and local study area where elevated levels of CACs may be encountered is completely controlled.	6-Jul-2016
NH-036.1	18-Aug-2016	Barbara Oke, Northern Health	Human Health	According to contour plots in Appendix 7-C, it does not appear that CAC elevations will be confined to areas of controlled access. This shows elevations in PM2.5 and PM10 that occur outside of the project fence lines in areas that are publicly accessible. How will access be completely controlled in these areas?	Please see the response to Health Canada's 2nd round comment #HC-004.1, provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo** Access to the Project area will be controlled at the main gate located along the existing road that connects the KS mine site to the ORAR, there is no physical fence line that surrounds the entire project. In general access is limited by the distance from any population centre. Therefore, while it is possible that people could be present in the areas outside of the fenceline that have elevated PM concentrations, those concentrations do not exceed the applicable criteria for PM10 or PM2.5 (i.e., BC MOE Ambient Air Quality Criteria/Objectives and Canadian Ambient Air Quality Standards). In addition, there is no unacceptable cancer risk from diesel exhaust for people that may be located at the fence line where maximum PM2.5 concentrations are predicted (as described in the response to Health Canada's 2nd round comment #HC-004.1, provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.** Particulate matter was assessed as a threshold contaminant (i.e., comparison to guidelines and calculation of hazard quotients) and as a non-threshold contaminant (ie., calculation of incremental lifetime cancer risks) according to Health Canada guidance for human health risk assessment. Standard best management practices to reduce PM as low as possible are provided in the Air Quality Management Plan for the Project (Section 24.3 of the Application) and include measures such as: implementation of energy efficiency measures; procurement policies to identify fuel and equipment specifications; regular servicing of all mobile and stationary equipment to maintain efficiency; training and instruction for on-site staff with duties related to the operation of equipment that emit air pollutants or controls air emissions (e.g., the required measures to be implemented during start-up, shut down, and emergency conditions); retrofitting of older engines, as required in BC for models manufactured between 1989 and 1993 that weigh over 8,200 kilograms; use of low-sulphur diesel in all equipment; minimization of vehicle and equipment idling, when not in use, taking account of differing operational requirements in summer and winter; use of electric powered equipment in the underground where practical, reducing the overall volume of exhaust emissions; and operating vehicles at designated speeds on site roads.	7-Oct-2016
NH-037	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	**Indoor air quality:** Please indicate why the Application did not assess the potential for workers to track dust from the mine site into buildings (e.g. on clothing/shoes), potentially impacting the health of workers and camp staff through the inhalation of contaminated dust.	The occupational health and safety of on-duty workers is not typically evaluated in Environmental Assessments (Health Canada 2010)1. Health and safety of on-duty workers is addressed by various legislation codes in BC such as the Occupational Health and Safety Regulation (B.C. Reg. 296/97)2 and associated policies and guidelines administered by WorkSafeBC, and the Health, Safety, and Reclamation Code (BC MEMPR 2008)3 administered by the Ministry of Energy and Mines. However, if workers are housed on-site, then an assessment of potential effects on human health to off-duty workers residing onsite can be considered (Health Canada 2010)1 and this assessment was provided in Chapter 18 of the Application. A mine dry will be located near the portals to the underground mine area. Workers coming off-sift will change out of their work clothing at this location before being transported back to the camp area. Thus, dust from clothing impacting interior air quality is not considered to be a pathway for air quality effects on workers or camp staff. In addition, it is expected that dust levels outdoors will be much higher than those indoors since building structures limit the exposure to air pollutants. The outdoor levels of air pollutants (including metals bound to particulate matter) were assessed in the Application in Chapter 18. It was assumed that off-duty workers would be exposed to these concentrations during all their off-duty hours and that the concentrations indoors would be the same as the concentrations outdoors. The assessment determined that only chromium bound to PM10 exceeded applicable criteria (Section 4.2 of Appendix 18-B). However, as shown in Table 4.7-1 of Appendix 18-B, the estimated daily intake of chromium from inhalation is much lower than that from all other exposure pathways (i.e., drinking water, dermal contact, and country foods ingestion). Furthermore, the chromium hazard quotients for adults during the Construction and Operations phases were not much different than those during baseline (Tables 6.1-1 and 6.1-2 of the Application). Therefore, it is expected that inhalation of contaminated dust indoors would be negligible. (1) Health Canada. 2010. Useful Information for Environmental Assessments. 978-1-001-15153-3. Health Canada, Environmental Assessment Division: Ottawa, ON. (2) Occupational Health and Safety Regulation, B.C. Reg. 296/97. (3) BC MEMPR. 2008. Health, Safety and Reclamation Code for Mines in British Columbia. British Columbia Ministry of Energy, Mines, and Petroleum Resources (BC MEMPR); Mining and Minerals Division: Victoria, BC.	6-Jul-2016
NH-037.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Thank you for the additional information; we are pleased with the mitigations for dust on clothing (will this include the removal of potentially contaminated footwear?). Given that health risks are calculated to exceed acceptable risk levels for a number of contaminants, and that there are a number of uncertainties in the assessment, we recommend that HEPA filtration be considered in all indoor environments. In addition to these measures, other monitoring and mitigation may be necessary to protect off-duty worker health.	Mitigation measures for dust on clothing will also apply to dust on footwear. Northern Health's recommendation of HEPA filtration is noted and appreciated. Though some individual contaminants were estimated to exceed acceptable risk levels (i.e. HQ > 0.2), this is a result of the highly conservative assumptions. Both the baseline and Project-related human health risk assessments (HHRA) were conservative and over-estimated the potential health risk to workers brought in from other areas of the province. The assessment assumed a worker would be onsite every day for the duration of the Construction and Operations phases; however, workers will have a 2 week on-site and and 2 week off-site work schedule, thus their actual exposure time on-site will be at least half of what was assumed in the Application. Workers (including off-duty workers) will be prohibited from hunting and fishing while onsite due to Project policies (Section 18.5.3.1 of the Application); however, the exposure assessment in the baseline and Project-related HHRA assumed that off-duty workers residing onsite would ingest country foods (i.e., ingestion of meat, fish, and berries were included in the exposure assessment). If country foods were removed from the assessment for off-duty workers then the calculated risks to off-duty worker health would be much lower as country foods are a primary exposure route (i.e., compared to other routes such as soil ingestion and inhalation) to contaminants of potential concern.The assumptions regarding exposure time and country food consumption provide a conservative over-estimation of potential health risks to off-duty workers. Despite the conservative assessment, all criteria air contaminants (CACs) emitted by the Project (i.e., not due to background conditions) were below applicable guidelines/objectives.	7-Oct-2016
NH-038	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	**Contaminants:** Provide further justification for the exclusion of potential contaminants from the assessment (e.g. PAHs, VOCs, cyanides, etc.). We advise that "experience from other projects and professional knowledge" (without additional detail) is not sufficient justification for excluding contaminants. Please indicate if cyanides or any other chemicals will be utilized for mineral processing or other mining activities.	Please see response to NH-005 Submitted May 6	6-Jul-2016
NH-038.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Thank you; see NH's response to comments above.	Please see response to NH-005 and NH-037.1.	7-Oct-2016
NH-039	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	We are aware of PM baseline monitoring data that was completed at the Blackwater Gold Mine site, which is located 110 km south of Vanderhoof. Please clarify if this was considered, given that it may be more representative of the geographical location than the monitoring sites included.	Please see response to NH-005 Submitted May 6	6-Jul-2016
NH-039.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Thank you; see NH's response to comments above.	Please see response to NH-005 and NH-037.1.	7-Oct-2016
NH-040	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	We note that the baseline assessment of metals contained in PM10 was completed using metal concentrations in dust samples collected from along roads. Please clarify whether impacts resulting from the Kemess South Mine site were considered (e.g. fugitive dust emissions from waste stockpiles and/or the open-mine site); please provide additional detail on the existing disturbance from the KS site (i.e. any stockpiles, etc.) or provide linkage to this information elsewhere in the application. Were samples from potential receptor sites near the KS Mine site included?	Please see response to NH-008 submitted May 6	6-Jul-2016
NH-040.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Thank you; see NH's response to comments above.	Please see response to NH-008 and NH-037.1.	7-Oct-2016
NH-041	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	"Median" sampling concentrations were utilized in the Human Health Risk Assessment (including the soil ingestion/dermal exposure, surface water and country foods assessments). Health Canada's Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA) states the following regarding preliminary quantitative HHRAs: "The soil sampling conducted at contaminated sites during a preliminary ESA that may be used in a PQRA is usually limited; it is not unusual for PQRA reports to be prepared on the basis of > 20 samples (of soil or other contaminated environmental media). As a result of the biased and limited nature of the sampling plan for sites being subjected to a PQRA, only the maximum measured concentration for each COPC should be employed for purposes of estimating human health risks at the site. Where, in the opinion of the risk assessor, the data are sufficiently numerous and rigorous to warrant an alternate statistical treatment of on-site contamination data (such as the use of a mean concentration, or the use of an upper confidence limit on the mean), the risk assessor or site proponent is advised to contact Health Canada to discuss the use of DQRAChem at the subject site." (Federal Contaminated Site Risk Assessment in Canada Part I, V. 2.0; Section 2.5 Exposure Assessment, p. 12) In Health Canada's Guidance on Human Health Detailed Quantitative Risk Assessment for Chemicals (DQRA), it is stated that: "For deterministic exposure assessments, chemical concentrations are represented by point estimates. These point estimates may be based on the arithmetic mean, upper 95% confidence interval of the mean, 95th percentile of the data distribution, or some other statistic depending on the quality and quantity of data available. Adequate data permitting, Health Canada prefers use of the mean or upper 95% confidence interval of the mean. However, for PQRAs where data are more limited, the 95th percentile of the data distribution or the maximum measured concentration will more likely be employed. For probabilistic assessments, chemical concentrations will be represented by the full distribution of all measured values at the site (see section 7.0)." (Federal Contaminated Site Risk Assessment in Canada Part V, Section 4.4 Characterization and Estimation of Chemical Concentrations, p. 41-42) Accordingly, we note that the use of the median value in the HHRA is not consistent with Health Canada's guidelines.	The quality and quantity of the data used in the HHRA were considered sufficient to allow the use of median statistics as there were greater than 20 samples for all media except for berries, which had 17 samples. However, mean values (as recommended by Health Canada) were not used as environmental data does not typically have a normal distribution and instead a non-parametric statistic (median) was used instead. In addition, the use of median statistics is also consistent with preferences and requirements of other regulators (e.g., BC Ministry of Environment) for water quality data used in developing water quality models, since the use of median statistics eliminates the potential for skewing of the statistic due to outliers (extreme values at either the low or high end of the concentration range). Median values were used in both the baseline HHRA (Appendix 18-A) and Project-related HHRA (Appendix 18-B) to allow the evaluation of the incremental change in contaminant concentrations due to the Project. It is the incremental change from baseline that is of interest in an environmental assessment and even if different statistics were used (e.g., 95th percentiles or maximums) the conclusion of the assessment would be the same as the relative incremental change would be the same.	6-Jul-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
NH-041.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Please refer to Comment #NH-004-1. We continue to have outstanding concerns with the statistical methodology. The statistical methods used in the HHRA do not allow an estimate of worst case scenario effects to human health. Health Canada has raised the same concerns; please refer to Health Canada's Second Round comments (including HC-016.1). Health Canada's guidance documents for HHRAs are intended for the consideration of environmental data. Thus we question the rationale that "mean values (as recommended by Health Canada) were not used as environmental data does not typically have a normal distribution and instead a non-parametric statistic (median) was used instead". Please note that as indicated in our previous comments, Health Canada guidance documents (Guidance on Human Health Detailed Quantitative Risk Assessment for Chemicals (DQRA)) recommend the following: "Adequate data permitting, Health Canada prefers use of the mean or upper 95% confidence interval of the mean. However, for PQRAs where data are more limited, the 95th percentile of the data distribution or the maximum measured concentration will more likely be employed". It is not the incremental change in contaminants concentrations that is to be considered in the HHRA, but the change in health risk due to project activities. The conclusions of the assessment would not necessarily be same if different statistics were used. Of particular note is that bringing a worker population into an area (who will reside in the area during off-duty time) with elevated health risks is a project-related impact; and with alternate statistical methods, the predicted health risk to these individuals would presumably be different. Further, the calculation of the changes in the absolute risk to human health is an important component of any HHRA, and would indeed impact the conclusions of the assessment (e.g. could increase the health risk above an 'acceptable' level).	Please see the response to Health Canada's 2nd round comments #HC-004.1 and HC-016.1, provided in the Memo memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.** There are no known full-time, year-round residents within the Human Health LSA. The Project is located approximately 250 km north of the town of Smithers, 430 km north-northwest of the city of Prince George. The closest communities to the Project by air are Kwadacha (Fort Ware; 79 km), Tsay Keh (111 km), and Takla Landing (182 km). Workers (including off-duty workers) are prohibited from hunting and fishing while onsite due to Project policies (Section 18.5.3.1 of the Application); however, the exposure assessment in the baseline and Project HHRA assumed that off-duty workers residing onsite would ingest country foods (i.e., ingestion of meat, fish, and berries were included in the exposure assessment). This is not the case and would not occur. This assumption was made to provide a very conservative estimate of risk to off-duty workers while residing onsite and to enable a comparison of the (negligible) incremental change in the hazard quotients for country foods between baseline, Construction phase, and Operations phase. Figure 18.5-2 of the Application shows that the risk to human health is not measurably different for each of the exposure pathways considered in each of baseline, Construction phase, and Operations phase. The incremental change in risk to human health due to the Project is negligible, and no change in human health would be expected due to the Project. If country foods were removed from the assessment for off-duty workers then the calculated risks to off-duty worker health would be much lower as country foods are a primary exposure route (i.e., compared to other routes such as soil ingestion and inhalation) to contaminants of potential concern. Furthermore, it was assumed that off-duty workers would be at the camp bunkhouse location year round, which is also an over-estimate as workers will have a 2 week on-site and and 2 week off-site work schedule, thus their actual exposure time on-site is at least half of what was assumed in the Application. These assumptions provide a conservative over-estimation of the potential health risk to off-duty workers.	7-Oct-2016
NH-042	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	Further, HC recommends the use of the maximum sampled concentration versus mean/95% UCLM/95th percentile of the data distribution/etc. depending on the sampling methodology (e.g. number of samples, how biased sampling locations are, etc), which is not clear. The soil sampling methodology should be more clearly defined in the HHRA. It is difficult to understand where, when and how samples were collected; and thus to ascertain which statistical methods would be most appropriate to the data. Regardless, we note that the use of the median value is not in line with the HC guidelines (as described above). We advise that this may considerably impact the conclusions of the effects assessment, and is an oversight.	Please see the response to Comment #NH-041 for discussion of the use of median values. As described in Section 4.5 of Appendix 18-A, there were 56 soil samples included in HHRA that were sampled in 2003 and 2014. The location of the samples was provided in Figure 4.5-1 of Appendix 18-A. Summary statistics for the soil samples were provided in Table 4.5-1 of Appendix 18-A. The soil sampling locations were distributed throughout the study area and are representative of the conditions within the study area; additional soil sampling was conducted in areas where potential effects could be expected (e.g., along roads). Due to the large number of soil samples and the representative area covered by the samples, AuRico considers the use of median values is justified.	6-Jul-2016
NH-042.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	In Table 4.5-1 of Appendix 18-A, what is meant by "n=9 to 56". Were these values in Table 4.5-1 calculated based upon 56 samples or 9 samples? It is stated in S. 4.5 that the top samples taken from "within the top 0 to 20 cm [of the soil] were included in the human health analysis". Was this a range of depths? Please see previous comments regarding median values	There was a total of 56 soil samples but not all parameters were analyzed in every sample due to differences in the baseline sampling programs and in the labs used for analyzing the samples over the years. Soil samples were obtained from depths ranging between 0 and 20 cm. Please see the response to Health Canada's 2nd round comment #HC-016.1, provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo** for information on the use of median values.	7-Oct-2016
NH-043	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	Please provide justification as to why the selected terrestrial wildlife species (moose, hare and ruffled grouse) were considered representative species (i.e. assumed to have the "highest rate of exposure"). According to Health Canada's guidance documents, secondary and tertiary consumers should be included given the added potential for the biomagnification of contaminants through food chain transfer (Health Canada's Supplemental Guidance on Human Health Risk Assessment for Country Foods, 2010). Given that it is stated that grizzly and black bear are hunted in the area, we ask why these were not included (given the higher potential for biomagnification for tertiary consumers)?	Please see response to NH-07 submitted May 6	6-Jul-2016
NH-043.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	See response above. We defer to HC's comment HC-007.1 for more information on the use of tissue-specific food chain modelling; we agree with HC's response.	Please see the response to Health Canada's 2nd round comment #HC-007.1, provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
NH-044	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	Also, we have some concerns that only the ingestion rates of the representative species was included in the calculation of health risks (For instance, since moose was considered a representative herbivore species, calculations should have incorporated the weight of consumption for all herbivore species rather than just moose) and that only meat (not organs, such as moose livers and kidneys) were incorporated into the calculations.	Please see the response to the Health Canada comment #HC-006 provided in the memo **20160706 KUG Comment HC-001, HC-004, HC-005, HC-006_Human Health _Memo**. Since it is not possible to assess all potential country foods, one representative species is selected from each of the following groups of foods: wild game (which includes small and large mammals and birds), fish, and vegetation. Representative country foods from the different groups are selected because the relative exposure of organisms in each group to environmental media varies with specific habitat and foraging behaviours (e.g., a moose has a different life history and potential for COPC exposure than a fish). A species that represents the highest consumption level and, therefore, results in the highest potential dietary exposure to COPCs, is selected from within each of these groups. If foods that represent the highest rate of exposure are determined to be safe for consumption, then all other foods within the group would also be considered safe for consumption. Health Canada (2010)[1] guidance does not state that the ingestion rates of more than one species in each category should be summed. As described in Section 4.0 of the Health Canada (2010)[1] guidance document on country foods: "It is also important to note that many uptake models typically provide an estimate of whole-animal residue levels and not the tissue-specific residue levels for muscle or organ meat. The whole body residue may over-estimate or under-estimate the actual contaminant residue levels in the specific tissue of interest." Section 4.0 of the Health Canada (2010)[1] guidance document on country foods also states: "Modelling of COPC uptake into tissue is generally conservative and may overestimate concentrations of COPC by orders of magnitude." Since Health Canada (2010)[1] guidance was followed in the HHRAs, only whole body contaminant residues in country foods were predicted and it is assumed that they were conservative estimates. (1) Health Canada. 2010. Federal Contaminated Site Risk Assessment in Canada, Supplemental Guidance on Human Health Risk Assessment for Country Foods (HHRAFoods). Contaminated Sites Division, Safe Environments Directorate: Ottawa, ON.	6-Jul-2016
NH-044.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	We defer to HC's comment HC-007.1 for more information on the use of tissue-specific food chain modelling; we agree with HC's response.	Please see the response to Health Canada's 2nd round comment #HC-007.1, provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
NH-045	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	NH feels that the Human Health Risk Assessment for the inhalation of metals bound to PM10 lacked sufficient detail (and robustness) to adequately assess potential impacts to human health.	Please see response to NH-006.	6-Jul-2016
NH-045.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	See above comments	Please see the response to Health Canada's 2nd round comment #HC-007.1, provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
NH-046	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	It is the reviewers understanding that the predicted concentrations of "project-related metal concentrations bound to PM10" were calculated based upon metal concentrations in "soil samples obtained from within 175 m of the roads", as well as "one ore metals sample". Please provide a rationale as to why this methodology was utilized for the Effects Assessment (as well as additional clarification on the sampling methods):	Please see response to NH-006.	6-Jul-2016
NH-046.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	See above comments	Please see the response to Health Canada's 2nd round comment #HC-007.1, provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
NH-047	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	**Metals Due to Ore Dust:** Please justify why the metal concentrations within this single ore sample are considered representative of the various types of rock (and dust that may be emitted from mining activities). Were variations in metal composition in different types of rock considered (given that fugitive dust emissions were predicted to occur due to the material handling of "waste rock, ore, crushed ore and stripped organics" such as due to "material drop onto stockpiles"; "mining activities, such as bulldozing, grinding, drilling and blasting"; and "wind erosion" of stockpiles, (S. 7.1.5 Predictive Study Methods for Air Quality). Please justify that this allows a conservative estimate of the metal composition of dust.	Please see response to NH-006.	6-Jul-2016
NH-047.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	See above comments	Please see the response to Health Canada's 2nd round comment #HC-007.1, provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
NH-048	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	**Metals Due to Road Dust:** Please clarify how many samples were included? See comments above regarding Health Canada guidelines on the use of maximum contaminant concentrations versus the 95th UCLM. We ask whether the use of 15 samples from these locations warrants sufficient statistical power for the use of the 95th UCLM; we advise that this may meaningfully impact the conclusions of the HHRA.	There were 15 soil samples from locations near roads (shown in Figure 4.6-1 of Appendix 18-B) included as "metals due to road dust". Health Canada (2010)[1] advises that the statistic used for point estimates depends on the quality and quantity of data available. Due to the small sample size, 95th UCLM concentrations were used in the calculations instead of median values. (1) Health Canada. 2010. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA). Version 2.0. Revised 2012. Contaminated Sites Division, Safe Environments Directorate: Ottawa, ON.	6-Jul-2016
NH-048.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Please refer to Comment #NH-004-1. We continue to have outstanding concerns with the statistical methodology. The statistical methods used in the HHRA do not allow an estimate of worst case scenario effects to human health. Health Canada has raised the same concerns; please refer to Health Canada's Second Round comments (including HC-016.1).	Please see the response to Health Canada's 2nd round comment #HC-004.1 and HC-016.1, provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
NH-049	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	Project activities were predicted to result in changes to soil metal concentrations (Appendix 18-B S. 3.4 Soil Quality). Given that this soil may be re-suspended due to road traffic, we ask why baseline soil quality levels were used for the project road dust assessment rather than modelled soil quality levels due to project activity? Why were the predicted changes to soil quality not included in this assessment of road dust? We advise that these modelled soil quality concentrations should be used instead to capture project effects. We advise that this may have a considerable impact on the conclusions of the HHRA.	Please see response to NH-006.	6-Jul-2016
NH-049.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	See above comments	Please see the response to Health Canada's 2nd round comment #HC-004.1 and HC-016.1, provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
NH-050	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	For the purposes of the metals in PM10 assessment, the camp location is considered to be representative of temporary receptor locations (and is the only receptor location assessed). We advise that the maximum PM10 concentration is instead utilized to ensure that potential impacts at all potential receptor locations are considered. In S. 7 Table 7.1-20 it is noted that the maximum predicted PM10 concentration during Construction and Operations is 16.2 and 8.5 ug/m^3 respectively. This is notably different than that at predicted at the camp (Construction 10.1 ug/m^3 and Operations 6.65 ug/m^3).	Please see response to NH-006.	6-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

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NH-050.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	See above comments	Please see the response to Health Canada's 2nd round comment #HC-004.1 and HC-016.1, provided in the Memo memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
NH-051	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	It was indicated in the AIR that changes in "drinking water quality" would be included as an indicator for Human Health impacts. While we note that the potential for human consumption of contaminated surface water was assessed, we expect further justification as to why the potential for changes in groundwater quality to impact human health was not included in the assessment.	As described in Sections 9.4.4.6 (Groundwater Use Downstream of the Project Area) and 18.5.2.3 (Drinking Water Quality) of the Application, the only known use of groundwater for potable drinking water in the groundwater regional study area (RSA) are three water supply wells located in the KS area (Figure 9.4-2 in Chapter 9 of the Application). As described in Table 9.6-14 in Chapter 9 (Hydrogeology Effects Assessment) of the Application, effects on groundwater quality are limited to the Project Site and limited only to the subsidence zone and upper East Cirque Creek drainage in the LSA1; therefore, there would be no effects to downstream receptors, should they install a drinking water well. There will be no effects to groundwater that people may drink as it is not expected that groundwater from the subsidence zone would be consumed. As described in Table 9.6-16 in Chapter 9 (Hydrogeology Effects Assessment) of the Application, effects on groundwater quality are limited to the immediate area between the TSF and Kemess Creek in the LSA2; therefore, there would be no effects to downstream receptors, should they install a drinking water well. There will be no effects to groundwater that people may drink as it is expected that groundwater would be diluted in Kemess Creek and dilution would continue downstream. As described in Sections 9.6.2.1 and 9.6.2.2 of the Application, the residual effects on groundwater quality and ultimately groundwater surface water interactions are of High magnitude and are Irreversible; however, their geographic extent is very limited to one small watershed in LSA1 (East Cirque Creek) and to the immediate area between the TSF and Kemess Creek in LSA2, and are thus considered Discrete. While development of the Project will result in measurable alteration of deep groundwater quality in the gossan, the quality of shallow groundwater draining the gossan is not expected to be materially altered. Given that deep groundwater is predicted to have only a minor contribution to East Cirque Creek and that East Cirque Creek itself is naturally affected by geochemical reactivity within the gossan, changes to surface water quality within East Cirque Creek are considered minor. Given that effects on groundwater quality are limited to deep groundwater and localized to the East Cirque Creek catchment, groundwater quality residual effects are considered to be Not Significant in LSA1. Likewise, while concentrations are elevated above background concentrations in the immediate area between the TSF and Kemess Creek in LSA2, the seepage flux and resultant loading to Kemess Creek and ultimately Attichika Creek is minor; therefore the groundwater quality residual effects are considered to be Not Significant in LSA2. The groundwater inputs to one watershed at the Project site but inputs to the waterbody are minor, thus surface water quality changes in the watershed from groundwater inputs are not significant. As such, residual effects of groundwater inputs on receptors accessing watersheds (e.g., Peace River Watershed) downstream of the Project are expected to be negligible.	6-Jul-2016
NH-051.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Please refer to attached memo on water quality (see proponent sharepoint – round 2 comments NH)	Please see response to comment NH-010.1.	7-Oct-2016
NH-052	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	We appreciate that the three potable water wells within the LSA are associated with Kemess South, and will be operated in accordance with existing permits. Please clarify how the water will be treated, and confirm that monitoring will capture any effects from the Kemess Underground Project. Permit monitoring requirements may not be sufficient to capture project-related effects to groundwater.	As described in Section 18.2.3 of the Application, the *Drinking Water Protection Act* (2001)[1] and Drinking Water Protection Regulation (B.C. Reg. 200/2003)[2] require that all water systems meet minimum water treatment standards, monitoring type and frequency, and specific water quality standards. Provincial and federal drinking water quality guidelines (DWQGs) are available to ensure potability of water and protection of human health. Drinking water quality should comply with the BC DWQGs (BC MOE 2016)[3], standards under the *BC Drinking Water Protection Act* (2001)[1], and BC Drinking Water Protection Regulation (B.C. Reg. 200/2003)[2]. Drinking water quality should also comply with the Canadian DWQGs (Health Canada 2015)[4]. As described in Section 18.5.2.3 of the Application, regular monitoring of the potable water distribution system does and will continue to occur in accordance with the conditions specified in applicable drinking water system operating permits authorized by Northern Health (Section 24.8.5 of the Application). Exceedances in parameters resulting from unsafe drinking water would trigger a drinking water advisory to all camp residents and resampling of the potable water system. The drinking water advisory would remain in place until Northern Health authorities are notified and subsequently lift the advisory. AuRico could add a treatment system (the type of treatment would depend on the parameter causing the exceedance) or identify alternate water sources if persistent exceedances of drinking water guidelines occur. As monitoring will take place at the drinking water wells, this would identify any project related effects on those wells. The Groundwater Monitoring Plan (Section 24.8 of the Application) provides more details on the monitoring of groundwater quality. This plan will be developed in further detail to support the Mines Act permitting process. (1) 2001. British Columbia Drinking Water Protection Act, SBC. C. c. 9. (2) British Columbia Drinking Water Protection Regulation, B.C. Reg. 200/2003. (3) BC MOE. 2016. Approved Water Quality Guidelines. http://www2.gov.bc.ca/gov/topic.page?id=044DD64C7E24415D83D07430964113C9 (accessed April 2016). (4) Health Canada. 2015. Guidelines for Canadian Drinking Water Quality - Summary Table. Federal- Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/index-eng.php (accessed January 2015).	6-Jul-2016
NH-052.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Please refer to attached memo on water quality (see proponent sharepoint – round 2 comments NH)	Please see response to comment NH-010.1.	7-Oct-2016
NH-053	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	Why were groundwater wells within the regional study area not considered? Additionally, we note that the project area ultimately drains to the Peace River watershed; please indicate if downstream receptors could be impacted?	As described in Sections 9.4.4.6 (Groundwater Use Downstream of the Project Area) and 18.5.2.3 (Drinking Water Quality) of the Application, the only known use of groundwater for potable drinking water in the groundwater regional study area (RSA) are three water supply wells located in the KS area (Figure 9.4-2 in Chapter 9 of the Application). As described in Table 9.6-14 in Chapter 9 (Hydrogeology Effects Assessment) of the Application, effects on groundwater quality are limited to the Project Site and limited only to the subsidence zone and upper East Cirque Creek drainage in the LSA1; therefore, there would be no effects to downstream receptors, should they install a drinking water well. There will be no effects to groundwater that people may drink as it is not expected that groundwater from the subsidence zone would be consumed. As described in Table 9.6-16 in Chapter 9 (Hydrogeology Effects Assessment) of the Application, effects on groundwater quality are limited to the immediate area between the TSF and Kemess Creek in the LSA2; therefore, there would be no effects to downstream receptors, should they install a drinking water well. There will be no effects to groundwater that people may drink as it is expected that groundwater would be diluted in Kemess Creek and dilution would continue downstream. As described in Sections 9.6.2.1 and 9.6.2.2 of the Application, the residual effects on groundwater quality and ultimately groundwater surface water interactions are of High magnitude and are Irreversible; however, their geographic extent is very limited to one small watershed in LSA1 (East Cirque Creek) and to the immediate area between the TSF and Kemess Creek in LSA2, and are thus considered Discrete. Deep groundwater is predicted to have only a minor contribution to East Cirque Creek with the majority of groundwater flow to the catchment derived from shallow groundwater in the Gossan. East Cirque Creek is naturally affected by geochemical reactivity within the gossan which in turn has influenced background groundwater quality in the gossan. Since the changes to groundwater quality within the gossan are negligible, changes to surface water quality within East Cirque Creek are minor and therefore the groundwater quality residual effects are considered to be Not Significant in LSA1. Likewise, while concentrations are elevated above background concentrations in the immediate area between the TSF and Kemess Creek in LSA2, the seepage flux and resultant loading to Kemess Creek and ultimately Attichika Creek is minor; therefore the groundwater quality residual effects are considered to be Not Significant in LSA2. The groundwater inputs to one watershed at the Project site but inputs to the waterbody are minor, thus surface water quality changes in the watershed from groundwater inputs are not significant. As such, residual effects of groundwater inputs on receptors accessing watersheds (e.g., Peace River Watershed) downstream of the Project are expected to be negligible.	6-Jul-2016
NH-053.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Please refer to attached memo on water quality (see proponent sharepoint – round 2 comments NH)	Please see response to comment NH-010.1.	7-Oct-2016
NH-054	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	It is stated in the Application that "as can be seen in the figures, there is very little change in the risk to human health due to the Project indicating that a change in human health due to the Project is unlikely to occur" (Appendix 18-B S 6.1 Risk Characterization). However, bringing workers into an area with elevated health risks should be considered an impact (given that off-duty exposures are not protected by OHS regulations). The project will bring a new, large "captive" population into the area (workers) and it is worthwhile to investigating whether these workers will be subject to elevated risk from baseline and project effects. As per guidelines, "an HQ of 0.2 was used (instead of 1.0) because the assessment does not consider intake of contaminants from all potential exposure routes (i.e., from consumption of retail foods)" (Appendix 18-B S. 6.1). In Appendix 18-B it is stated "this suggests that there could be risk to human health due to these non-carcinogenic metals, since additional intake of these metals could occur through ingestion of retail foods (but not other pathways, since the other pathways constitute 100% of the exposure through that pathway)" (S. 8.0 Conclusion). We disagree with the assertion that these pathways can be assumed to constitute 100% of exposure through that pathway. On-duty exposures (e.g. during underground mining), and exposure while not at the site were not considered (e.g. workers and all other receptors are considered temporary receptors, and will exist in other environments where they may be exposed through multiple media). Thus it is advisable that the HQ of 0.2 is a meaningful threshold for health effects. We expect that the Proponent takes into consideration how on-duty exposures may impact susceptibility to off-duty exposures. Accordingly, given that the guideline hazard quotient of 0.2 is exceeded for non-carcinogenic effects for a number of metals, and that there is an elevated cancer risk due to arsenic ingestion, we advise that additional mitigation strategies are implemented. Specific comments regarding this include the following: - The Air Quality Management Plan should include metal concentrations bound to PM10 in addition to the other contaminants stipulated for consideration. - We recommend that air quality mitigation measures including HEPA filtration of all indoor environments. We also recommend a continuous PM monitoring station at the camp site, with filters regularly tested for arsenic, chromium, mercury and methylmercury content (and any other potentially elevated metals that may elicit health effects). Household dust monitoring for content of these metals may also be needed. In addition to these measures, other monitoring and mitigation may be necessary. Further, please specify how the BC MEM code protects on-duty workers from arsenic exposure. Given the high arsenic levels in the region, if this protection does not exist in the code please specify how workers will be protected from arsenic exposures while working.	The purpose of an environmental assessment is to evaluate the change in risk from baseline due to project activities; the intent is not to evaluate how the risk from baseline conditions may affect workers brought into the area. The human health effects assessment (Chapter 18 of the Application) evaluated the baseline risk and Project-related risk to off-duty workers. Note that there was (during Kemess South Mine operations) and is (as part of ongoing closure activities for Kemess South Mine) workers present onsite, residing at the accommodation complex, which would be considered during the baseline HHRA. Also note that workers (including off-duty workers) are prohibited from hunting and fishing while onsite due to Project policies (Section 18.5.3.1 of the Application); however, the exposure assessment in the baseline and Project HHRA assumed that off-duty workers residing onsite would ingest country foods (i.e., ingestion of meat, fish, and berries were included in the exposure assessment). This is not the case and would not occur. This assumption was made to provide a very conservative estimate of risk to off-duty workers while residing onsite and to enable a comparison of the (negligible) incremental change in the hazard quotients for country foods between baseline, construction phase, and operations phase. Figure 18.5-2 of the Application shows that the risk to human health is essentially the same (i.e., not measurably different) for each of the exposure pathways considered in each of baseline, construction phase, and operations phase. The incremental change in risk to human health due to the Project is negligible, and no change in human health would be expected due to the Project. As per standard practice, the occupational health and safety of on-duty workers is not evaluated in Environmental Assessments in BC (Health Canada 2010)1 and assessment of risks to on-duty workers was specifically excluded from the scope of the assessment described in the AIR (Section 6.10.5.1 of the AIR). All working group members, including Northern Health, had the opportunity to comment on the AIR prior to it being finalized by the BC EAO. Health and safety of on-duty workers is addressed by various legislation codes in BC such as the Occupational Health and Safety Regulation (B.C. Reg. 296/97)2 and associated policies and guidelines administered by WorkSafeBC, and the Health, Safety, and Reclamation Code (BC MEMPR 2008)3 administered by the Ministry of Energy and Mines. Therefore, consideration of how on-duty exposure may impact the susceptibility to off-duty exposures is considered to be outside the scope of the Application. The Air Quality Management Plan will be developed in further detail to support the Mines Act and Environmental Management Act permitting process. Furthermore, the risk from ingestion of arsenic is due to baseline conditions and the mitigation of natural background conditions of a site is not required in the environmental assessment process. The proponent is not responsible for mitigating naturally-occurring conditions in a highly mineralized environment. Industry standard mitigation measures have been proposed for air quality (including fugitive dust emissions; Sections 7.1.7, 18.5.3.1, and 24.3 of the Application) and additional mitigation measures have been proposed for surface water quality (Sections 11.5.3.1 and 18.5.3.1 of the Application) to ensure that residual effects to water quality (and potential for effects to country foods) is minimized. Based on the baseline and Project-related HHRA and the conclusions presented in the Application, the incremental change in risk to human health due to the Project is negligible and no residual effects to human health are predicted. Therefore, no additional mitigation measures are warranted beyond those described in the Application. (1) Health Canada. 2010. Useful Information for Environmental Assessments. 978-1-001-15153-3. Health Canada, Environmental Assessment Division: Ottawa, ON. (2) Occupational Health and Safety Regulation, B.C. Reg. 296/97. (3) BC MEMPR. 2008. Health, Safety and Reclamation Code for Mines in British Columbia. British Columbia Ministry of Energy, Mines, and Petroleum Resources (BC MEMPR); Mining and Minerals Division: Victoria, BC.	6-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
NH-054.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	NH disagrees. The purpose of an environmental assessment is indeed to evaluate the change in risk from baseline due to project activities. Bringing a captive population (staying in camp during off-duty time) into an area is a project activity, and if there are elevated risks in this area, this is indeed a change in risk from baseline due to project activities. The fact that workers were present at the site during previous mining operations and that workers are at site for KS closure activities is not relevant. The fact that workers from previous projects may have previously/may currently be at risk of health effects does not negate the potential health effects of the Project. Bringing a captive worker population to live into an area with health risk is a "change in risk from baseline due to project activities". The Proponent is responsible for managing health effects of their project. This includes protecting the health of off-duty workers. Given the uncertainties in the HHRA for metals in dust, we recommend that the Proponent implements HEPA filtration in all indoor environments.	It is not possible to quantify the baseline exposure for each worker brought in to work at the Project site, especially considering that there will be hundreds of workers with hundreds of different baseline exposures. Therefore, to simplify the human health effects assessment, a baseline HHRA of the Project area was conducted, which is directly comparable to the Project-related HHRA. It is acknowledged that there is uncertainty in this assumption and that the baseline risk determined for off-duty workers may not represent their real-world baseline risk. However, the risk calculated for off-duty workers included the consumption of country foods as an exposure pathway but off-duty workers will be prohibited from hunting, fishing, and gathering due to Project policies. The assessment also assumed that off-duty workers would be present on-site year round, which is an over-estimate as workers will have a 2 week on-site and 2 week off-site work schedule. Therefore, the calculated risks to off-duty workers were overestimated in the Application as conservative measure. The human health risks identified in the Application are associated with baseline conditions, not Project-related emissions. Mitigation measures for baseline conditions are not required in an environmental assessment. All criteria air contaminants (CACs) emitted by the Project (i.e., not due to background conditions) were below applicable guidelines/objectives; therefore, additional mitigation for CACs are not deemed necessary.	7-Oct-2016
NH-055	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	Other limitations of the assessment methodology that support the implementation of additional mitigation measures include: - What about additive exposure to contaminants that target the same target organs (e.g. multiple contaminants with renal toxicity causing additive effect on kidney function)? We appreciate that this was done for carcinogens; what about other contaminants?	Additive exposure to contaminants (other than carcinogens) that target the same organs was not conducted. This is because the calculated hazard quotients (HQs), described in Section 18.5.2.5 of the Application, found that the incremental change in HQs from baseline due to the Project was negligible (Figures 18.5-2 and 18.5-3 of the Application). It is the incremental change from baseline that is of interest in an environmental assessment and even if an additive exposure approach was applied to COPCs acting on the same target organ, in the baseline risk assessment and the project risk assessment the relative incremental change in HQs between the risk assessments would be the same. The conclusions of the effects assessment regarding potential for residual effects from Project related changes would remain valid. Based on the baseline and Project-related HHRA and the conclusions presented in the Application, the incremental change in risk to human health due to the Project is negligible and no residual effects to human health are predicted. Calculating hazard quotients using the additive exposure approach to contaminants is not considered to be warranted.	6-Jul-2016
NH-055.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	See our responses to comments above.	See response to comment NH-054.1	7-Oct-2016
NH-056	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	It is noted that several jurisdictions classify PM2.5 as a potential carcinogen. Please recognize that the International Agency for Research on Cancer has classed air pollution and particulate air pollution as a Class 1 carcinogen (carcinogenic to humans). The recent meta analysis http://ehp.niehs.nih.gov/1408092/ provides an estimate on the magnitude of effect for outdoor PM2.5 and we are aware that the California Office of Environmental Health Hazard Assessments (OEHHA) has developed an inhalation unit risk and slope factor for diesel exhaust particulate matter http://oehha.ca.gov/chemicals/diesel-exhaust-particulate. We are aware that other jurisdictions are using these values in the absence of national values and we are aware that there is precedence of using these values in BC as they were used in the 2015 Lower Fraser Valley Air Toxics Risk Assessment and Emission Inventory which was presented as evidence in the Trans Mountain Pipeline Expansion NEB process https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90552/548311/956726/2392873/2449925/2451574/2785067/C234-7-23_-_Exhibit_18%2C_Sonoma_Technology_2015_Toxic_Air_Pollutants_Risk_Assessment_-_A4L8A4.pdf?nodeid=2784974&vernum=-2. We feel that it is reasonable to estimate cancer risk from PM exposure based on these OEHHA values or other methods given PM's classification as an IARC group 1 carcinogen. Old dust fall criteria – protection of health and environment – not accurate. Was designed for nuisance absence. Also used pollution control objectives in water quality as well. – not accurate statement – discharge is not acutely toxic, compare to water quality guidelines	Please see the response to the Health Canada comment #HC-004 provided in the memo **20160706 A.1 KUG Comment HC-001, HC-004, HC-005, HC-006_Human Health _Memo** which provides the rationale for excluding direct quantitative assessment of exhaust and particulate matter as carcinogens. Dustfall particles larger than 10 µm in diameter are primarily deposited in the respiratory tract above the larynx and do not reach the lungs (WHO 2000)[1]. The evaluation of particulate air pollution for human health has shifted focus to the finer fractions of suspended particles ($PM_{2.5}$ and PM_{10}), as the smaller fractions are responsible for the observed adverse health effects (Health Canada 1999; WHO 2000)[1, 2]. Health Canada (1999)[2], the World Health Organization (WHO 2000)[1], and the United States Environmental Protection Agency (US EPA 2012)[3] no longer consider dustfall or total suspended particles (TSP) in the evaluation of health effects from particulates in air, and instead focus on $PM_{2.5}$ and PM_{10} as those particles can reach the thoracic area of the lungs (WHO 2000)[1]. Thus, even though TSP and dustfall concentrations were predicted by the air quality model, the human health effects assessment only considered predicted concentrations of PM_{10} and $PM_{2.5}$. BC Pollution Control Objectives (BC MOE 1979)[4] were used as benchmarks for evaluating predicted effluent quality. The proponent understands that these objectives have been rescinded; however, in the absence of other relevant objectives (e.g., MMER) they represent a useful tool for assessing the likelihood of achieving permittable effluent limits. BC Pollution Control Objectives have recently been used in other approved BC Applications, including KSM and Brucejack projects, for benchmarking effluent quality. The proponent understands that discharge limits that consider site-specific conditions including available low flow dilution will be established during permitting. (1) WHO. 2000. Air Quality Guidelines for Europe, 2nd Edition. WHO Regional Publications, European Series, No. 91. World Health Organization Regional Office for Europe: Copenhagen, DK. (2) Health Canada. 1999. National Ambient Air Quality Objectives for Particulate Matter - Addendum to the Science Assessment Document. Particulate Matter ≤ 10 µm and ≤ 2.5 µm. A report by the Federal-Provincial Working Group on Air Quality Objectives and Guidelines: Ottawa, ON. (3) US EPA. 2012. AIRTrends 1995 Summary: Particulate Matter (PM-10). United States Environmental Protection Agency. http://www.epa.gov/airtrends/aqtrnd95/pm10.html (accessed August 2014). (4) BC MOE. 1979. Pollution Control Objectives for the Mining, Smelting, and Related Industries of British Columbia. British Columbia Ministry of Environment, Pollution Control Board. Victoria, BC.	6-Jul-2016
NH-056.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Please see above comments. We note that Health Canada had similar concerns, and due to capacity limitations, we defer to Health Canada's expertise.	See response to comment NH-054.1	7-Oct-2016
NH-057	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	We very much appreciate the additional information that was provided in the updated Application on potential impacts to human health in the event of an accident/malfunction. It is stated in the updated Application that the "potential for health effects to the general public or First Nations land users is considered in the 'environment' category" (S. 22.5.4). While we appreciate that effects due to environmental effects were considered, we ask that the potential for public land users to be injured in the event of an explosion, fire and/or flood is also considered (for example, where are temporary receptor locations in relation to areas where explosives are stored?). If a fatality or reversible health effect is a potential consequence, we note that effects should be considered "high" or "severe" in magnitude (according to the definitions indicated in Table 22.5-3).	Interaction between fires/explosions and health effects to the general public are not expected due to the controlled access to the site. Fuel storage tanks and explosive magazines will be located more than 1000 m from the access control point to the mine site area and expected to be beyond any potential blast radius from an explosion. Thus the risk of health effects from fires/explosions to the general public is expected to be very low, as the potential receptor exposure is very low.	6-Jul-2016
NH-057.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	What about the injury risk to off-duty workers at the accommodation camp? Further detail on potential blast radius should be provided or further assessment completed on the potential for injury. What about a dam failure? Could this cause injury to receptors in the vicinity? We ask that when additional information is provided on the hazardous materials to be kept on site, the relevant Emergency Response Plans are also updated. Response procedures should be updated to ensure they consider the toxicity and persistence of these substances. We ask that this is included as a Condition of the certificate.	There is the potential that off-duty workers could be at risk of injury at the camp bunkhouses in the event of an accident or malfunction. However, the camp facilities are located outside of the blasting radius of areas associated with planned blasting. Likewise, the accommodation camp is not expected to be affected by a KUG TSF dam failure; it is located outside of the range of modelled breach extents. Measures implemented in the event of an accident or malfunction would be consistent with the conceptual Environmental Emergency, Spill, and Hazardous Materials Plan to be developed in more detail to support a Mines Act permit application. When additional information is provided on the hazardous materials to be kept on site, the Environmental Emergency, Spill, and Hazardous Materials Plan developed for the Mine Act permit will also be updated. Response procedures will be updated to ensure they consider the toxicity and persistence of these substances.	7-Oct-2016
NH-058	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	Additionally, we ask that it is recognized that in the event of an accident/malfunction, environmental effects to air quality and soil quality can also impact human health.	Acknowledged; it is recognized that in the event of an accident or malfunction, environmental effects due to changes in air quality and soil quality beyond applicable objectives or guidelines could potentially affect human health.	6-Jul-2016
NH-059	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	Further, the stated definition of "moderate" health effects is "lost time injury/illness or severe, reversible health effect(s) resulting from acute, short-term exposure or progressive chronic condition, infectious disease". We expect additional justification that potential residual health effects due to an accident/malfunction would be "reversible short term" and fit the "moderate" in magnitude definition (Residual Effects as stipulated in Table 22.7-4). We recognize that it is stated in the Application that water advisories, dilution of contaminants and clean-up/mitigation measures would prevent long-term health effects. However, we expect additional justification that contaminants would not persist in the environment and/or cause irreversible health effects at predicted exposure dosages. It should be acknowledged that there may be risks associated with even trace amounts of some contaminants. Also, it should be noted that some contaminants may cause chronic health effects, and that in the event that contaminants cannot be completely remediated and are persistent, long-term health impacts could occur. Please also identify any potential barriers that may prevent an effective spill response/remediation. Further, we ask that the potential psychosocial impacts of such an event are considered. It is our understanding that environmental disasters of this nature could profoundly impact community health and mental health due to impacts to community cohesion, fear of contamination, stress, loss of jobs, financial uncertainty, country food accessibility, etc. Would alternative drinking water sources be provided to individuals affected by the drinking water advisories? In these remote locations, we note that this could be a considerable impact.	Please see the response to the Health Canada comment #NH-059 in the memo **20160706 KUG Comment NH-059 Accidents and Malfunctions_HH_Memo**	6-Jul-2016

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NH-059.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Historically, accidents and malfunctions may have been considered separately and rarely been assessed in a quantitative manner. However, given the recent events at Mount Polley, we advise that this is an important consideration. Given that in the event of a tailings dam breach the assessment predicts "significant" residual effects to surface water, soil, harvestable plants, fish, wildlife, etc., we feel this is of particular concern. Thank you for the additional information provided in the memo on Accidents and Malfunctions. We appreciate the commitment to effective communication in the event of an accident, and ask that a communication strategy is incorporated into the Emergency Response Plan. We continue to ask that the following mitigations are committed to in the event of a slope/dam failure or other accidental discharge of material, and that they are included as Conditions of the certificate: • In order to ensure that water users are notified in a timely manner of possible contamination, it would be advisable that an effective communication strategy is established so that potential water users may be forewarned of any impending contamination issues. This should include an inventory of all water users that may be impacted. • A requirement that a detailed post remediation HHRA be part of the Proponent's accident response and recovery plan. Also a commitment to obtain local health authority agreement and approval on methodology, exposure pathways and contaminants of concern prior to the HHRA being conducted	AuRico will incorporate an effective communication strategy and requirement for a post remediation HHRA for severe accidents as part of a more detailed Emergency Response Plan developed to support an application for a Mines Act permit.	7-Oct-2016
NH-060	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	Further, we ask that the following information is provided to adequately assess the potential for public health to be impacted in the event of an Accident/Malfunction: - Receptor locations: Human receptors that may be impacted are identified (including information on ground and surface water usage, and consideration of downstream watersheds that may be impacted). This should also include any receptor locations that may be impacted by an explosion, fire or flood. -Toxicity/persistence: The application should identify all hazardous materials and their constituents that may be emitted to air, soil and water during a spill, fire, explosion or tailings dam breach. We ask that the application includes information on the toxicity and persistence of contaminants that may be released (e.g. VOCs, PAHs, cyanides)	Receptor locations: There are no known full-time residents of the human health local study area (LSA) and it is not expected that an onsite accident or malfunction would extend beyond the LSA. While there may be temporary land users in the LSA, their locations are highly variable and intermittent and thus are not defined. It is noted that access to the mine site area will be fully controlled to authorized users, generally public access will be prohibited. Toxicity/persistence: Section 24.6.4.1 (Types of Hazardous Materials) of the Application identifies the hazardous materials anticipated to be present on the Project site that could potentially be involved in an accident or malfunction. A table detailing the specific hazardous materials on site per Project phase will be developed during permitting to supplement Table 24.6-1 of the Application, which is the anticipated list of typical hazardous materials. An inventory of hazardous materials will list all designated chemicals on site, and will include MSDS and WHMIS information on the products to ensure that Project personnel have all the necessary information for their safe handling, transportation, storage, use, and disposal. Thus information on the toxicity and persistence of contaminants that may be released during an accident or malfunction will be made available during the permitting stage.	6-Jul-2016
NH-060.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Please see response to NH-059. We ask that when additional information is provided on the hazardous materials to be kept on site, the relevant Emergency Response Plans are also updated. Response procedures should be updated to ensure they consider the toxicity and persistence of these substances. We ask that this is included as a Condition of the certificate.	Please see the response to comments NH-057.1 and NH-059.1.	7-Oct-2016
NH-061	15-Jun-2016	Melissa Aalhus, Northern Health	Human Health	Given that in the event of a tailings dam breach the assessment predicts potentially "significant" residual effects to human health, we feel this is of particular concern. Experience from Mount Polley suggests that the effects of accidents and malfunctions can be far-reaching. Further, given that the project area drains into the Peace River watershed, in the event of an accident, downstream impacts to human health could be much more catastrophic than was experienced with Mount Polley. Accordingly, we feel that further assessment is required, and we maintain that completing an HHRA on accidents/malfunctions is an important consideration. This ensures that public health actions that may be necessary are identified, and that any changes deemed to be necessary to prevent and respond appropriately to these impacts are made at the pre-approval stage. We advise that the following commitments are included as mitigations in the event of a slope or dam failure or other accidental discharge of material: • In order to ensure that water users are notified in a timely manner of possible contamination, it would be advisable that an effective communication strategy is established so that potential water users may be forewarned of any impending contamination issues. This should include an inventory of all water users that may be impacted. • A requirement that a detailed post remediation HHRA be part of the Proponent's accident response and recovery plan. Also a commitment to obtain local health authority agreement and approval on methodology, exposure pathways and contaminants of concern prior to the HHRA being conducted. • More substantial consideration and commitment to spill-related long term health impacts if they arise. • A requirement for the Proponent to clarify their financial commitment to post-spill recovery and compensation costs, and demonstrate their ability to cover these costs.	Environmental assessments for human health consider the potential for effects due to normal or typical operating conditions for proposed projects. Accidents and malfunctions are considered separately and are rarely assessed in a quantitative manner due to the high level of uncertainty and number of assumptions that would be required to support meaningful quantitative assessment. Assessment of accidents and malfunctions for the Project was provided in Chapter 22 of the Application and potential effects to human health due to a dam breach were considered qualitatively in Section 22.7.7.1 of the Application. As described in in Section 22.7.7.1 of the Application, communication with First Nations, the public, and other stakeholders regarding monitoring and environmental effects would be ongoing following a dam breach. As part of the emergency response, it is expected that drinking water advisories would be in place to ensure that people do not consume water that is affected dam breach until it is shown to be safe for human consumption. Emergency response plan will be further developed to support the Mines Act permitting process. A human health and ecological risk assessment is expected to be required by regulators as part of the long-term follow-up in the unlikely event of a dam breach. Financial commitments are covered by the Ministry of Energy and Mines in the form of bonding.	6-Jul-2016
NH-061.1	18-Aug-2016	Melissa Aalhus, Northern Health	Human Health	Please see response to NH-059. We continue to ask that the following mitigations are committed to in the event of a slope/dam failure or other accidental discharge of material, and that they are included as Conditions of the certificate: • In order to ensure that water users are notified in a timely manner of possible contamination, it would be advisable that an effective communication strategy is established so that potential water users may be forewarned of any impending contamination issues. This should include an inventory of all water users that may be impacted. • A requirement that a detailed post remediation HHRA be part of the Proponent's accident response and recovery plan. Also a commitment to obtain local health authority agreement and approval on methodology, exposure pathways and contaminants of concern prior to the HHRA being conducted	Please see the response to cpomment NH-059.1.	7-Oct-2016
HC-001	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	There is no assessment of noise impacts on temporary or seasonally used human receptor locations. Appendix 20-A Tse Keh Nay TK LU Study shows numerous sites that appear to be within the noise modelling domain (for example, Figures 8 and 9; Appendix 4a and 4b). A quantitative assessment of noise impacts should be undertaken at these sites, including the calculation of a change in percent highly annoyed (%HA), or if deemed unnecessary, justification to explain why a quantitative noise assessment is not required. The proponent may wish to collaborate with TKN to establish which, if any, mapped traditional use sites are currently used seasonally or temporarily. Alternatively, a noise assessment could be conducted using the maximum predicted levels at the nearest receptor location, as a worst case scenario. Rationale: A quantitative analysis of noise is necessary to understand the potential impacts on nearby Indigenous peoples.	The response to Health Canada comment #HC-001 will be provided in the Memo **20160706 KUG Comment HC-001, HC-004, HC-005, HC-006_Human Health _Memo.**	6-Jul-2016
HC-002	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	It appears that the noise model was conducted assuming only calm wind conditions, which could result in an underestimate of noise levels in prevailing downwind locations. Justification for assuming calm conditions only is required, given nearby meteorological stations show clear predominating wind directions with calm conditions typically occurring less than 7 percent of the time (App 7-B, Figures 4.3-1a, b and c; Figure 4.3-2).	Adverse meteorological conditions have the potential to increase noise levels, for example wind speeds up to 3 m/s blowing from the source to receptor or temperature inversions. At wind speeds above 3 m/s, winds tend to increase ambient noise emissions to the extent that a sites contribution is masked. Above 5 m/s noise levels can be difficult to quantify (e.g. via measurement) as the effects of wind on the microphone are significant, even with a wind screen fitted. An increase in noise due to adverse meteorological conditions is more significant for receptors situated at distance (e.g. 500 to 1000m+) from a noise source. The increase in noise due to a worst-case noise enhancing scenario (e.g. 3 m/s source to receiver wind and Class G inversions) is expected to be between 3 and 8 dB(A). In this case only calm conditions have been modelled due to the close proximity (<150 m) of the closest and/or potentially most affected human and wildlife receptors (R14 – Camp Bunkhouses and WR1 – Osprey Nest) to dominant noise emissions sources. Noise levels associated with the site are expected to comply at other locations despite the potential effects of adverse meteorological conditions. This is primarily due to the reduction in noise over distance where it is expected that levels will be approximately 10 to 15 dB(A) lower at distances of 500 and 1000 m (from a point source) when compared to receptors at 150 m. The majority of human receptors considered in the Kemess Underground Project Environmental Noise and Blast Study Report are outside of the study area, at distances where noise impacts are not expected. Emissions were however predicted; at receptors R15 to R45 (described in Table 3.1 of Appendix 7-D) where noise levels are predicted to be at or below 0 dB. In these areas, any increase in noise due to adverse meteorological conditions would result in non significant and compliant levels.	6-Jul-2016
HC-003	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	Air quality impacts have been assessed only at the camp bunkhouse location. Air quality modelling plots (App. 7-D) show predicted concentrations may be higher at other locations in the modelling domain, and Appendix 20-A Tse Key Nay TK LU Study shows numerous use sites that appear to be within the air quality modelling domain (for example, Figures 8 and 9; Appendix 4a and 4b). A quantitative assessment of air quality impacts should be undertaken at these sites, or if deemed unnecessary, justification to explain why such an assessment is not required. The proponent may wish to collaborate with TKN to establish which, if any, mapped traditional use sites are currently used seasonally or temporarily. Alternatively, an air quality assessment could be conducted for the maximum predicted concentration at the nearest receptor location, as a worst case scenario. Rationale: A quantitative air quality analysis is necessary to understand the potential impact of air contaminants on Indigenous peoples.	As described in Section 7.1.6 of the Application, all maximum predicted concentrations of SO_2, NO_2, CO, TSP, PM_{10}, $PM_{2.5}$, and dustfall deposition were below the air quality objectives at all locations modelled during both the Construction and Operations phases of the Project. Therefore, there are no anticipated impacts from changes in air quality on temporary or seasonally used human receptor locations.	6-Jul-2016
HC-004	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	The health risk associated with inhalation of diesel particulate matter was not provided, based on the absence of an inhalation slope factor from Health Canada or the US EPA. An inhalation slope factor is available from the California Office of Health Hazard Assessment, California Environmental Protection Agency. This source for acceptable unit risks and slope factors is noted in Part I: Guidance in Human Health Preliminary Quantitative Risk Assessment (PQRA) Version 2.0, pg. 22. (http://www.oehha.ca.gov/air/hot_spots/2009/AppendixA.pdf) An assessment of ICLR for diesel particulate should be included. Rationale: Incremental lifetime cancer risk due to air emissions will be underestimated if diesel PM is not included.	The response to Health Canada comment #HC-004 will be provided in the Memo **20160706 KUG Comment HC-001, HC-004, HC-005, HC-006_Human Health _Memo.**	6-Jul-2016

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HC-004.1	29-Jul-2016	Eleanor Setton, Health Canada	Human Health	The proponent's response is not sufficient to justify the omission. The Health Canada Human Health Risk Assessment for Diesel Exhaust does not suggest it would be inappropriate to use the California EPA slope factor for cancer risk. HC is waiting for the outcome of a Health Effects Institute expert panel before making a decision on deriving a cancer risk slope factor for DPM, but this does not preclude the use of the CalEPA slope factor for analysis. The cancer risk analysis should still be done, and qualifications if needed can be added about the database and slope factor derivation. Health Canada has determined that diesel exhaust is carcinogenic in humans, which is consistent with the conclusion of the International Agency for Research on Cancer, and that diesel exhaust is associated with significant population health impacts in Canada. Within the recent HHRA for diesel exhaust (2016), Health Canada did not publish a diesel exhaust slope factor, and did not assess the scientific literature for use in quantitative exposure-response analysis of lung cancer risk. The rationale for this, as stated in the Health Canada document, is that Health Canada would consider the conclusions of the very recently published report of the Health Effects Institute expert panel on the potential utility of the existing epidemiological studies for estimation of cancer risk associated with diesel exhaust exposure, to inform any potential future activities in this area. As cited by the proponent, Health Canada stated that observations made in rat bioassays are not considered directly relevant to that process, due to a number of factors. The last three bullets/quotes provided by the proponent are not directly related to the decision to not include a slope factor analysis in the Health Canada HHRA, but rather were listed in the discussion of overall limitations in the database. Respirable elemental carbon represents one of the best exposure metrics for diesel exhaust used in epidemiology studies to date. As stated, it is difficult to measure general population exposure to REC or to fine particulate matter exposure (PM2.5) from diesel exhaust, because it is very difficult to distinguish between the various sources of these metrics in ambient air. However, it is possible to model exposure to REC and PM2.5 from diesel sources for a specific scenario that includes characterization of those diesel sources. This would be useful in estimating population exposure due to an emission source or a change in emissions. The California EPA slope factor for cancer risk associated with exposure to diesel exhaust was derived from epidemiological data of exposed workers. As stated above, the Health Canada HHRA for diesel exhaust does not include a critique of the use of those specific data for the purposes of deriving a slope factor.	The response is provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
HC-004.2	31-Oct-2016	Eleanor Setton, Health Canada	Human Health	Health Canada appreciates the proponent has quantified incremental lifetime cancer risk resulting from diesel exhaust exposure due to the project. It is not clear how annual averaged PM2.5 was proportioned, and this should be explained. Table 2.2-2 should include the total PM2.5 concentration at the receptor for both phases in order to demonstrate the portion attributed to diesel exhaust.	Table 2.2-1 of the Memo "20160927_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo" shows the predicted total annual PM2.5 concentration, which includes the background concentration of 1.3 µg/m3, at the camp bunkhouse location during the Operation Phase of 1.57 µg/m3 (0.037 µg/m3 without background). The total annual PM2.5 concentration at the camp bunkhouse location during the Construction Phase was 1.59 µg/m3 (0.041 µg/m3 without background). The contribution from diesel exhaust to PM2.5 at the camp bunkhouse location during the Operation phase was 0.016 µg/m3, which means diesel exhaust contributed to 44% of the Project-related PM2.5 at this location. The contribution from diesel exhaust to PM2.5 at the camp bunkhouse location during the Construction phase was 0.012 µg/m3, which means diesel exhaust contributed to 30% of the Project-related PM2.5 at this location.	10-Nov-2016
HC-005	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	In Table 18.5-2 , the estimated risk for toddlers is lower during the Operations (including baseline) phase compared to the estimated Baseline risk, for aluminum, chromium, lead, manganese, thallium, vanadium and zinc. If correct, an explanation of how/why this occurs should be provided.	The response to Health Canada comment #HC-005 will be provided in the Memo **20160706 KUG Comment HC-001, HC-004, HC-005, HC-006_Human Health _Memo.**	6-Jul-2016
HC-006	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	Representative species from large mammals (moose), small mammals (snowshoe hare), birds (ruffed grouse), fish (bull trout, dolly varden, mountain whitefish and rainbow trout) and vegetation (crow berries and soap berries) are used as indicators for other species within each group, assuming that if "foods that represent the highest rate of exposure are determined to be safe for consumption, then all other foods within the group would also be considered safe for consumption." The exposure assessment is based on consumption of only these country foods, and therefore does not account for the potentially cumulative nature of dietary intake. For example, Table 28b of the British Columbia First Nations Food, Nutrition and the Environment Study (BC FNFNES) reports a 95th percentile consumption of 105 g/person/day for moose meat, as used in the HHRA, but also reports 26.64 for deer meat, 8.78 for elk meat, 1.67 for caribou meat, and 0.56 for sheep meat, totalling 142.65 g/day/person for large herbivorous mammals. If moose is meant to represent large mammals, logically the total consumption of all large mammals should be the basis for assessment, not just the consumption of moose. Rationale: The "worst case" estimate of risk due to ingestion of country foods by Indigenous peoples may be underestimated.	The response to Health Canada comment #HC-006 will be provided in the Memo **20160706 KUG Comment HC-001, HC-004, HC-005, HC-006_Human Health _Memo.**	6-Jul-2016
HC-006.1	29-Jul-2016	Eleanor Setton, Health Canada	Human Health	The proponent's response addesses this issue by including additional foods in the analysis, although moose liver and kidney are not included. See comment HC-007.1	Please see response to HC-007.1 in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
HC-006.2	31-Oct-2016	Eleanor Setton, Health Canada	Human Health	See response HC 007.2b	See response to HC 007.2b	10-Nov-2016
HC-007	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	Only moose muscle tissue is included in the HHRA (baseline and project), although it is acknowledged on pg 4-23 that the BC FNFNES Study reports 29% of Ecozone 4 participants (from the communities of Tsay Keh Dene and Tl'azt'en First Nations) reported consuming moose kidney and 19% reported eating moose liver. Note also that Table 30b of the BC FNFNES reports approximately 94% of cadmium intake is due to moose liver and kidney for residents of Ecozone 4. Given that cadmium is a COPC, the HHRA should include moose kidney and liver. Rationale: the estimate of risk due to ingestion of country foods by Indigenous peoples may be underestimated by not including organ meat consumption in the exposure assessment.	Please see the response to Health Canada comment #HC-006 provided in the Memo **20160706 KUG Comment HC-001, HC-004, HC-005, HC-006_Human Health _Memo.** Total consumption of meat (e.g., muscle, kidney, liver) was added to the consumption rate for toddlers and adults in the memo response. However, please note that tissue modelling recommended by Health Canada (2010)[1] does not incorporate tissue specific calculations: "It is also important to note that many uptake models typically provide an estimate of whole-animal residue levels and not the tissue-specific residue levels for muscle or organ meat. The whole body residue may over-estimate or under-estimate the actual contaminant residue levels in the specific tissue of interest." Modelling of whole body residues is the approach recommended in the Health Canada (2010)[1] guidance, due to the uncertainty introduced with modelling tissue specific contaminant residues. (1) Health Canada. 2010. Federal Contaminated Site Risk Assessment in Canada, Supplemental Guidance on Human Health Risk Assessment for Country Foods (HHRAFoods). Contaminated Sites Division, Safe Environments Directorate: Ottawa, ON.	6-Jul-2016
HC-007.1	29-Jul-2016	Eleanor Setton, Health Canada	Human Health	Health Canada recognizes the uncertainties inherent in undertaking tissue-specific food chain modelling; however, the predicted levels of cadmium in moose tissue may be far too low. The EIS makes use of consumption levels from the British Columbia First Nations Food, Nutrition, and the Environment Study (BC FNFNES)(http://www.fnfnes.ca/download). The BC FNFNES also includes measured levels of contaminants in commonly consumed country foods which provides an opportunity to compare the proponent's predicted tissue levels to measured field data. For example, Table 29 in the BC FNFNES reports average cadmium in moose meat as 0.02 ug/g (fresh), moose liver as 3.51 ug/g (fresh) and moose kidney as 11.85 ug/g (fresh). The EIS modelled level for moose meat is 0.000865 mg/kg (wet) [note ug/g is equivalent to mg/kg], approximately 23 times lower than the average measured level reported in the BC FNFNES. Using only the current modelled cadmium level in tissue for the HHRA may grossly underestimate the associated health risk, particularly in light of substantially higher measured levels in moose liver and kidney, as reported in the BC FNFNES. Where the HHRA uses median measured levels of cadmium for rainbow trout and soap berries, these are very similar to the average measured levels reported in the BC FNFNES: the HHRA uses 0.0025 mg/kg (wet) for rainbow trout and the BC FNFNES reports 0.002 ug/g (fresh); the HHRA uses .001 mg/kg (wet) for soap/crow berries and the BC FNFNES reports 0.004 ug/g (fresh) for soap berries. NOTE: The modelled levels of cadmium for grouse and hare (reported for rabbit in the BC FNFNES) are also much lower in comparison to reported average measured levels (~ 145 times lower and ~98,000 times lower respectively). Modelled levels are also much lower than measured average levels for lead in moose meat, hare and grouse, and for arsenic in hare. Health Canada recognizes there may be limits to the BC FNFNES study and would prefer the HHRA use data gathered through sampling commonly consumed country foods within the study area, but suggests the proponent may wish to incorporate the measured data reported in the BC FNFNES to revise the HHRA, particularly by including moose liver and kidney.	The response is provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
HC-007.2a	31-Oct-2016	Eleanor Setton, Health Canada	Human Health	The proponent has restated that the incremental changes in COPC concentrations during the construction and operational phases of the project will be negligible and thus any potential health risks from traditional food consumption are due to existing conditions. Health Canada cannot determine the suitability of models employed to predict incremental changes in COPC concentrations in traditional foods and therefore cannot comment on the accuracy of their conclusions stating that the incremental changes are negligible. As such, Health Canada recommends that the proponent monitor the levels of COPCs in environmental media (air, soil, water, sediment) to confirm their modelled prediction of a negligible impact to the levels of COPCs. If monitoring results indicate an increase in COPCs in environmental media, traditional foods should subsequently be monitored for COPC concentrations as well. Monitoring and follow-up programs should be developed in consultation with identified indigenous groups and local health authorities, taking into account the health concerns expressed by these groups, and be undertaken at intervals that would allow for timely responses to protect human health in the event any risks are identified.	The food chain model used in the HHRA was developed by Golder Associates Ltd. (2005) for Health Canada under the Federal Contaminated Sites Accelerated Action Plan and is consistent with Health Canada guidance provided in *Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment* (Health Canada 2010) identified in the Kemess Underground Project Application Information Requirements. As such, AuRico maintains that application of the model is suitable for the project assessment. The HHRA that was completed identified that predicted changes to human health risk are low. Additionally, there will be no hunting and no fishing policies in place for project personnel and AuRico are in discussions with the TKN as part of a potential Impact Benefits Agreement regarding an area of restricted access related to traditional use including collection of country foods. Thus, in addition to low predicted changes to the human health risk in the area, there is expected to be low country food use in the mine site area. Thus, a specific country foods monitoring program does not seem to be warranted. However, an extensive water quality monitoring program will be in place as part of the Fish and Aquatics Effects Monitoring Program that will also include fish tissue sampling to address MMER environmental effects monitoring requirements. Data collected as part of these programs will also be compared to applicable human health guidelines. Golder Associates Ltd. 2005. Guidance for Including Country Foods in Human Health Risk Assessments for Federal Contaminated Sites. 04-1412-041. Prepared for Health Canada: Burnaby, BC. Health Canada. 2010. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA). Version 2.0. Revised 2012. Contaminated Sites Division, Safe Environments Directorate: Ottawa, ON.	10-Nov-2016
HC-007.2b	31-Oct-2016	Eleanor Setton, Health Canada	Human Health	Health Canada notes that the proponent has updated predictions of tissue concentrations, but has not provided a baseline HHRA for country foods using these updated values. Regardless of the magnitude of predicted changes due to project activities, an accurate characterization of health effects under the baseline (existing) conditions would be useful in the event the incremental changes to COPC concentrations in environmental media are not as predicted through modelling.	It is acknowledged that an updated baseline HHRA that includes the updated COPC concentrations in country foods would be useful. However, it should be noted that the COPC concentrations in fish and vegetation country foods were accurate as those were measured concentrations. For mammalian and avian country foods (i.e., moose, snowshoe hare, and ruffed grouse), tissue concentrations are often not available for an HHRA and the importance and usefulness of accurate numbers increases with increased risk associated with the project, as described in Section 1.3 of Health Canada (2010): "*When a PQRA determines that, for maximal exposures, potentially unacceptable human health risks may exist, it may be appropriate to undertake a DQRA prior to defining remedial or risk management options* ." Since mammalian and avian tissue concentrations predicted for the KUG Project indicate that the change from baseline attributed to the Project is negligible, then the change in potential risk to human health is also negligible. Therefore, further assessment with a DQRA or with updated mammalian and avian tissue concentrations is not necessary. Health Canada. 2010. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA). Version 2.0. Revised 2012. Contaminated Sites Division, Safe Environments Directorate: Ottawa, ON.	10-Nov-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
HC-008	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	The assessment reports that the "95th percentile soil concentrations were used to calculate baseline metal concentrations bound to PM10 (shown in Table 5.2-1). The metal concentrations bound to PM10 were used to determine the EDI of metals that human receptors could receive via inhalation." Other parts of the assessment report that the 95th% Upper Confidence Limit of the Mean (95% UCLM) was used (See Appendix 18-B, p. 3-6). Clarification is required as to which statistical method was used to calculate baseline metal concentrations bound to PM10.	The text in Section 5.2 (Inhalation of Air) of Appendix 18-A is incorrect as it was the 95% UCLM (not the 95th percentile as stated) that was used in the calculation of baseline metal concentrations bound to PM_{10}. This was presented correctly in Table 4.4-2 of Appendix 18-A. This correction does not change conclusions regarding potential human health affects presented in the Application.	6-Jul-2016
HC-009	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	The last paragraph states "The highest predicted metal concentration bound to PM10 from either road or ore dust (shown in Table 3.3-2) was used to determine the estimated daily intake (EDI) of each metal COPC that humans receive via inhalation". This implies there are no sites that may be influenced by both sources. The proponent should provide a rationale as to why the assessment did not evaluate both sources together (i.e, road dust + ore dust).	As shown in Figure 3.4-1 of the Application, soil sampling sites were either affected primarily by road dust or ore dust. To simplify the calculations required, only road dust or ore dust was applied to each site. While this simplification may underestimate metal concentrations at some sites, other sites will be overestimated and it is expected that the over- and underestimation will balance out in the evaluation. No sites are expected to be significantly affected by both road and ore dust particulate sources, as indicated by the percent change in soil concentrations from baseline to the Construction and Operations phases (Appendices C and D of Appendix 18-B).	6-Jul-2016
HC-009.1	29-Jul-2016	Eleanor Setton, Health Canada	Human Health	Health Canada notes the statement "highest predicted metal concentration bound to PM10 from either road or ore dust…was used…" may be misleading. A more accurate statement would be "highest 95th% UCLM metal concentration bound to PM10…" See also comment HC-016.1	Acknowledged. Please see response to HC-016.1 in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo.**	7-Oct-2016
HC-010	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	On page 4-6 of Section 4.4.2 of Appendix 18-A, 15 soil sample sites are listed as being near roads, and data from these sites are used to predict concentrations of metals bound to PM10. The 95th UCLMs of various metals associated with these samples are listed in Table 4.4-2. Later, in Table 4.5-1, the same UCLM values are listed, however the sample N is larger than 15. For example, the sample N for Aluminum is reported as 47 in Table 4.5-1. Also, In App 18-B, Table 3.4-1 reports existing metal concentrations in soil samples located near roads and provides different UCLMs than those reported in App 18-A Tables 4.4-2 and 4.5-1. Clarification or correction is required.	The text in Section 4.4.2 of Appendix 18-A is incorrect. Instead of limiting the number of soil sites (i.e., n = 15) to those around roads in the calculation of metals bound to PM_{10}, all metal samples were included (i.e., n = 56). Thus the values in Tables 4.4-2 and 4.5-1 of Appendix 18-A are correct as all samples were included, which is more representative of baseline conditions. In Appendix 18-B, the source of dust was taken into account (roads or ore) in the calculation of metals bound to PM_{10}. The Project HHRA (Appendix 18-B) took into account the two primary dust sources due to the Project (roads and ore handling/processing), which is why different UCLMs were reported than in Appendix 18-A.	6-Jul-2016
HC-011	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	Direct exposure to COPCs in soil was assessed using levels measured in the top 20cm of soil. Health Canada guidance indicates direct exposure to soil should be based on levels in top 5cm unless otherwise justified. A rationale for using the top 20cm is required. Page 7 of Federal Contaminated Site Risk Assessment in Canada part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA) Version 2.0, 2010.	Soil deeper than 5 cm may be exposed during Project activities, thus to be representative, soil samples up to 20 cm in depth were included in the assessment as deeper soil horizons may have different metal concentrations.	6-Jul-2016
HC-011.1	29-Jul-2016	Eleanor Setton, Health Canada	Human Health	The proponent identified that deeper soils may be exposed during Project activities which may have different metal concentrations, and evaluated soil concentrations to a depth of 20cm. However, if deeper soils may be exposed with project activities, and people can potentially come into contact with the deeper soils, adequate data at the appropriate soil depth should be included in order to adequately assess potential exposure of people to site soils. Otherwise, if contact is only expected in the top 20 cm of the soil, no further comment.	Deeper soils may be exposed during project activities but the depth of soil layers that will be exposed is unknown. Therefore, an ore sample was included in the assessment of dust deposition and dust sources in the predictive modelling were either attributed to road dust or ore dust. Since ore is more mineralized than soil, this is expected to be a conservative assumption as it will overestimate metal concentrations in deeper soil levels (that are less mineralized than ore but more mineralized than surface soils).	7-Oct-2016
HC-012	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	HC Contaminated Sites Division has withdrawn the previous TRV of 0.0036 mg/kg BW/d for lead that is used in this risk assessment because it was based on the WHO JECFA (2000) value that was withdrawn in 2011. It is recommended that for lead, TRVs that are based on more recent science and supported with sufficient rationale be used instead. Alternate TRVs, including values from the WHO JECFA (2011) and EFSA (2013) may be used with appropriate scientific rationale. European Food Safety Authority (EFSA) 2013. Scientific opinion on lead in food. EFSA Panel on Contaminants in the Food Chain (CONTM), European Food Safety Authority, Parma, Italy. EFSA J. 8(4): 1570. Available at http://www.efsa.europa.eu/en/search/doc/1570.pdf World Health Organization Joint Expert Committee on Food Additives (WHO JECFA) 2011. Safety evaluation of certain food additives and contaminants. Prepared by the seventy-third meeting of the Joint FAO/WHO Expert Committee on Food Additives (JEFCA). World Health Organization, Geneva, Switzerland (WHO Food Additives Series, No. 64). Available at: http://www.inchem.org/documents/jefca/jecmono/v64je01.pdf	The WHO JECFA (2011) and EFSA (2013) do not provide new TRVs (or Provisional Tolerable Weekly Intakes) for lead as there is no threshold for effects from lead, thus it is not possible to establish a new TRV that would be considered health protective. The WHO JECFA (2011) document states: "The Committee reaffirmed that because of the neurodevelopmental effects, fetuses, infants and children are the subgroups that are most sensitive to lead. The mean dietary exposure estimates for children aged about 1–4 years range from 0.03 to 9 µg/kg bw per day. The health impact at the lower end of this range is considered negligible by the Committee, because it is below the exposure level of 0.3 µg/kg bw per day calculated to be associated with a population decrease of 0.5 IQ point. The higher end of the exposure range is higher than the level of 1.9 µg/kg bw per day calculated to be associated with a population decrease of 3 IQ points, which is deemed by the Committee to be a concern. For adults, the mean dietary lead exposure estimates range from 0.02 to 3 µg/kg bw per day. The lower end of this range (0.02 µg/kg bw per day) is considerably below the exposure level of 1.2 µg/kg bw per day calculated by the Committee to be associated with a population increase in systolic blood pressure of 1 mmHg (0.1333 kPa). The Committee considered that any health risk that would be expected to occur at this exposure level is negligible." As provided in Table 5.7-1 of Appendix 18-A, the estimated daily intake (EDI) of lead for toddlers during baseline was 1.80 x 10-4 mg/kg BW/day (which is 1.80 x 10-1 µg/kg BW/day). As provided in Table 4.7-1 of Appendix 18-B, the EDI of lead for toddlers and during the Construction and Operations phases was 1.87 x 10-4 and 1.60 x 10-4 mg/kg BW/day, respectively (which is 1.87 x 10-1 and 1.60 x 10-1 µg/kg BW/day, respectively). All three of these EDIs for toddlers can be considered negligible because they are below the exposure level of 0.3 µg/kg BW/day calculated to be associated with a population decrease of 0.5 IQ point (WHO JECFA 2011).The conclusions of the assessment are unchanged using the WHO JECFA (2011) exposure level as a TRV. As provided in Table 5.7-2 of Appendix 18-A, the EDI of lead for adults during baseline was 7.87 x 10-5 mg/kg BW/day (which is 7.87 x 10-2 µg/kg BW/day). As provided in Table 4.7-2 of Appendix 18-B, the EDI of lead for adults and during the Construction and Operations phases was 8.31 x 10-5 and 7.84 x 10-5 mg/kg BW/day, respectively (which is 8.31 x 10-2 and 7.84 x 10-2 µg/kg BW/day, respectively). All three of these EDIs for adults can be considered negligible because they are below the exposure level of 1.2 µg/kg BW/day calculated to be associated with a population increase in systolic blood pressure of 1 mmHg (WHO JECFA 2011). The conclusions of the assessment are unchanged using the WHO JECFA (2011) exposure level as a TRV.	6-Jul-2016
HC-012.1	29-Jul-2016	Eleanor Setton, Health Canada	Human Health	As noted by the proponent, WHO JECFA (2011) and EFSA (2013) cite health impacts based on neurological (i.e., population based IQ decrement), and cardiovascular (i.e., systolic blood pressure) effects, and that lead is recognized as a non-threshold substance. Section 6.2.8 should be revised to reflect the information provided in the response.	The comment is acknowledged. However, the Application and Appendices are not be revised at this stage of the formal review process.	7-Oct-2016
HC-012.2	31-Oct-2016	Eleanor Setton, Health Canada	Human Health	Health Canada acknowedges the EIS and Appendices will not be revised at this time, and is satisfied that the discussion is part of the project record via the comments made and responses received.	Comment noted, no further response required.	10-Nov-2016
HC-013	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	The text describing the TRV selection states that the TDI chosen for soluble nickel used in this risk assessment (0.025 mg/kg BW/day) cited from Health Canada (2011) was chosen because it is more conservative than the TDI of 0.011 mg/kg BW/d listed in HC (2010b). Please note that the TDI of 0.011 mg/kg BW/d from HC (2010b) is more conservative than the TDI of 0.025 mg/kg BW/day from HC (2011). Please verify the choice of TDI used for nickel and the rationale for the choice of the TDI. For the soil ingestion and dermal exposure pathway, we suggest that the TDI from HC (2010b) be used.	It is acknowledged that the nickel TDI of 0.011 mg/kg BW/day is more conservative than 0.025 mg/kg BW/day. Hazard quotients (HQs) for toddlers and adults have been re-calculated using the nickel TDI of 0.011 mg/kg BW/day and are as follows: • Toddlers: baseline HQ for nickel = 0.0300; Construction phase HQ for nickel = 0.0302; Operations phase HQ for nickel = 0.0308. • Adults: baseline HQ for nickel = 0.0124; Construction phase HQ for nickel = 0.0125; Operations phase HQ for nickel = 0.0131. Despite the difference in the TRV used in the calculations, the HQs for toddlers and adults remain below the HQ threshold of 0.2 during baseline, Construction and Operations phases.	6-Jul-2016
HC-014	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	Please note the TDIs listed for selenium from HC (2010b) should be 6.2 mg/kg bw/d for toddlers and 5.7 mg/kg bw/d for adults.	The µg/kg-d TDIs applied in the HHRAs are considered to be correct. Table 1 in HC (2010b) presents TDIs for selenium of 6.2 mg/kg BW/day for toddlers and 5.7 mg/kg BW/day for adults. However, in Appendix A of HC (2010b), the TDIs for selenium are listed as 6.2 µg/kg-d (equivalent to 0.0062 mg/kg-d) for toddlers and 5.7 µg/kg-d (equivalent to 0.0057 mg/kg-d) for adults, which is based on a NOAEL for infants and children of 7 µg/kg-d (equivalent to 0.007 mg/kg-d). It was Appendix A of HC (2010b) that was consulted when sourcing TRVs for the HHRAs. This reference is consistent with the TDIs that are also provided for selenium in the Federal Contaminated Site Risk Assessment in Canada Part IV: Spreadsheet Tool (Health Canada 2008)[1] and in the range of the oral reference dose for clinical selenosis provided by the US EPA Integrated Risk Information System (IRIS; 1991)[2] Chemical Assessment Summary (0.005 mg/kg-d or 5 µg/kg-d). (1) Health Canada. 2008. Federal Contaminated Site Risk Assessment in Canada, Part IV: Spreadsheet Tool for Human Health Preliminary Quantitative Risk Assessment (PQRA). October 31, 2008. (2) US EPA Integrated Risk Information System (IRIS). 1991. Chemical Assessment Summary for Selenium and Compounds. Website: https://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=472 (Accessed 6/29/2016).	6-Jul-2016
HC-015	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	The TDI listed in 6.2.17 appears to be for vanadium pentoxide. Please verify whether a TDI for 'vanadium and compounds' should be used instead of the TDI for vanadium pentoxide.	The Agency for Toxic Substances and Disease Registry (ATSDR 2016)[1] provides a minimal risk level (MRL) for vanadium of 0.01 mg/kg/day for intermediate duration oral exposure. Acute duration and chronic duration oral exposure MRLs were not derived (ATSDR 2016)[1]. The TDI for vanadium pentoxide of 0.009 mg/kg BW/day (provided by the US EPA IRIS database) was used in the Application, which is slightly lower (and more conservative) than the MRL for vanadium and compounds. Thus using the ATSDR MLR for vanadium would decrease the hazard quotients, indicating a lower risk to adults and toddlers than was calculated in the assessment. (1) ATSDR. 2012. ToxGuide for Vanadium. Agency for Toxic Substances and Disease Registry. Accessed online June 2016, from: http://www.atsdr.cdc.gov/toxguides/toxguide-58.pdf.	6-Jul-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
HC-016	15-Jun-2016	Eleanor Setton, Health Canada	Human Health	The Baseline HHRA generally employs mean, median or 95% UCLM levels as inputs to the exposure assessments and supporting models. For example, in App 18-A, Section 5.2, the 95% UCLM is used for inhalation of metals in air (note: described as 95th percentile, but values are the same as those reported as 95% UCLM); in Section 5.3 and 5.4, the median baseline metal concentration in soil is used to assess direct ingestion and dermal exposure respectively; in Section 5.5 the mean of medians from water quality sampling sites is used to assess exposure via drinking water; and in Section 5.6, the median levels of metals in fish tissue were used for exposure assessment and the median baseline metal levels in water, soil and vegetation were used for food chain modelling. The Project HHRA is similar. Section 4.2 notes the highest predicted metal concentrations bound to PM10 were used to calculate intake, however this incorporates the baseline level which uses the 95th UCLM; Sections 4.3 and 4.4 note predicted metal concentrations use to estimate exposure from ingesting soil and from dermal contact are based on dust fall deposition and baseline levels reported in Appendices C and D, where it is not clear which statistic is employed in the tables; Section 4.5 appears to use the median of means for exposure via drinking water; etc. In addition to estimates based on mean, median or 95th UCLM values, estimates based on the 95th percentile levels in water, soil, fish and vegetation are also required to fully understand the range of potential impact. Rationale: The use of the 95th percentile levels will result in the estimation of a 'worse case scenario', which can be put into context in terms of expected levels of use and consumption.	The quality and quantity of the data used in the HHRAs were considered sufficient to allow the use of median statistics as there were greater than 20 samples for all media except for berries, which had 17 samples. However, mean values (as recommended by Health Canada) were not used as environmental data does not typically have a normal distribution and a non-parametric statistic (median) was used instead. In addition, the use of median statistics is also consistent with preferences and requirements of other regulators (e.g., BC Ministry of Environment) for water quality data used in developing water quality models, since the use of median statistics eliminates the potential for skewing of the statistic due to outliers (extreme values at either the low or high end of the concentration range). The metal concentrations bound to PM10 utilized 95% UCLM metal concentrations in soil to apply to PM10 concentrations since air quality objectives for particulate matter are based on averaging annual 95 to 98 percentile concentrations over three years. Thus the 95% UCLM was used in the calculations instead of median concentration (as done with other environmental media). Median values were used in both the baseline HHRA (Appendix 18-A) and Project-related HHRA (Appendix 18-B) to allow the evaluation of the incremental change in contaminant concentrations in environmental media due to the Project. It is the incremental change in risk (e.g., hazard quotients) between baseline and the Project HHRA that is of interest in an environmental assessment, when assessing the potential for residual effects from Project related activities. Even if different statistics were used (e.g., 95th percentiles) the overall conclusion of the assessment would remain consistent as long as the same summary statistics were applied to media concentrations in both baseline and Project risk assessments.	6-Jul-2016
HC-016.1	29-Jul-2016	Eleanor Setton, Health Canada	Human Health	Health Canada appreciates there may be sufficient data to employ median or 95th percentile UCLM values in the HHRA; however, results are presented as 'worst case' or as the 'most conservative' scenario, which is not entirely the case for all parameters used for the HHRA. For example, Chapter 18, 6th paragraph pg. 18-54 reads: " It is likely that the risk to human health is significantly overestimated due to the conservative assumptions made throughout the Project-related HHRA. Actual levels of risk are likely to be much smaller, since the estimated daily intake of COPCs through country foods ingestion are overestimated by the use of conservative statistics (e.g., upper case water quality data) and the assumption that 100% of air inhalation, water ingestion, country foods ingestion, and soil contact occurs within the Human Health LSA." Clearly the assumption made about 100% of inhalation, ingestion and soil contact occuring in the study area is 'worst case', but many of the statistics representing COPC concentrations are not conservative. Median surface water COPC concentrations (derived as the median of the medians from multiple sample sites) are used for ingestion via drinking water. Appendix 18-A, Table 4.6-1 and 4.6-2 show that for some COPCs, the median is much lower than the 95th% UCLM, 95th% or maximum, and notably, this distribution represents only the medians from the sample sites. Health Canada suggests the use of median concentrations is not conservative. It may be that temporary users of the area preferentially use surface water from specific locations, and a more conservative approach would be to take the median or 95th% UCLM from the area most likely to be used. Otherwise, the proponent should provide adequate justification as to why the use of the median of medians is conservative. Air quality COPC concentrations are derived from the 95th% UCLM concentration of metal in soils. Appendix 18-A, Table 4.5-1 shows that for many COPCs, the 95th% UCLM concentrations are substantially lower than the 95th percentile levels, and even more so compared to the maximum measured levels. Health Canada suggestst the use of 95th% UCLM is only moderately conservative. Median COPC concentrations in soil are employed for soil ingestion and dermal absorption. Appendix 18-A, Table 4.5-1 shows that for many COPCs, the median is much lower than the 95th% UCLM, the 95th percentile levels, and the maximum. Health Canada suggests the use of median concentrations is not conservative. Median baseline metal concentrations in water, soil, and vegetation were used as inputs to the food chain modelling. Similarly, median values of metals in fish tissue were employed. Health Canada suggests these are not conservative.	The response is provided in the memo **20161004_A.1_KUG Comments HC-004.1, 007.1, 016.1__Round 2_HH_Memo**.	7-Oct-2016
HC-016.2	31-Oct-2016	Eleanor Setton, Health Canada	Human Health	Health Canada acknowledges the summary provided. As per the text, surface water quality data in Table 4.2-1 should be described as the "mean of the median monthly 95th percentile predicted baseline concentrations".	The comment is acknowledged. However, the Application and Appendices are not being revised at this stage of the formal review process.	10-Nov-2016
FLNRO-001	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Please change the legislation in effect in BC is the Water Sustainability Act (WSA) (replaced the Water Act earlier this year)	This comment is acknowledged.	6-Jul-2016
FLNRO-002	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Please note that the WSA has requirements to consider compensatory mitigation measures for impacts to aquatic resources and the Fish Protection Act has been absorbed into the WSA.	This comment is acknowledged.	6-Jul-2016
FLNRO-003	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	It would be useful to have separate enlarged map of the LSA	The map is provided in the memo **20160706 KUG Comment FLNRO-003_Fish and Aquatic LSA_Memo**	6-Jul-2016
FLNRO-004	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Please clarify the proximity of known or potential BT staging and spawning sites, and other fish utilization, to proposed discharge point	There are limited pockets of potential bull trout spawning habitat starting ~ 50 m downstream from the discharge pipe location. Surveys indicate habitats in the immediate vicinity of the proposed discharge pipe are not used by bull trout spawners. A total of five bull trout redds were located over the course of two years (2014 and 2015) between 500 and 1400 m downstream from the proposed discharge pipe. Bull trout fry and parr are present along the stream margin, especially along the left side margins in the vicinity of the proposed discharge pipe location and downstream from the discharge location. Habitats along the margin and inside channels in lower Attichika are also utilized by small numbers of juvenile rainbow trout, Dolly Varden, and mountain whitefish, and all age classes of sculpins. An updated summary of sampling is provided in Appendix 14-C, Table 2.3.6 of the Application. Two known bull trout staging areas are present approximately 150 and 700 m upstream from the proposed discharge pipe location. Lower Attichika has frequent deep pools located downstream from the discharge location as outlined in Appendix 14-A of the Application (Section 4.3.1.2). These may be used as short-term holding areas during the bull trout spawning upstream migration.	6-Jul-2016
FLNRO-004.1	6-Sep-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Since at this time the area of aquatic habitat potentially affected by acutely toxic discharge in Attichika Creek downstream of the discharge location is unknown, we recommend that an EA Certificate condition be included that commits the proponent to offsetting (compensating) for any loss of known bull trout or rainbow trout spawning areas that might be within the dilution zone of the discharge point, once this area is defined. Offsetting for affected salmonid spawning habitat should be presented in an offset plan that is acceptable to EAO and FLNRO.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
FLNRO-005	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Please specify the potential for the gravel areas on the margins at the discharge point and the mixing zone, to be used as salmonid spawning substrate.	There is no evidence of salmonid fish species other than bull trout spawning in the lower reach of Attichika Creek. Juvenile sampling indicates that rainbow trout and whitefish fry are not present in samples undertaken in the lower reach indicative of lack of spawning by these two fish species. Dolly Varden throughout the Thutade Watershed spawn in small tributaries, often groundwater influenced, rather than in mainstem reaches such as in lower Attichika. The bed materials at the margins of the proposed discharge point are simply too large for all species of salmonids. Pockets of suitable habitat for bull trout spawning were identified at a point approximately 50 m below the discharge location and downstream. More detail is provided in response to the Comment #FNRO-011. The presence of young-of-the-year slimy sculpins suggest that this species does spawn in the lower reach of Attichika Creek including sites downstream from the proposed discharge point.	6-Jul-2016
FLNRO-006	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Please provide an estimate of the area (m2) of potential BT spawning habitat at the proposed discharge point (in the IDZ), as well as downstream of this point in Attichika Creek	Table 2.3.7 in the baseline report Appendix 14-C provides an assessment of potential bull trout spawning habitat in the vicinity of the proposed discharge pipe on Attichika Creek. Bed material at the immediate crossing site is too large and the streamflows are too fast for potential bull trout spawning. Approximately 400 m^2 of potential spawning habitat is located along a narrow strip mostly on the stream right bank (looking downstream) in sections starting approximateley 50 m downstream from the pipe for 300 m. No bull trout redds have been found in this section. Potential spawning habitat becomes increasingly marginal as one proceeds downstream to a point approximately 3 km downstream where it becomes so sandy that it has no potential below this point. A rough estimate is that this section could comprise 3000 m^2 of generally poor quality spawning habitat for Attichika bull trout. An average of two bull trout redds have been located in this lower section in the past two years. Observations during our annual redd surveys in the Attichika suggest that potential bull trout spawning habitats are extensive in the upper watershed. These upstream mainstem spawning habitats in Attichika Creek could comprise 10 times or more the total amount estimated in the lower Attichika. These upstream habitats are high quality sites used by most of the bull trout spawners observed during the surveys. We do not consider the availability of suitable spawning habitats as a limiting factor for bull trout production in the Attichika Watershed. These estimates are based on qualitative assessments by experienced bull trout biologists during the redd surveys.	6-Jul-2016
FLNRO-006.1	6-Sep-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	You do not have a follow up on this comment as the toxicity within the migration corridor from discharge is not as toxic as you first thought; Discharge will be required to be less than chronic WQG at the edge of the IDZ through permitting. This modelling will be completed as part of permitting.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
FLNRO-007	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	How much potential BT spawning or known redd locations are there in Attycelley Creek, below the confluence with East Cirque Creek?	Complete bull trout redd surveys were conducted in Attycelley Creek for seven years. In total 47 bull trout redds were counted in the mainstem creek with 40 of these (85%) located in the headwater reach upstream from East Cirque Creek. The two headwater reaches offer extensive areas for potential bull trout spawners, and seepages in these headwaters are the main Dolly Varden spawning habitats in the Attycelley. The reach located downstream from East Cirque Creek, especially downstream from Amazay Creek, also has extensive sections that appear quite suitable for bull trout spawning but are simply not used. More detailed descriptions of Attycelley bull trout use are presented in the Appendix 14-A baseline report. These estimates are based on qualitative surveys, and total areas involved have not been measured.	6-Jul-2016
FLNRO-008	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Other mitigation for instream work for the installation of the discharge point in Attichika will need to include measures such as site isolation, fish salvage, sediment control prior to WSA approval for this project	This comment is acknowledged and will be addressed at the time of permitting.	6-Jul-2016
FLNRO-009	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Whether or not a fisheries offsetting plan is required is the decision of DFO's (under the Fisheries Act) and/or FLNRO's decision (under the Water Sustainability Act). Technically it is not possible to design diffuser so that treated water releases avoids fish habitats, because it is in fish bearing waters. But it should avoid high value fish habitat. Please provide additional details on how the 'no treated water release' section will be determined along the channel cross section, and how large this section is proposed to be.	This comment is acknowledged and will be addressed at the time of permitting.	6-Jul-2016
FLNRO-010	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Note that winter is not the approved instream work window for streams that have fall spawning and spring spawning fish. Instream work during the winter will require a timing window variance, as well as a current (at the time of construction) fish habitat assessment to ensure that no active bull trout redds are located at or downstream of the proposed installation site. Winter construction will make it challenging to develop an effective isolation and fish salvage plans, and additional measures, or a change in the proposed timing, will be required.	The Omineca and Peace instream work window for bull trout is June 15 to August 15. We suggest that the early winter might be a more suitable timing window for instream work for installing and removing the diffuser pipe. This is recommended for the following reasons: 1) There is limited bull trout spawning located downstream from the diffuser location; 2.) The timing would overlap bull trout migration past this site from July through mid-August; and 3) The June period is a period of high flow in the lower Attichika that would make working conditions more difficult. We also suggest that the wetter ground on the Attichika flood plain would be easier to work in after freeze-up. Information gathered during the fall surveys after bull trout spawning is completed would be used to determine whether any bull trout had spawned in the vicinity of the proposed discharge pipe location. Details in terms of timing and methods would be provided at the time of permitting.	6-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

	For Working Group Use				For Proponent Use	
ID #	Comment Date (i.e. 22-May-16)	Reviewer Name / Agency (i.e. Alex Kwang, MEM)	Subject (See "instructions" tab)	Comment (Include Memo reference as applicable)	Proponent Response (Include Memo reference as applicable)	Response Date
FLNRO-011	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Recommend that riparian reserves, particularly around small streams, be greater than the requirements under FRPA, i.e. minimum of 10 meters or more. All riparian impacts should be accounted for, in order to develop an effective offset plan for any permanent or temporary losses. Recommend the use of live staking or other soft engineering options for stabilizing stream banks, rather than riprap armour. Recommend seeding with native pioneering species (e.g. alder, poplar) rather than agronomic grass mixes on exposed, disturbed soils in riparian areas.	The Proponent will incorporate these recommendations into any riparian disturbance that will occur along the Attichika at the site of the diffuser installation. Disturbance will be minimized and the site will be restored.	6-Jul-2016
FLNRO-012	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	The project application should not contain recommendations (should), only project commitments (will)	This comment is acknowledged.	6-Jul-2016
FLNRO-013	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Instream works will also be reviewed by FLNRO for a Change Approval under the Water Sustainability Act	This comment is acknowledged.	6-Jul-2016
FLNRO-014	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Please clarify whether the 5% change in flow, to determine significance, refers to instantaneous discharge or annual runoff or some other metric.	Changes in flow are based on monthly flows. The detailed hydrological analyses and assumptions are outlined in Chapter 10 (Surface Hydrology Effects Assessment) of the Application.	6-Jul-2016
FLNRO-015	17-Jun-2016	Zsolt Sary, FLNRO	Fish and Aquatic Habitat	Please specify the proposed setbacks and buffers around natural water bodies and wetlands, and locations where this applies	Any encroachment into the riparian area on the Attichika floodplain would be set back 30 m from the highwater streambank except at the point of the pipeline installation. The riparian clearing to install the diffuser would be kept to a minimum needed to operate equipment required for the installation. A site plan showing the riparian setback would be prepared.	6-Jul-2016
FLNRO-016	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 3/308. Table 15.2-1. FRPA. There is approved UWR for Mountain Goat within the LSA not captured within the table, and approved caribou and stone's sheep UWR within the RSA not captured on the mapping.	The UWR for mountain goat (U-7-030) within the LSA was approved on May 24, 2016 and made publically available on June 2, 2016 while the assessment was submitted for First Nation screening in January 2016, and as such it was considered as a proposed UWR for the assessment as shown in Figure 15.2-1 in Section 15.2 of the Application. Similarly, the UWRs U-7-025, U-7-028 and U-7-29 for caribou and stone's sheep within the RSA were approved on May 24, 2016 and made publically available on June 2, 2016 while the assessment was submitted in January 2016. As such, these UWRs were not included in the assessment. The recently effective UWRs will be further considered as part of the Mines Act, Land Act, and FRPA authorizations process. The UWRs within the RSA where only use of the ORAR will occur (U-7-025 and U-7-029) include an exception for road permits. The orders indicate in their Appendices that the order does not apply if a road permit was entered into before the order takes effect. This would apply to AuRico as permits for use of the ORAR were already obtained prior to May 2016 when these UWRs were approved. See memo **20160706 - KUG Comment FLNRO-016, FLNRO-017, FLNRO-018, FLNRO-127, FLNRO-128, FLNRO-134_UWR_Memo** for revised figures of UWRs in the wildlife study areas.	6-Jul-2016
FLNRO-017	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 10/308. *The LSA does not overlap with any approved UWRs.* This is incorrect. The LSA overlaps with approved UWR U-7-030 for Mountain Goat.	The UWR for mountain goat within the LSA was approved on May 24, 2016 and made publically available on June 2, 2016 while the assessment was submitted in January 2016, and as such it was considered as a proposed UWR for the assessment as shown in Figure 15.2-1 in Section 15.2 of the Application. Thus the statement in the Application was correct at time of completion. See memo **20160706 - KUG Comment FLNRO-016, FLNRO-017, FLNRO-018, FLNRO-127, FLNRO-128, FLNRO-134_UWR_Memo** for revised figures of UWRs in the wildlife study areas.	6-Jul-2016
FLNRO-017.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	regarding the approved UWR. The proposal has been in the public domain since 2013, and a simple conversation with FLNRO about values in the study area prior to application submission would have identified these areas.	The original comment FLNRO-017 was regarding UWRs within the LSA and the presence of UWR U-7-030 for Mountain Goat in the LSA. The importance and value of this area was captured in the assessment by consideration of it as a proposed UWR (Figure 15.2-1) and determining if Kemess Underground Project would result in any habitat loss within the UWR polygons for mountain goat in the LSA (Table 15.6-6). No habitat loss or alteration will occur within UWR U-7-030 (Figure 15.6-14).	20-Oct-2016
FLNRO-018	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	The RSA also overlaps with approved UWR for Chase herd caribou U-7-025 and approved UWR for Stone's sheep U-7-028.	UWR 7-028 and 7-025 were made publically available on June 2, 2016 and these added 11,700 km2 of Stone's sheep UWR and 2,035 km2 of caribou UWR to the RSA. The final approved UWRs will be further considered as part of the Mines Act, Land Act, and FRPA authorizations process. The UWRs within the RSA where only use of the ORAR will occur (U-7-025 and U-7-029) include an exception for road permits. The orders indicate in their Appendices that the order does not apply if a road permit was entered into before the order takes effect. This would apply to AuRico as permits for use of the ORAR were already obtained prior to May 2016 when these UWRs were approved. See memo **20160706 - KUG Comment FLNRO-016, FLNRO-017, FLNRO-018, FLNRO-127, FLNRO-128, FLNRO-134_UWR_Memo** for revised figures of UWRs in the wildlife study areas.	6-Jul-2016
FLNRO-019	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 28. Request for curriculum vitae from those biologists who developed and undertook the habitat capability and suitability models. Specifically identify their past training, experience and expertise in model developments.	Shaun Freeman (B.Sc., R.P. Bio) completed the habitat suitability modelling that was used in the wildlife assessment. His major area of technical expertise is associated with the field inventory of wildlife and habitat suitability mapping. He has extensive experience with inventory of a number of wildlife species and groups using a wide range of techniques including hundreds of hours of aerial survey and scores of days of ground-based methods for ungulates of western Canada (e.g. moose, mountain ungulates, northern caribou, and mule deer). He has conducted the habitat suitability modelling for projects in the province that have received their environmental assessment certification such as Brucejack, KSM, and the Northwest Transmission Line. Laurence Turney (B.Sc., R.P. Bio) completed the habitat capability modelling that was included in the application in Appendix 15-A. However, the capability modelling was not used for the assessment. Laurence Turney, Owner/Senior Wildlife Biologist, is the sole proprietor of Ardea Biological Consulting. He graduated from the University of Victoria in 1983 with an emphasis on zoology and ecology and has over 15 years of fish and wildlife habitat related experience. Laurence has held positions with consulting firms, the Department of Renewable Resources in the Northwest Territories, and the BC Ministry of the Environment. Laurence has extensive experience in field assessment methods including sign removal transects, encounter transects and aerial surveys.	6-Jul-2016
FLNRO-020	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 30. Aerial Surveys. What methods were used to stratify the area when doing the caribou surveys? What did the flight lines look like?	Transects were flown and discussed in the wildlife baseline (Appendix 15-A), page 11-6. Aerial ungulate flight lines are shown in Figure 10.6-1 of Appendix 15-A.	6-Jul-2016
FLNRO-021	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	page 31. 15.4-1. Late winter low elevation use adjacent to ORAR. What disturbance from increased mine traffic and recreational use for these caribou? Wolves? What frequency of vehicle caribou sighting from KS, and were there ever instances of vehicle/caribou collisions?	GPS collar data presented in Figure 15.4-1 in Section 15.4 of the Application is from the Sittler et. al. (2015) report. This data was collected from 2012-2015 when Kemess South was in care and maintenance. During Kemess South operations only wildlife incidents and observations on site were recorded and not any along the ORAR. There was one wildlife incident of a collision with a vehicle and a moose but none with caribou. Wildlife observations in late winter (January to April) of 2008 and 2009 included 8 caribou on February 22, 2008, 1 wolf on April 29, 2008, 4 wolves on April 9, 2009, and 1 wolf on April 29, 2009.	6-Jul-2016
FLNRO-022	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 32. *Ground surveys for caribou were last completed during 2005.* Has caribou use of this area changed in the past 11 years? How has the use changed compared to when it was ploughed in 2005, to when it was not plowed for the past 5 years?	A comparison of caribou data collected during years when Kemess South was operational (1998 - 2011) to the current phase of care and maintenance (2012 to present) was not conducted. Caribou aerial survey data presented in Sittler et. al. (2015) that was collected in 2010 and 2012 within the appropriate survey unit of T2 was requested from the province in October 2015 but as of March 2016 has still not been received (latest email regarding data request from Susanne Williamson on March 3, 2016). However, as stated on page 15-30 of the Application, "In survey unit T2, which is 732 km^2, 64 caribou were observed in 2010 including 16 calves. This gives a density of 87/1000 km^2. In 2012, 40 caribou were observed including 7 calves for a density of 55/1000 km^{2}". Based on this information which is generalized to the whole survey unit (T2) in which Kemess South occurs, the caribou density was lower during care and maintenance than during operations.	6-Jul-2016
FLNRO-022.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	FLNRO does not have control over data requests to the Ministry of Environment; however, this caribou data was not requested from FLNRO. In 2012, 40 caribou were observed including 7 calves for a density of 55/1000 km2". Based on this information which is generalized to the whole survey unit (T2) in which Kemess South occurs, the caribou density was lower during care and maintenance than during operations. Does this not suggest additional care should be taken in terms of disturbance (i.e. if the population density has decreased since 2010).	Adrian Batho with FLNRO and Dean Peard with the Ministry of the Environment were contacted regarding the Sittler et al. (2015) datasets on October 15, 2015. This was based on a recommendation from Victor Brumovsky and Scott McNay with WildlifeInfometrics from whom the data was originally requested on October 13, 2015.The data was then requested through the Knowledge Management Branch as instructed by Michael Klaczek, a wildlife biologist with FLNRO. Dean Peard, then uploaded the GPS collar data from the Sittler et al. (2015) report to the Species Inventory Web Explorer which is where it was accessed. Subsequent interactions regarding the outstanding aerial survey and polygon data from the Sittler et al. (2015) report have been with Susanne Williamson who works in the Knowledge Management Branch. The population trend of the Chase herd is listed as unknown in the 2014 COSEWIC report and in the 2014 Recovery Strategy. AuRico is minimizing disturbance through mitigation such as designing an underground mine with a small footprint, using existing Kemess South facilities to reduce additional habitat loss and alteration, avoiding wetlands where possible during final infrastructure siting, as well as other mitigaiton listed in Chapters 15 and 24.	20-Oct-2016
FLNRO-023	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Sensory disturbance to caribou during calving?	Sensory disturbance to caribou is assessed in Section 15.6.2.2 of the Application. During the spring calving period, disturbance to caribou within 6.4 ha of high quality habitat may occur related to blasting (108 dB) and within 69.6 ha of the LSA due to instantaneous traffic noise. This is equivalent to 0.3% and 3.4% respectively of the high quality spring habitat available within the LSA (Table 15.6-3 and Figure 15.6-7 in Section 15.6 of the Application). Sensory disturbance was considered negligible and therefore not a residual effect.	6-Jul-2016
FLNRO-024	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 38. Figure 15.4-4. What are the caribou observations on this map? How does the habitat suitability compare with the GPS collared information from 15.4-1? Many of the spring observations in 15.4-1 correspond to low suitability mapping. Is this correct?	The caribou observations on Figure 15.4-4 in Section 15.4 of the Application are from the calving surveys as described on page 15-33 (32/308). Collared data were not available in time to assess habitat suitability models, however it is acknowledged that having this information would have benefited model development.	6-Jul-2016
FLNRO-024.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	Is there concern related to model verification, and how high/moderate/low habitat is defined in terms of the overall determination of significance, or potential for offsetting?	As discussed at the September 15, 2016 working group sub-committee for wildlife meeting, baseline observations of animals will be used to determine habitat suitability modelling consistent with animal observations and habitat ratings. A **memo 20161020_KUG Comments_FLNRO 024.1_habitat suitability_Memo** provides the results to support improved confidence in the habitat suitability modelling. AuRico has also entered a data license sharing agreement with CWS in order to consider the draft critical habitat mapping for the Chase herd when it becomes available. The Kemess Underground Project has an infrastructure area of <100 ha so there is not a concern related to significance determination as the Project was designed to have a small footprint and take advantage of existing areas developed for Kemess South.	20-Oct-2016
FLNRO-025	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 45. Statement. Mountain goats are a blue listed species in BC (not in text).	Acknowledged that mountain goat is a blue-listed species. Red and blue-listed species are listed on page 15-2 (2/308) which does include mountain goat.	6-Jul-2016
FLNRO-026	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 47. *The LSA does not overlap with any approved UWRs.* This statement is incorrect. UWR U_7_030 has been approved.	The UWR for mountain goat within the LSA was approved on May 24, 2016 and made publically available on June 2, 2016 while the assessment was completed in January 2016, and as such it was considered as a proposed UWR for the assessment as shown in Figure 15.2-1 in Section 15.2 of the Application. The statement was correct at the time of application.	6-Jul-2016
FLNRO-027	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	It is suggested the other mountain goat *proposed* UWR have not had observed goats in them. Based on how many surveys, and what was the timing of those surveys?	Page 15-48 of the Application provides the requested information: "Aerial surveys for ungulates have taken place in September and December 2003; February and July 2004; February and April 2005; and March 2015. Ground surveys to support the aerial survey results occurred from late May to early June 2005 and 2007." The flight lines for the surveys can be seen in Figure 12.6-1 in Appendix 15-A.	6-Jul-2016
FLNRO-028	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 49. As identified on the winter habitat suitability outputs, significant concern with project activities on approved UWR Units 870, 863, 830 and 871. How was the Natural Resource Sector endorsed Environmental Mitigation Plan followed? After minimizing impacts via proposed mitigation, has an on-site restoration or offsetting been proposed?	The Environmental Mitigation Policy and Procedures have been followed with regards to the mitigation hierarchy levels 1, 2, and 3 i.e. avoid, minimize and restore on-site (see Chapter 6 of the Application). The UWR Units 870, 863, 830 and 871 associated with UWR U-7-030 in the LSA for mountain goats have been avoided by Project infrastructure.	6-Jul-2016
FLNRO-029	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 50. What was the frequency of assessment to determine if goats were using habitat? Is it being suggested that because mountain goat presence wasn't idenitifed during surveys that the habitat isn't of value?	As stated on page 15-48 of the Application, "Aerial surveys for ungulates have taken place in September and December 2003; February and July 2004; February and April 2005; and March 2015. Ground surveys to support the aerial survey results occurred from late May to early June 2005 and 2007." The statement on page 15-51 is related to mountain goat observations from aerial surveys regarding use of mountain goat winter habitat in the LSA rather than a value judgement; "Thus, it is possible that while most high elevation habitats have been mapped as High to Moderately High rated habitat for mountain goat in the winter, not all may be used by the local population of goats."	6-Jul-2016
FLNRO-030	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	It was identified that 4-12 goats were consistently identified north of the subsidence zone, referenced in 2005, in an established UWR. Is there more recent information? This data is over 10 years old, is the population still in the area, has it grown, how has it changed if at all from the activities of Kemess South and now multiple years of no activity in the area? The summer habitat suitability model consistently shows high value habitat in established UWR. Again, after mitigation, how has the EMP been considered for on-site restoration or offsetting?	The consistent use of this area is based on observations made between 2003 and 2013 and derived from multiple surveys (Turney and Roberts 2005, Turney et al. 2005 and Roberts 2015), see page 184/417 in Appendix 15-A. The most recent aerial survey for mountain goat occurred in March 2015. A total of eight mountain goats were observed in four different groups; two lone adult males, one group of four with two adult females and two juveniles, and a group with adult female and a juvenile. Only the group of four animals was observed in the LSA, in the mountain block north of the proposed subsidence zone (Figure 12.8-5 of Appendix 15-A). This location has been identified in previous surveys and from incidental observations, as being inhabited by between four to twelve mountain goats. The UWR units in the LSA for mountain goats have been avoided by Project infrastructure. Talus, broken rock and steeper slopes within the subsidence area, may extend escape terrain to the benefit of goats for accessing adjacent forage. Topography that is more broken will not hinder goat movement, and it is likely that suitable forage will still be produced by the area after subsidence, so habitat values should not be degraded.	6-Jul-2016

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FLNRO-031	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	There is little mention of mountain goats in the RSA. Of note, we have recent reports of Mountain Goats off the ORAR through the Lay Creek canyon.	Surveys of mountain goat were restricted to the LSA, the RSA was not surveyed. However it was assumed that suitable habitat throughout the RSA would be occupied.	6-Jul-2016
FLNRO-032	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 59. Given the added disturbance to Grizzly bear in the project area, what thought has been put to mitigation, onsite restoration and offset?	The residual effect of loss of high quality grizzly bear habitat is not significant at 2.3% of the LSA, thus offsetting is not proposed. On-site restoration (Chapter 6 of the Application) will occur as mitigation for wildlife habitat loss.	6-Jul-2016
FLNRO-032.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	Given Aurico is not proposing any offsetting due to the low, but incremental habitat loss for all species identified, is there any opportunity for contributions to regional monitoring and recovery programs related to wildlife?	AuRico is willing to consider opportunities for contributions to regional monitoring and recovery programs related to wildlife.	20-Oct-2016
FLNRO-033	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 61. *Dedicated ground based snow track surveys (fur bearers) were conducted between 2003 and 2008* . Did this time period not coincide with operations of Kemess south? Would results expect to differ during decommissioned periods 2011 to present when sensory disturbance would be minimized?	The locations of the snow tracks surveys are shown in Figure 8.6-2 of Appendix 15-A. Although some of the snow transects were within 2 km of the Kemess South infrastructure and where furbearer abundance may have been reduced due to sensory disturbance, there were also snow track surveys further north of the Kemess South footprint where sensory disturbance is assumed to have been minimal.	6-Jul-2016
FLNRO-034	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 64. Given the disturbance to furbearers (marten) based on habitat suitability models (and in consideration of the blue listed wolverine), what mitigation and offsets have been put to this species as part of the application?	The residual effect of loss of high quality American marten habitat is not significant at 4.6% of the LSA, thus offsetting is not proposed. On-site restoration (Chapter 6) will occur as mitigation for wildlife habitat loss.	6-Jul-2016
FLNRO-035	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 97. Is aircraft noise really part of baseline? What is the frequency of flights from Kemess 2011 – present compared with what is expected during operations?	From 2011 till present, flights occur every Wednesday, with additional flights occurring throughout the field season. During operations, flights are anticipated to occur 4 days/week.	6-Jul-2016
FLNRO-035.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	FLNRO concern about utilization of Kemess south operations as baseline. Would sensory disturbance not be expected to differ compared to care/maintenance?	Sensory disturbance associated with Kemess Underground Project was considered as a potential residual effect in section 15.6 due to continuous noise during Operations, instantaneous noise from blasting during Construction, and instantaneous noise due to traffic during Operations. Noise levels for the assessment of sensory disturbance were based on noise modelling. The amount of high-quality habitat affected by noise beyond that lost to Project infrastructure and surrounding buffers was determined as described in Section 15.6.1.3. Sensory disturbance is anticipated to increase with Kemess Underground Project as compared to Kemess South during the care and maintenance phase.	20-Oct-2016
FLNRO-036	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 99. What was the mortality of wildlife stuck on roads due to high snowbanks during Kemess South operations?	There were no recorded incidents of wildlife mortality due to high snowbanks during Kemess South operations.	6-Jul-2016
FLNRO-037	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 100. *Vehicle-wildlife collision data for highways in BC was used to estimate the potential effect of direct mortality.* Kemess South operated for over a decade. What was the wildlife/vehicle mortality reported and associated with that project?	There was 1 wildlife/vehicle mortality reported during Kemess South operations as a result of collision between a contractor pick-up truck and a moose.	6-Jul-2016
FLNRO-038	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Is there concern related to indirect mortality of predators such as wolves on species such as caribou, created by new roads and winter maintenance allowing increased line of sight?	Indirect mortality from predators is briefly described in Section 15.5.1.5 and assessed in Appendix 15-C.	6-Jul-2016
FLNRO-039	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 111. When screening contaminants for 10% of background, what was considered background? Pre-Kemess south?	Background in this context is considered to be existing conditions for media quality in the LSA and RSA of the KUG Project. As described in Section 3.2.1.1 of Appendix 11-D, baseline (background) water quality in the LSA , within and downstream of the former KS Mine includes samples from the post closure period of the KS Mine (April 2011 to December 2014). Outside and upstream of the KS Mine footprint, baseline conditions were derived from samples collected between 1996 and 2015. As described in Appendix 18-B, with respect to soil quality, background samples were collected in 2003 and 2014 in the KUG Project LSA.	6-Jul-2016
FLNRO-039.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	When assessing the 10% in relation to background, is the assimilative capacity of the receiving environments related to specific contaminants and established toxicological thresholds considered, or if the contaminants are within 10 % of 'background'/current disturbance, regardless of those concentrations, they are considered non-significant?	The COPC selection procedure considered both background concentrations and water quality guidelines. As described in Section 11.6.1.3 of the Application, background concentration plus 10% was used in COPC selection to allow for the variability that can occur due to analytical uncertainty and, for the purposes of the assessment, would define these parameters as measurably different from existing concentrations, indicating an effect to surface water quality. Assimilative capacity or toxicity thresholds were not considered in this comparison.	20-Oct-2016
FLNRO-040	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	*'Where parameters were predicted to be greater than background concentrations plus 10% and guidelines in only a single model time step, these were not identified as COPCs'....* Does this assume these parameters are all chronic in nature versus acute which can have an impact on a much shorter scale (e.g. 96hrLC50)?	As described in Section 11.6.1.3 of the Application, parameters with predicted water concentrations above background+10% and the aquatic life water quality guideline within a single time-step of a month were excluded as COPCs. The rationale that the short duration and infrequent occurence of the exceedence make it unlikely to produce significant residual effects in wildlife receptors that range over areas of the LSA or RSA. These single time step exceedences of the applicable water quality guidelines (identified in Appendix 11-D) also tend to fall below the guidelines for protection of wildlife and livestock watering (see Chapter 15, Table 15.5-4, of the Application) or are within the natural range of system variation noted in baseline concentrations for the waterbody and are not expected to contribute to Project-related effects.	6-Jul-2016
FLNRO-041	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	*'If wildlife VCs and their habitat (high-quality habitat) are not present in the areas... They were screened out..* How was the determination made to only use high quality habitat? This is based on models that have a certain level of error, and on baseline that is intermittent both during kemess south operations and 2011-present. How would the results differ using moderate quality habitat?	Both conditions of no reported observations of VCs and no high quality habitat present had to be met to screen out the VC. If these conditions exist it suggests a very low likelihood of the LSA being an important area in the landscape to the VC. As described in Section 15.5.2.1 of the Application, wildlife use of the Project study areas were based on observation of wildlife through incidental observations and during baseline studies, or where high value habitat was predicted in areas where baseline studies were not conducted and wildlife observations had not been made. It is a reasonable assumption that areas where wildlife have been observed or are predicted to have high quality habitat are areas where receptors are expected to spend the most time and where there exists the greatest potential for exposure to COPCs and potential for effects. Chapter 15 of the Application identifies that the change in soil quality from dustfall is negligible between baseline and the Project and that Project related effects on wildlife are not expected. The only waterbodies where COPCs for wildlife have been identified are Waste Rock Creek and East Cirque Creek. Upon reviewing the habitat for potential receptors around these two areas and the rationale provided for inclusion or exclusion of potential receptors for further COPC evaluation, consideration of moderate vs. high habitat quality would not have changed the choice of receptors considered further in the residual effects assessment. The results of the assessment would not have changed.	6-Jul-2016
FLNRO-042	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 112. How do the maximum dust fall predictive rates compare with real data collected during Kemess South operations and operational fugitive dust permit requirements of EPD?	The predicted maximum dustfall rate estimated for the Kemess Underground Project is was 0.63 mg/dm^2/day including the background concentration of 0.56 mg/dm^2/day. Based on Kemess South data, the maximum dustfall recorded was 63.7 g/m^2/month or 20.9 mg/dm^2/day (unit conversion; 1000 mg/g, 102 dm^2/m^2 and 30.42 days/month) at the "west of security shack near forest" monitoring location. The maximum dustfall rate estimated for the Kemess Underground project is much less (97% less) than the maximum dustfall measured at the Kemess South mine in 2004. The lower and upper BC Ambient Air Quality Objectives for dustfall are 1.7 and 2.9 mg/dm^2/day, respectively. The Kemess Underground Project maximum dustfall rate is 63% less than the lower dustfall objective and 78% less than the upper dustfall objective	6-Jul-2016
FLNRO-043	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 113. Again, confused on what is considered baseline. Pre-Kemess south or post Kemess south. If the latter, how are those concentrations plus 10% considered an accurate representation of conditions and risk and how were these determinations and criteria established??	As described in Appendix 18-B, with respect to soil quality, samples representing baseline conditions for the KUG Project LSA were collected in 2003 and 2014 (after disturbances from the now closed KS Mine had occurred). Samples collected during this period represent existing land conditions where the KUG Project is proposed. These data represent a reasonable characterization of baseline conditions for environmental assessment purposes, where the intention of the Wildlife Effects Assessment is to evaluate the potential for effects as a result of the proposed KUG Project. In evaluating Project-related effects, the inclusion of a 10% buffer in the baseline conditions accounts for variability associated with field sampling, lab methods, and conservative assumptions made during modelling of future soil conditions. COPCs with predicted concentrations within 10% of baseline conditions are not expected to be measurable or to produce distinguishable project related effects on wildlife receptors.	6-Jul-2016
FLNRO-044	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 115. What is considered baseline for the dust fall assessment?	As described in Appendix 18-B, baseline soil quality was determined from samples collected in 2003 and 2014 in the KUG Project LSA.	6-Jul-2016
FLNRO-045	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	What is considered baseline for the soil analysis? Pre or post Kemess South.	With respect to soil quality, samples representing baseline conditions for the KUG Project were collected in 2003 and 2014 (after disturbances from the now closed KS Mine had occurred).	6-Jul-2016
FLNRO-046	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Is it Aurico's opinion that even with slightly elevated Mo concentrations the risk to wildlife values of molybdenosis is low?	AuRico's view is that the risk to wildlife values of molybdenosis is low based on the effects assessment in the Application in Sections 15.6.2 (woodland caribou) and 15.6.3 (moose). Molybdenum exposure is a greater risk to ungulates, and the primary route of exposure is through diet (i.e., vegetation). Water is not a significant exposure route compared to diet. Molybdenum is predicted to have concentrations higher than the BC water quality guidelines for wildlife in the Tailings Storage Facility (TSF) and Waste Rock Creek in Post-closure during the month of May only. Concentrations (mean 0.06 mg/L, maximum 0.07 mg/L) are marginally higher than the guideline (0.05 mg/L) during this month. Some bioaccumulation of molybdenum may occur in macrophytes (aquatic vegetation) during this time; however, macrophytes would just be beginning the growth season in May and would not likely have a significant biomass during this month. While it is possible that ungulates may spend some time in the area around Waste Rock Creek, both moose and woodland caribou have large home ranges, and are not likely to remain in one location (i.e., Waste Rock Creek) for extended periods of time. In addition, once the intake of elevated concentration of molybdenum from diet or water ceases (e.g., the concentration goes from just above the guideline to below the guideline), short-term effects are reversed (MEND 2008). These factors decrease their probability and risk of exposure during the one month (May) per year in which molybdenum concentrations are elevated above the wildlife water quality guideline and residual effects are not expected. The Fish and Aquatic Effects Monitoring Plan (Chapter 24, Section 24.7, of the Application) will be implemented to monitor the concentrations of COPCs in environmental media and biota. Based on monitoring results, adaptive management and mitigation will be implemented where necessary.	6-Jul-2016
FLNRO-047	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 120. *'Parameters that were greater than water quality guidelines were then compared to background concentrations'* . What is defined as background? Pre or post kemess south? If background is considered post Kemess south, and the additive effects from Kemess underground are small yet additive, is there not inherent risk, even if contaminant increases are within the pre-defined 10%? Further, there is added concern that a residual effect would likely not be identified, thus not carried forward into the cumulative effects assessment. ...??	The objective of the effects assessment is to evaluate the potential for KUG Project related effects. Existing water conditions are considered in the assessment to account for the incremental change in contaminant of potential concern concentrations associated with the Project. A cumulative effects assessment is only conducted where a residual effect from the Project has been identified. Where risks from the proposed KUG Project are negligible above risks from existing conditions in the proposed Project area, a cumulative effects assessment is not warranted. Water quality predictions for Project phases are based on incremental loading of the Project to existing baseline conditions. As described in Chapter 11 (Section 11.4.2.) of the Application, existing baseline (i.e., background) water quality in the LSA was derived from samples within the mine site area associated with pre-Kemess South (KS) Mine (1996) and samples from the post closure period of the KS Mine (2011 to 2014). Outside of the KS Mine footprint, baseline samples were collected during baseline studies for the former Kemess North Project (2002) and during subsequent monitoring between 2003 to 2014. In the Regional Study Area (RSA), background water quality consists of results from the Finlay River (since 2003) and Thutade Lake (2012 to 2015). Rationale for the selection of background data for water quality modelling and the effects assessment is provided in Section 3.2.1 of Appendix 11-D. Since it isn't possible to separate the historical or continued influence of KS Mine infrastructure on water quality compared to pre-KS Mine conditions, the contribution of KS Mine was incorporated in the modelling exercise such that the KUG Project-specific assessment is inherently cumulative of KS. The rationale for defining background + 10% as the threshold for identifying Project-related effects is described in Section 11.6.13 of the Application. This threshold is based on the assumption that changes in environmental media concentrations of less than 10% would not be detectable due to analytical uncertainty, and would not have measurable effects on water quality or biological receptors. See also response in memo **20161103_KUG Comments TKN_WG Meeting Sept 15 2016_Memo**	6-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
FLNRO-048	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 120. What mitigation measures are to be used to deter wildlife from the TSF?	Some forms of mining activity in the area around the proposed KUG TSF are considered to be a deterrent to wildlife, such as the East dam construction activities. Also, as a component of the routine monitoring and maintenance that will occur for KUG pipelines running to and from the KUG TSF, incidental wildlife sitings within the KUG TSF will be recorded and adaptively managed as necessary. There are no additional mitigation measures proposed at this time. Also the road to the TSF KUG falls within our Bear Aware Safety area, therefore the Safety Department will maintain an active program to deter habituation by bears.	6-Jul-2016
FLNRO-049	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 124. Are sandpipers or dippers in the project area? Are they being assessed to risk from selenium?	American dipper and sandpipers are present in the terrestrial LSA and terrestrial RSA, Waterfowl Survey Areas and Breeding Bird Atlas Surveys 2003 to 2014 (Table 4.8-1 in Appendix 15-A). As stated in Section 15.4.4.2 of the Application, American dippers are riverine waterfowl with a preference for river and creek habitat. As noted in Table 4.8-1 in Appendix 15-A sandpipers are wetland shorebirds and were also identified in the terrestrial LSA and terrestrial RSA. Sandpipers and dippers are considered as part of the larger group of migratory waterbirds in the effects assessment. Effects on migratory waterbirds were considered in the residual effects assessment related to exposure to COPCs in water and COPCs bioaccumulated in the foodweb. The assessment concluded that risks to waterbirds are likely to be negligible because the concentrations of COPCs are within the range of concentrations currently measured in Waste Rock Creek and birds are likely to forage over a much wider area than just Waste Rock Creek (which decreases their exposure). The Fish and Aquatic Effects Monitoring Plan Section 24.7 of the Application will be implemented to monitor the concentrations of COPCs in water and biota. Based on monitoring results, adaptive management and mitigation will be implemented where necessary.	6-Jul-2016
FLNRO-049.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	The assessment concluded that risks to waterbirds are likely to be negligible because the concentrations of COPCs are within the range of concentrations currently measured in Waste Rock Creek and birds are likely to forage over a much wider area than just Waste Rock Creek (which decreases their exposure) What biological field studies are currently happening to support the conclusions that current effects are likely negligible? i.e. are there ongoing EEM programs specific to water birds, egg tissue collections, have bioaccumulation models been completed to assess how Se transfers between environmental compartments?	The assessment concluded that additional loadings predicted for the Kemess Underground Project would be negligible or lower than existing loadings of selenium (from Kemess South) to the environment. Assessment of risk associated with existing Kemess South facilities is outside the scope of the Kemess Underground Project EAC Application. AuRico has, and continues to, implement a selenimum management plan and aquatic effects monitoring program approved by the BC Ministry of Environment related to the existing Kemess South facilities. Neither the selenium management plan or aquatic effects monitoring plan include bird specific studies or bioaccumulation models.	20-Oct-2016
FLNRO-050	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 125. It appears from the table that 'background' is accounting for current Kemess conditions and only the addictive effects from this project are being assessed. Is this correct?	Yes, that is correct to some extent. Please also see the responses to comments FLNRO-039, FLNRO-043, FLNRO-044, and FLNRO-047.	6-Jul-2016
FLNRO-051	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 129. Mitigation is mentioned, what about on site restoration or offsetting??	On-site restoration activities will be consistent with the Closure and Reclamation Plan (Chapter 6 of the Application) with wildlife and wildlife habitat objectives. There are no significant residual impacts, and therefore, no offsetting is proposed.	6-Jul-2016
FLNRO-052	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 130. Types of lighting are described to minimize effects to wildlife. Can this be included as an EA condition?	Effects on wildlife will be mitigated by using directed/focused lighting rather than broad area lighting and by shielding lights to minimize stray light. Lighting in non-essential areas will be used only when necessary, without compromising safety of employees.	6-Jul-2016
FLNRO-052.1	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Do these need to be included as conditions?	This response will be covered in the document prepared by EAO.	20-Oct-2016
FLNRO-053	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	There are descriptions of air craft use and maintaining buffers from sensitive wildlife areas (such as UWR). Condition to follow guidance in *A Compendium of Wildlife Guidelines for Industrial Development Projects in the North Area, British Columbia (2014)* , or specific approved UWR General Wildlife Measures.	The comment is acknowledged.	6-Jul-2016
FLNRO-053.1	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Do these need to be included as conditions?	This response will be covered in the document prepared by EAO.	20-Oct-2016
FLNRO-054	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Potential mitigation a for discharge line, re ramps. What frequency will these be installed, and what will their design look like? Do we need an EA Condition?	The installation of wildlife access ramps is identified as a commitment in the Wildlife Management Plan. Design details of the gravel ramps will be determined during permitting and discussed with regulators and First Nations. The intention of the ramps is to provide wildlife with reasonable opportunities for movement across the water discharge line. Crossing opportunities will be established at a rate of 4 crossings per 1 km of above-ground pipeline. Ramps will be constructed using available materials from site including rocks, coarse woody material, and soil/overburden. Ramps will be vegetated with species consistent with the Reclamation and Closure Plan (Chapter 6 of the Application). Locations for ramps will be opportunistically selected to align with existing wildlife trails.	6-Jul-2016
FLNRO-055	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	What about mitigation, on-site restoration or offsetting for disruption of movement related to the conveyor system?	Disruption of movement due to the conveyor system was not found to be a significant residual effect for moose (page 168/308), grizzly bear (page 190/308), or caribou (page 157/308) as only 1.2 km (page 99/308) of forested area north of the existing Kemess South footprint are affected by the conveyor. As such, mitigation specific to the conveyor has not been proposed. The conveyor will be fully removed during the Closure Phase.	6-Jul-2016
FLNRO-056	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 131. Request EA Condition to track wildlife observations and mortalities to be submitted annually to MFLNRO.	Wildlife monitoring and reporting is outlined in the Wildlife Management Plan. The request to submit this information to FLNRO is acknowledged.	6-Jul-2016
FLNRO-057	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 141. *'In order to put the habitat loss and alteration calculations within a regional context, it was assumed that the proportion of high quality and suitable habitat available in the LSA also represents the proportion that would be available within the RSA'* . Is this a fair calculation? How much core caribou habitat is located in the LSA? The RSA contains significant UWR, so how is that reflective within your assessment?	Habitat suitability modelling resulted in the identification of 232 to 2,646 ha (Table 15.6-2 in Section 15.6 of the Application) of high quality habitat depending on the season within the LSA for caribou which was used for habitat loss calculations. Habitat loss calculations used infrastructure buffers ranging in size from 50 m for diversion ditches, 100 m for existing infrastructure, and 250 m for new infrastructure and as such are an overestimate of the amount that will be lost. With these buffers, habitat loss and alteration ranges from 2.2 to 18.2 % of the LSA depending on the season (Table 15.-2 in Section 15.6 of the Application). If the amount of high quality habitat was underestimated in the RSA using the assumptions in the assessment, the result to the conclusions of the assessment would be that the percent lost in the RSA due to the Project would be less than that presented in Table 15.6-2 in Section 15.6 of the Application.	6-Jul-2016
FLNRO-058	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 145. *'The project occurs outside any protected areas and UWR for caribou'* . The project and almost the entirety of the LSA directly overlaps with draft Environment Canada critical habitat mapping for Southern Mountain Caribou, northern group high elevation winter/summer range, while the Attichika drainage directly overlaps with low elevation critical habitat winter range. Draft mapping can be requested directly from Environment Canada. How is this project consistent with the principles identified in the Federal Recovery strategy that speak to retention of all areas of high elevation winter and/or summer range, and within the northern group, a perpetual state o 65 % undisturbed low elevation? From the strategy, *Habitat alteration resulting from industrial activities on southern mountain caribou ranges has been linked to: reduced spatial separation between caribou and other prey or predators (Peters 2010); reduced range occupancy (Smith et al. 2000, Apps and McLellan 2006, Wittmer et al. 2007); reduced adult caribou survival (Smith 2004, Wittmer et al. 2007); and population declines (Wittmer et al. 2007). (Recovery Strategy for the Woodland Caribou, Southern Mountain population in Canada)*	AuRico will request the draft critical habitat mapping from Environment and Climate Change Canada and will take it into consideration for further development of the wildlife management plan to support subsequent Mines Act, Land Act, and FRPA authorizations process. The southern mountain caribou recovery strategy applies to critical habitat in the local population unit boundaries as identified within the recovery strategy itself. Currently, the Chase herd local population unit boundary is within the RSA where no habitat loss will occur. Therefore, the application is fully consistent with the principles and information publically available regarding the southern mountain caribou herds. The caribou that occur within the LSA are within the southern zone of trace occurrence (Sittler et al 2015) to which the Management Plan for the Northern Mountain Population of Woodland Caribou (*Ranger tarandus caribou*) in Canada (2012) applies.	6-Jul-2016
FLNRO-059	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 145. *'At the project scale, this represents a maximum reduction of 1.6-18.2% relative to the high quality habitat that is available in the LSA'* What type of on-site restoration or offsetting is proposed to account for this loss?	Given the negligible amount of habitat loss relative to what is available to caribou in a regional context, habitat loss and alteration is not predicted to result in a residual effect on caribou and thus offsetting is not proposed. On-site restoration (Chapter 6 of the Application) will occur as mitigation for wildlife habitat loss. Also, habitat loss calculations used infrastructure buffers ranging in size from 50 m for diversion ditches, 100 m for existing infrastructure, and 250 m for new infrastructure, and as such are an overestimate of the amount that will be lost.	6-Jul-2016
FLNRO-059.1	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Given the need for a Federal Recovery Strategy for caribou, any habitat loss is a concern. Recommend to the EAO to receive guidance from ECCC related to the Recovery Strategy, identification of Critical Habitat, and application of the protection measures identified under the Species at Risk Act.	This response will be covered in the document prepared by EAO.	20-Oct-2016
FLNRO-060	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 159. Anticipated loss of high quality moose habitat in the LSA. Has the proponent gone through the Environmental Mitigation Policy and after mitigative measures proposed offsets to account for this?	The residual effect of loss of high quality moose habitat is not significant at 2% of the LSA, thus offsetting is not proposed. On-site restoration (Chapter 6 of the Application) will occur as mitigation for wildlife habitat loss.	6-Jul-2016
FLNRO-061	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 167. The conveyor is anticipated to be a barrier to moose, except when it passes through a tunnel. Where is this tunnel located? Why can't additional areas be created to facilitate wildlife movement?	The tunnel is located between the two proposed tunnel portals shown on Figure 15.6-9 in insets 2 and 3 (in Section 15.6 of the Application). There will also be a section of the conveyor in the Kemess Lake Valley area between the norther access tunnel portal and portal to the underground declines that will be elevated above the ground surface sufficiently to allow for passage of moose. Disruption of movement due to the conveyor system was not found to be a significant residual effect for moose (page 15-194 or 168/308), as only 1.2 km (page 15-106 or 99/308) of forested area north of the existing Kemess South footprint are affected by the conveyor. As such, mitigation specific to the conveyor has not been proposed. The conveyor will be completely removed during the Closure Phase.	6-Jul-2016
FLNRO-062	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	*Ramps are to be installed along the discharge water line.* At what frequency, gradient will these be designed? What is this based on?	The intention of the ramps is to provide wildlife with reasonable opportunities for movement across the water discharge line. Design details of the gravel ramps will be determined during permitting and discussed with regulators and First Nations. Crossing opportunities will be established at a rate of 4 crossings per 1km of above-ground pipeline. Ramps will be constructed using available materials from site including rocks, coarse woody material, and soil/overburden. Ramps will be vegetated with species consistent with the Reclamation and Closure Plan (Chapter 6 of the Application). Locations for ramps will be opportunistically selected to align with existing wildlife trails.	6-Jul-2016
FLNRO-063	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 168. If moose movement across the water discharge route is unknown, how can the likely hood of effects be set at moderate and determined to be not significant? Who's opinion set this?	Estimates of the population from the baseline report (Appendix 15-A, page 10-11) suggest an average moose density of 15 to 32/100 km^2. In the LSA which is 166 km2, this would be between 25 to 53 moose and thus only a small proportion of the 4,800 moose as estimated by Cadsand et al. (2013) in the north Williston will be exposed to this effect. Disruption of movement due to the conveyor system was not found to be a significant residual effect for moose (page 15-194 or 168/308), as only 1.2 km (page 15-106 or 99/308) of forested area north of the existing Kemess South footprint are affected by the conveyor. Consistent with alternate prey theory recommended for management of caribou by Wilson (2009) and implemented in the RSA as a GWM of caribou UWR 07-025, FLNRO's objective is to reduce moose densities where they may be overlapping with caribou habitat. If a slight reduction of the use of the area by the moose population occurs it will be consistent with FLNRO's caribou management strategy for the region. Cadsand, B., D.C. Heard, J. Courtier, A. Batho, and G.S. Watts. 2013. Moose Density and Composition in the North Williston Watershed, British Columbia, Winter 2012-2013. BC Ministry of Forests, Lands, and Natural Resource Operations: Prince George, BC.	6-Jul-2016
FLNRO-064	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 169. How many moose were killed by direct vehicle collisions by Kemess staff and contractors during Kemess south operations and how has this data been used to influence the effects assessment?	During Kemess South Operations, there was 1 direct mortality of a moose resulting from a collision with a contractor vehicle.	6-Jul-2016
FLNRO-065	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	What is the difference in moose density between the project area and the Highway 37 project area used in the determination of collisions?	The density of moose for the Kemess area was estimated at 0.15 to 0.32 moose/km2 (pg. 10-10 of Appendix 15-A). Habitat along the Northwest Transmission Line reflecting density in area associated with Hwy 37 was estimated at 0.32 moose/km2 (±0.47) (Rescan 2009) suggesting no appreciable difference. Rescan. 2009. Northwest Transmission Line Project: Wildlife Characterization Baseline Report. Prepared for British Columbia Transmission Corporation by Rescan Environmental Services Ltd. October, 2009.	6-Jul-2016
FLNRO-066	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	What is the frequency planned for breaks in snowbanks during ploughing?	The frequency has not yet been established. Gaps would be preferentially located on corners and be adaptively managed by road maintenance personnel based on wildlife observations of use along the road during the winter. It is recommended by Huijser et al (2015) that spacing of between 400 m and 800 m be used to provide escape opportunities for large ungulates along roads. Reference: Huijser, M. P., Kociolek, A. V., Allen, T. D., McGowen, P., Cramer, P. C., & Venner, M. (2015). Construction Guidelines For Wildlife Fencing And Associated Escape And Lateral Access Control Measures. American Association of State Highway and Transportation Officials (AASHTO).	6-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
FLNRO-066.1	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Does this need to be identified as a Condition? Will it be covered in the Plan?	This response will be covered in the document prepared by EAO.	20-Oct-2016
FLNRO-067	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 170. When it is identified that Mo is only slightly higher predicted compared to baseline, is this referencing pre-Kemess south or post Kemess south?	The reference is to Waste Rock Creek baseline conditions from data collected post- closure of the former KS Mine. As described in Section 11.4.3.1 of the Application (starting on page 11-65 for Waste Rock Creek), there is limited baseline data available from prior to the development of KS Mine. Therefore, data from the post-closure phase of KS Mine has been used to represent existing conditions and used as the baseline data in the surface water quality model.	6-Jul-2016
FLNRO-068	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 171. *Concentrations of Mo in tissues of moose are not anticipated to change relative to current tissue concentrations* What are current tissue concentrations? The proponent is referencing not to expect a large increase above current, but what effect has Kemess south had on moose Mo tissue levels and how will slight incremental concentrations from Kemess underground influence this?	Tissue concentrations were not collected and have not been quantitatively calculated for the wildlife effects assessment. The statement is made based on a comparative assessment of molybdenum concentrations in water during existing and predicted post- closure conditions given the effect that water may have on aquatic vegetation concentrations, and that predicted soil concentrations are negligibly different from baseline soil concentrations. Moose have a wide foraging range and tissue concentrations would realistically be from exposures over a variety of habitats in the LSA. Tissue molybdenum concentrations for moose in the LSA were calculated for baseline (0.0200 mg/kg wet weight) and the Project construction (0.0202 mg/kg wet weight) and operations (0.0201 mg/kg wet weight) phases as part of the human health country foods assessment (see Table 5.6-1 in Appendix 18-A and Tables 4.6-3 and 4.6-4 in Appendix 18-B) . These calculations support the conclusion that change in moose tissue concentrations are expected to be negligible between existing and proposed Project conditions. The incremental change between existing and proposed Project conditions is what is focused on in the wildlife effects assessment.	6-Jul-2016
FLNRO-069	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 171. *The potential effect of attractants was scoped out of the assessment because mountain goats are seldom reported to be attracted to mining projects* What is this based on? Reference? During the reviewers 10+ years of mine inspections in the NE BC coal belt mountain goats were frequently observed around pits and mine projects.	Agreed, goats have been observed using open pit mines in NE BC, and this is a definite issue for coal mines. However, it is unlikely that goats would be attracted to use underground mines, and there are no accounts of goats using adits in the literature. Mountain goat observations near existing infrastructure were negligible during Kemess South Operations (there were none included in the incidental wildlife sighting logs). The few sightings of mountain goats occurred primarily along the talus slopes adjacent to the KS TSF during Operations and also along the 2:1 slope of the TSF since Closure.	6-Jul-2016
FLNRO-070	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 172. Proposed Ungulate Winter Range. This is Approved Ungulate Winter Range.	The UWR for mountain goat within the LSA was approved on May 24, 2016 and made publically available on June 2, 2016 while the assessment was completed in January 2016, and as such it was considered as a proposed UWR for the assessment as shown in Figure 15.2-1 in Section 15.2 of the Application.	6-Jul-2016
FLNRO-071	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	*No mountain goat were observed in the subsidence zone* Based on what level of survey effort?	As stated on page 15-48 "Aerial surveys for ungulates have taken place in September and December 2003; February and July 2004; February and April 2005; and March 2015. Ground surveys to support the aerial survey results occurred from late May to early June 2005 and 2007."	6-Jul-2016
FLNRO-072	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 174. Figure 15.6-14. The altered habitat is adjacent to approved UWR. With the General Wildlife Measures for mountain goat disturbance buffers are included that would be captured within the project related effects (i.e. 2000 m line of sight for helicopter work July 15-Oct 31 and 500m disturbance buffer from July 15-October 31). How was this accounted for in the analysis?	As stated on page 15-04 of the Application "The Province of BC provides guidance on helicopter activities in and near goat habitat (Management Plan for the Mountain Goat in BC; BC MOE 2010). The current guidelines state that helicopters should avoid flying within a 2 km buffer either horizontally or vertically from mountain goat habitat. It is anticipated that a 2 km buffer away from mountain goat high quality habitat will be practical if helicopter access is required." As shown on Figures 15.6-15 and 15.6-1 in Section 15.6 of the Application, and comparing to locations of UWRs in Figure 15.6-14 of the Application (page 174/308) no noise disturbance is anticipated within the UWRs.	6-Jul-2016
FLNRO-073	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	It is recommended that as an EA Condition for the project the disturbance related GWMs and those identified in the North Area Guidance Document be followed except for safety or spill related emergencies.	The comment is acknowledged.	6-Jul-2016
FLNRO-073.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	Does this need to be an EA condition?	This response will be covered in the document prepared by EAO.	20-Oct-2016
FLNRO-074	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 180. The proposed exhaust ventilation is proposed in high value habitat, but little details speaking to the effects of this on mountain goats and their habitat is included. Request more information specifically linking exhaust ventilation to mountain goats and their habitat.	The exhaust ventilation is for the control of diesel engine exhaust emissions and mineral dust concentrations, to within prescribed levels for humans to work in that environment. As such air leaving the vent will still be capable of sustaining human life and not introduce any separate effects from the mine infrastructure beyond those already assessed. Additional information on the air emissions from this vent raise can be found in Section 7.1 of the Application. The vent will be 5 m in diameter and is considered as part of the infrastructure. It was considered in the effect of disruption of movement.	6-Jul-2016
FLNRO-075	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	What level of mountain goat and vehicle collisions occurred during Kemess South operations?	There were no occurances of mountain goat and vehicle collisions reported during Kemess South operations.	6-Jul-2016
FLNRO-076	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 183. *A total of 49 ha of high-quality grizzly bear habitat will be lost or altered due to the Project footprint*.... As per the EMP, what sort of on-site restoration or offsetting has been proposed to account for this loss?	The residual effect of loss of high quality grizzly bear habitat is not significant at 2.3% of the LSA, thus offsetting is not proposed. On-site restoration (Chapter 6 of the Application) will occur as mitigation for wildlife habitat loss.	6-Jul-2016
FLNRO-077	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 189. Discussion on the north south barrier created by the conveyor system and discharge line. Discussion on creation of gravel ramps over pipe to facilitate movement. What is the design for these ramps, the frequencies of occurrence along the linear disturbance, and what is the relationship of predators using these ramps to target prey species? What effect does the linear line have on fragmenting habitat and the usefulness of that habitat?	Design details of the gravel ramps will be determined during permitting and discussed with regulators and First Nations. Predators are likely to exploit any situation that may give them an advantage for accessing prey, which would include areas where ungulates may be funneled or where their movement is restricted. The extent of how predators will use these ramps is unknown. Human activity will potentially limit the attractiveness of this area to predators, potentially mitigating any additional depredation that may result from the ramps during operation. The conveyor potentially crosses an area where moose may travel from high elevation to low elevation seasonal habitats which may result in a shift in movement to go around this barrier. Properly designed and placed ramps will ensure that the effects of habitat fragmentation is mitigated in associated with the water discharge line.	6-Jul-2016
FLNRO-078	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 190. *Grizzly bear mortality due to vehicle collisions is expected to be negligible*..... During Kemess South operations, how many grizzly bear/vehicle collisions occurred?	There were no occurances of grizzly bear and vehicle collisions reported during Kemess South operations.	6-Jul-2016
FLNRO-079	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 191. Clarification.. The security gate would not prevent hunters rom using Attichika Creek areas and the water line as a walkway down to the wetland complex?	Correct; therefore, there will be an additional gate installed at the top of the right of way along the proposed discharge pipeline route to Attichika Creek, at the junction with the ORAR.	6-Jul-2016
FLNRO-080	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 195. 318 ha of high quality marten/fisher habitat to be lost or altered due to project. What sort of EMP / onsite restoration or offsetting is proposed to account for this?	The residual effect of loss of high quality American marten habitat is not significant at 4.6% of the LSA, thus offsetting is not proposed. On-site restoration (Chapter 6 of the Application) will occur as mitigation for wildlife habitat loss. Also, habitat loss calculations used infrastructure buffers ranging in size from 50 m for diversion ditches, 100 m for existing infrastructure, and 250 m for new infrastructure and as such are an overestimate of the amount that will be lost.	6-Jul-2016
FLNRO-081	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	What sort of surveys have occurred in the high quality habitat area and have denning sites, etc been identified?	As identified on pg. 8-4 of the baseline report (Appendix 15-A) surveys for furbearers included: Dedicated Snow track surveys, Incidental Observations during Wildlife Habitat Assessment (WHA) plots, Incidental Observations during other wildlife aerial and ground track transects, Incidental Observations during other baseline ecological surveys. Each of these methods had the potential of identifying denning sites. Further den surveys will be conducted with pre-clearing surveys during construction (Table 24.19-1 of the Wildlife Environmental Management Plan, Section 24.19 of the Application).	6-Jul-2016
FLNRO-082	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 201. It is assumed that American marten will be able to pass underneath the conveyor as it will be slightly elevated above the ground.. What about the blue listed fisher?	The conveyor will be raised approximately 15 cm from the ground (page 15-106 of the Application). It is also anticipated that the fisher and American marten will be able to pass under the conveyor.	6-Jul-2016
FLNRO-083	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	The water discharge line will be a barrier to movement, but 'can' be mitigated by creating ramps.. What is the design and frequency of these ramps to be constructed?	Design details of the gravel ramps will be determined during permitting and discussed with regulators and First Nations. The intention of the ramps is to provide wildlife with reasonable opportunities for movement across the water discharge line. Crossing opportunities will be established at a rate of 4 crossings per 1km of above-ground pipeline. Ramps will be constructed using available materials from site including rocks, coarse woody material, and soil/overburden. Ramps will be vegetated with species consistent with the Reclamation and Closure Plan (Chapter 6 of the Application). Locations for ramps will be opportunistically selected to align with existing wildlife trails.	6-Jul-2016
FLNRO-084	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 202. *The use of habitat by wolverine to the west and east of the conveyor and discharge line is unknown*... Why is this? Is this because baseline surveys weren't able to assess wolverine or because baseline surveys weren't done?	Baseline surveys were not conducted at an intensity necessary to evaluate wolverine use at a finer scale within a watershed or between habitat types within a watershed.	6-Jul-2016
FLNRO-085	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 204. Request EA Condition that will avoid clearing of trees where there are active denning sites.	This is captured in the Wildlife Management Plan, where commitments identified include: • Avoid clearing high-quality forested denning habitat during March to May (low elevation older growth forests); • Conduct pre-clearing surveys to identify and avoid active den sites if clearing occurs in high-quality denning habitat during March to May; and • Maintain buffer around any identified active dens.	6-Jul-2016
FLNRO-086	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 208. 84 ha (of hoary marmot) high quality habitat will be lost or altered due to the Project footprint and buffers. As per the EMP hierarchy, what sort of onsite restoration or offsetting are proposed, especially in consideration of direct effect to dens and colonies?	The residual effect of loss of high quality hoary marmot habitat is not significant at 7.4% of the available high-quality marmot habitat in the LSA, thus offsetting is not proposed. Additionally, none of the previously observed dens fall within the anticipated subsidence zone. Pre-construction surveys will be conducted to identify active hoary marmot dens within the anticipated subsidence zone.	6-Jul-2016
FLNRO-087	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	*If subsidence affects these dens, then additional mitigation may be warranted*... What types of mitigation will be used? Does this need to be an EA Condition?	Pre-construction surveys will be conducted to identify active hoary marmot dens within the anticipated subsidence zone. If dens are identified within the subsidence zone, then efforts will be made to trap and relocate the animals to nearby suitable habita. The adjacent Central Cirque could provide a reasonable option.	6-Jul-2016
FLNRO-088	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 211. *Direct mortality may occur if the area of the subsidence zone is greater than anticipated*... What is the level of confidence in the subsidence zone spatial assessment?	The spatial assessment of the subsidence zone included a 250m buffer surrounding the predicted subsidence zone. This buffer was created to account for any additional habitat loss, alteration or disturbance that could arise for various wildlife VCs and to ensure a conservative approach for the assessment.	6-Jul-2016
FLNRO-089	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 212. 300 ha of bat habitat will be lost or altered due to the project footprint and buffers. As per the EMP hierarchy, what sort of onsite restoration or offsetting has been proposed?	The residual effect of loss of suitable maternal roosting forest habitat is not significant at 4.6% of the LSA, thus offsetting is not proposed. No karst formations were identified in the LSA and so no bat hibernaculum habit in the LSA will be lost or altered. On-site restoration (Chapter 6 of the Application) will occur as mitigation for wildlife habitat loss.	6-Jul-2016
FLNRO-090	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 219. Request EA Condition for proponent to utilize lighting that will reduce impacts and attractants to bats.	Wildlife monitoring will include reporting incidental observations of bats using Project infrastructure. If bat observations near infrastructure indicate that lighting is an attractant, then alternate lighting will be considered in order to reduce attractants to bats to Project infrastructure.	6-Jul-2016
FLNRO-090.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	Alternate lighting will be utilized? Concern with non-committal language.	This response will be covered in the document prepared by EAO.	20-Oct-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
FLNRO-091	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 222. What sort of onsite restoration or offsetting is being proposed for the habitat loss of the red listed northern goshawk and the blue listed short eared owl?	The residual effect of loss or alteration of suitable northern goshawk habitat and short-eared owl habitat is not significant at 1.9% and 2.5% respectively in the LSA, thus offsetting is not proposed. On-site restoration activities will be consistent with the Reclamation and Closure Plan (Chapter 6 of the Application) with wildlife and wildlife habitat objectives.	6-Jul-2016
FLNRO-092	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 231. *Actual concentrations of selenium are expected to be lower than predicted concentrations during closure and post-closure…..* This is not consistent with the reviewers experience at any of the coal operations in NE BC, where actual concentrations were often well above predicted concentrations. Is there that much confidence in the modeling?	Please note that the KUG is not a coal mine and should not be considered comparable to the coal mines in either Northeast or Southeast BC. The predictive modelling employs a number of conservative assumptions as described in Chapter 11 (Section 11.6.1.1) of the Application, and in Appendix 11-D (Section 3.3). One key conservative assumption is that the clay cover on the leach cap waste rock is 100% ineffective at reducing loadings from the KS waste rock pile to Waste Rock Creek. If the leach cap is effective at removing even 10% of the selenium loading from the KS waste rock pile, the KUG water quality model will overpredict the selenium concentrations in Waste Rock Creek. In addition, there is water treatment proposed for selenium removal, which minimizes the loading of selenium from the KUG TSF during the Construction, Operations, and Closure phases and decreases the loading of selenium from legacy KS infrastructure (i.e., by treating the water from the selenium retention pond). Sensitivity analyses for the water quality model predictions were also provided in Appendix 11-D, which increase the confidence in the modelling predictions.	6-Jul-2016
FLNRO-093	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Only one osprey nest was found in the LSA? Even at the mouth of Attichika Creek and the east shore of Thudate Lake? This wouldn't capture the raptors who's nest are just outside the LSA but feed within the LSA. What are the selenium concentrations predicted at the wetland complex at the mouth of Attichika and Thudade lakes, and what risk is there to raptors? OR is the primary risk from Waste Rock Creek? Would one not expect the bio accumulation rates and trophic transfer factors to differ between the lotic Waste Rock Creek and the lentic wetlands/Thudatde Lake??	There were no modelling nodes in the Attichika wetlands. While bioaccumulation rates of selenium may be higher in lentic than lotic waterways, COPCs were not identified in Attichika Creek and Thutade Lake based on screening predicted surface water concentrations against baseline+10% concentrations and applicable water quality guidelines (see Appendix 11-D, Appendix 3). Concentrations of selenium in Attichika Creek and Thutade Lake were below water quality guidelines for the protection of aquatic life and for the protection of wildlife. Project related effects are not expected from these areas, including for raptors. COPCs were identified in Waste Rock Creek (including selenium), the exposure pathway is operable, and as such raptor exposure to selenium concentrations from Waste Rock Creek was evaluated as part of a residual effects assessment (Section 15.6.9.5 of the Application).	6-Jul-2016
FLNRO-094	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 233. A total of 338.5 ha of migratory bird habitat to be lost due to project relate disturbance. As per the EMP, what sort of onsite restoration or offsetting is proposed?	The residual effect of loss of high quality migratory waterbird habitat is not significant at 6.6% of the LSA, thus offsetting is not proposed. On-site restoration (Chapter 6) will occur as mitigation for wildlife habitat loss. In addtion, mitigation will include avoiding active waterbird nests by conducting clearing outside the breeding period (April 1 to July 31) or through pre-construction surveys for nests in suitable habitat when clearing occurs during the breeding period. If waterbird nests are found during the pre-construction surveys, an undisturbed buffer area will be established around nests.	6-Jul-2016
FLNRO-095	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 244. Risk of direct update of contaminants from TSF and Waste Rock creek. What about site sediment ponds, Attichika Creek and Thutade Lake?	COPCs were not identified in Attichika Creek and Thutade Lake based on screening predicted surface water concentrations against baseline+10% concentrations and applicable water quality guidelines (see Appendix 11-D, Appendix 3). Any concern regarding sediment ponds can be addressed by pumping the water to the KUG TSF and if necessary deterrrents such as canons will be used.	6-Jul-2016
FLNRO-096	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 245. Have any bio accumulation models been developed for selenium in Waste Rock creek, Attichika creek and the wetland areas to assess risk to water birds? Has any effort been taken thus far to assess nests of waterfowl to assess embryo deformity resulting from Kemess south?	No, waterbird bioaccumulation models and site specific sampling were not included in the scope of the wildlife effects assessment and have not been completed specific to Kemess South. As predicted selenium (Se) concentrations are within the range of existing variation in Waste Rock Creek, residual KUG Project effects on waterbirds are not expected.	6-Jul-2016
FLNRO-097	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	How were dipper or sandpiper considered? Table 4.8-1 in Appendix 15-A suggest they are present. How was risk assessed to them from COPCs?	Sandpipers and dippers are considered as part of the larger group of migratory waterbirds in the effects assessment. Effects on migratory waterbirds were considered in the residual effects assessment related to exposure to COPCs in water and COPCs bioaccumulated in the foodweb (see also response to comment FLNRO-049).	6-Jul-2016
FLNRO-098	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 245. The only project source of COPCs is Waste Rock creek… Are there no sediment ponds located on site that would contain elevated levels of COPCs?	An assessment of potential effects due to exposure of wildlife to the KUG TSF or collection ponds is provided in Section 15.5.1.7 of the Application (Chemicals of Potential Concern, Tailings Storage Facility and Collection/Seepage Ponds). Table 15.5-5 of the Application shows the predicted concentrations of metals in water that exceed water quality guidelines for the protection of wildlife in the KUG TSF. Section 15.6.10.4 of the Application identifies that water quality in the KUG TSF and collection ponds will be monitored as part of the Surface Water Management Plan and compared to wildlife guidelines, if water quality exceeds guidelines mitigation measures will be applied to the areas to deter wildlife from the ponds, as detailed in the Wildlife Management and Monitoring Plan. Under these monitoring and mitigation conditions, no residual effects due to chemical hazards in water storage ponds are predicted for the Project.	6-Jul-2016
FLNRO-099	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 246. 488 ha of migratory land bird habitat to be removed or altered. As per the EMP, what sort of onsite restoration or offsetting plan is proposed?	The residual effect of loss of high quality migratory landbird habitat is not significant at 3% of the LSA, thus offsetting is not proposed. On-site restoration (Chapter 6 of the Application) will occur as mitigation for wildlife habitat loss.	6-Jul-2016
FLNRO-100	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 250. Pre-clearing surveys should be conducted by a RPBio.	The comment is acknowledged.	6-Jul-2016
FLNRO-100.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	Would like this as a Condition.	This response will be covered in the document prepared by EAO.	20-Oct-2016
FLNRO-101	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 256. Tadpoles have only been observed in the RSA. Based on how many surveys in the LSA?	Surveys for amphibians were conducted before 2003, during 2003, 2004, 2006, 2007, 2009, and 2014 (see Section 3.6 of Appendix 15-A). The methods and intensity of these surveys are detailed in Sections 3.6 and 3.8 of Appendix 15-A.	6-Jul-2016
FLNRO-102	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	11ha of the blue listed Western Toad habitat to be lost or altered. What is Aurico's onsite restoration or offsetting plan?	In the EA, the residual effect of loss of high quality Western Toad habitat is not significant at 4.2% of the LSA, thus offsetting is not proposed. On-site restoration (Chapter 6) will occur as mitigation for wildlife habitat loss. In addition, it should be noted that the loss and alteration of habitat for western toad was calculated for western toad by assuming that all shallow open water is suitable breeding habitat. The 10.7 ha of habitat loss represented these shallow open water bodies in the footprint areas that included substantive buffer zones (from 25 m to 250 m) around planned infrastructure. However, toad are known to be very selective in the sites that they choose for breeding and frequently return to the same sites in subsequent years, which means that not all shallow open water sites are actually breeding ponds. Baseline surveys conducted for western toad identified breeding sites in the RSA, one site in the LSA and no sites within the proposed Project footprint. Therefore, the 10.7 ha of habitat loss and alteration represents a worst case scenario (as is appropriate when assessing potential Project effects). The real-world conclusion of the EA is that none of the ponds in the footprint were identified as breeding ponds and all wetlands within proximity of planned disturbance will be prioritized for avoidance during final infrastructure siting, thus the actual loss of breeding habitat for toads is expected to be negligible.	9-Aug-2016
FLNRO-103	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 259. *It is assumed that western toads can meet their life cycle needs on either side of the pipeline…* Is this 'assumption' supported by your baseline habitat assessments?	This is a conservative assumption as no tadpoles have been documented in the LSA during previous survey, however adults have been encountered in the LSA (Section 3.8 of Appendix 15-A).	6-Jul-2016
FLNRO-104	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 260. Pre clearing surveys should be undertaken by an RPBio.	The comment is acknowledged.	6-Jul-2016
FLNRO-104.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	Would like this as a Condition.	This response will be covered in the document prepared by EAO.	20-Oct-2016
FLNRO-105	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 261. Attichika Creek and the lower wetlands of Attichika creek contain no potential breeding habitat for western toad?	Western toad and Columbia spotted frog were identified in the lower Attichika Creek, however breeding was not confirmed, see Section 3.8.3 of Appendix 15-A.	6-Jul-2016
FLNRO-106	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	3 mg/L of nitrate is within the 'natural' variability of Waste Rock creek?	Yes. Chapter 15, Table 15.5-6, of the Application identifies that existing variation (5th and 95th percentile) within Waste Rock Creek encompasses nitrate concentrations greater than 3 mg/L.	6-Jul-2016
FLNRO-107	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 261. It seems that predicted Cu levels are very close to acute thresholds for morality, and no anticipated effect is anticipated? Is there that much confidence in the accuracy of the water quality predictions? What is the level of uncertainty in the predictions and how does that relate back to this conclusion?	Based on existing water quality data (Chapter 11 of the Application) median hardness of Waste Rock Creek surface waters is 116 mg /L in May. This means that the copper water quality guideline for the protection of aquatic life is 0.0129 µg/L The text in page 15-261 notes that the BC MOE technical appendix for the guideline derivation considers that exposure of embryo-larval stage of some amphibians to copper levels of 0.005 mg/L to 0.010 mg/L can exhibit an appreciable increased frequency of mortality (BC MOE 1987). The study supporting this statement is aged (1979*), has toxicity endpoints applicable to softer waters than found in Waste Rock Creek in May, and refers to data from the most sensitive species tested, the southern gray tree frog (Hyla chrysoscelis) and the northern leopard frog (Rana pipiens). However, copper toxicity to amphibians is ameliorated by increasing water hardness. A larger amphibian toxicity dataset is also included in the more recent draft Alberta water quality guidelines (Appendix 1, August 1996**) compared to what was available for the derivation of the BC MOE water quality guideline. Predicted post-closure total copper concentrations in May are: (1) well below the calculated BC acute guideline (0.0129 µg/L) when hardness is accounted for and below the acute toxicity endpoint (1.12 mg/L, hardness 100-120 mg/L, for the two lined salamander) for amphibians relied upon in the Alberta draft guideline derivation (Appendix 1, August 1996**). Residual Project effects are not anticipated because: maximum predicted copper concentrations only slightly exceed the BC chronic guideline; the range of copper concentrations is within existing variation of Waste Rock Creek; water quality is within the recommended limits protective of fish and amphibians in hard water (BC MOE 1987); toxicity to embryo-larval lifestages of sensitive species is expected to be ameliorated by the higher hardness of Waste Rock Creek; and conservative assumptions have been incorporated into the water quality predictions for Waste Rock Creek to ensure effects to receptors are not underpredicted. Sensitivity analyses were conducted for the water quality model predictions and are provided in Appendix 11-D. References: (*) Birge, W.J. and J.A. Black. 1979. Effects of Copper on Embryonic and Juvenile Stages of Aquatic Animals. In: Copper in the Environment, Part II. Health Effects. Edited by Jerome O. Nriagu. Published by John Wiley and Sons, pp. 373-399. (**) Alberta Environmental Protection, 1996. Draft Alberta Water Quality Guideline for the Protection of Freshwater Aquatic Life: Copper. August 1996.	6-Jul-2016
FLNRO-108	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Selenium concentrations >2ug/L are considered within the 'natural' variability of the system??	Yes, the existing variation of selenium concentrations in Waste Rock Creek is determined from summary statistics of existing baseline data and provided in Chapter 15, Table 15.5-6 and Chapter 11, Table 11.6-5 of the Application. Project contributions of selenium to Waste Rock Creek are small relative to the existing conditions in this creek because the Project has proposed selenium water treatment to manage selenium loading from KUG.	6-Jul-2016
FLNRO-109	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Se concentrations in Waste Rock Creek are predicted to be 5-20 times greater than guidelines, but this is justified because the Kemess South selenium concentrations can't be effectively managed to below 2ug/L and thus these high concentrations are considered baseline? I don't support this reasoning.., especially considering no residual effect will occur thus a cumulative effects assessment is not part of this application.	The elevated concentrations of selenium predicted in Waste Rock Creek are not due to the Kemess Underground Project. Selenium is elevated in Waste Rock Creek under current conditions because of existing disturbances related to the former KS Mine, which is not a KUG Project effect. Evaluating the effects of the former KS Mine relative to pre-KS Mine conditions is not part of the effects assessment for the KUG Project (i.e., because the existing conditions due to the KS Mine is not a KUG Project effect). Selenium for the former KS Mine is being managed as part of the closure/post-closure planning for that mine, including measures such as the leach cap. In addition, selenium will be actively managed for the KUG Project through the use of selenium water treatment technology. Overall, the potential effects of KUG on Waste Rock Creek is to ameliorate Se and other parameters; in Post-closure once the KUG TSF water is suitable for release it is expected to be 'cleaner' than the current (existing) WQ in Waste Rock Creek.	6-Jul-2016
FLNRO-109.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	Still concerns related to selenium concentrations, and the additive effects from KUG. Will defer to MOE Impact Assessment Biologist.	Aurico acknowledges the comment; no further response is required at this time.	20-Oct-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
FLNRO-110	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 262. *Increases in accumulation of selenium into the lower levels of the food web and bio transformation to organic forms which are more toxic to egg laying vertebrates is not anticipated to increase relative to current conditions, and thus, bio accumulation of selenium in amphibians is not anticipated to result from project related activities.* Please provide a summary of all amphibian related contaminant (selenium) induced assessments conducted within the LSA.	As described in Section 15.4.5, Amphibian studies done in the LSA focused on surveys, transects, trap sites, wildlife habitat assessments, visual encounter surveys and opportunistic surveys. Water quality (Section 11.4 and Appendix 11-A and 11-B) sampling and sediment quality, aquatic resource tissue and fish tissue sampling (Section 15.4 and Appendix 15-A), including analysis of selenium, was conducted at a number of sites throughout the LSA. Vegetation sampling for tissue metals (including selenium) was also conducted along Waste Rock Creek and Attichika Creek (Section 13.4 and Appendix 13-A). No specific studies related to bioaccumulation of selenium in amphibians were conducted. Selenium concentrations are predicted to be elevated in Waste Rock Creek, but are within the range of concentrations that are currently occuring in this creek as a result of the former KS Mine. The elevated selenium concentrations in Waste Rock Creek are not a Project residual effect. Selenium for the former KS Mine is being managed as part of the closure/post-closure planning for that mine, including measures such as the leach cap. In addition, selenium will be actively managed for the KUG Project through the use of selenium water treatment technology, which will remain in place until concentrations in the TSF meet discharge criteria for release without treatment.	6-Jul-2016
FLNRO-111	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 263. Has table 15.6-22, especially the disruption of movement, included within the analysis the impacts from the ORAR as described in 15-c?	No, effects from the ORAR are dealt with exclusively in Appendix 15-C.	6-Jul-2016
FLNRO-112	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 264-266, Table 15.6-23. Contains non-committal language such as 'avoid'. Prefer Conditions that state will not, or will. e.g. It is stated that the project with 'avoid' wetlands during final project infrastructure setting. If the project can't 'avoid' these wetlands, will that change the significance determination? (This applies to all mitigation listed as 'avoid').	"Avoid" is a commitment.	6-Jul-2016
FLNRO-112.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	Is 'avoid' a commitment? Clarification from EAO.	This response will be covered in the document prepared by EAO.	20-Oct-2016
FLNRO-113	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 267. Should the CE boundaries for assessment of effects not also include the ORAR?	No, as the effects assessment is completed separately for the ORAR from the remainder of the project specific effects assessment. Project related use of the ORAR is not considered a component of the project for the purposes of the assessment as it is an existing shared use road, and Kemess Underground Project traffic will be similar or less than traffic levels during the recent past related to the Kemess South mine. The cumulative effects boundary does encompass the upper 168 km portion to the ORAR for which AuRico will be the sole industrial user.	6-Jul-2016
FLNRO-114	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 272. *The activities of…. Recreation.. Are not anticipated to contribute to disruption of movement of wildlife.* Does this determination include snowmobile use and winter access now created via the ploughing of the ORAR?	The potential effects on wildlife along the ORAR related to snowmobile use is discussed in Appendix 15-C including mitigation methods to be used to limit potential impacts from recreational snowmobile users.	6-Jul-2016
FLNRO-115	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 273. Table 15.7-3. How has the winter clearing and use of the ORAR been captured in this table? Increased trapping, recreation in addition to the indirect effect of predators?	These effects are considered in the Appendix 15-C. Recreation from snowmobiling and access of hunting, recreation and non regulated activities has been considered in Appendix 15-C. Trapping is restricted to trappers holding tenure and they are responsible and committed to furbearer management on their traplines. As such harvest from legal trapping due to road access is not considered an impact.	6-Jul-2016
FLNRO-116	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 274. Table 15.7-4. Request for the biologists rationale to justify removing activities related to ORAR.	As potential effects related to the ORAR is assessed separately in Appendix 15-C, these activities were removed from Section 15.7 of the Application to avoid redundancy.	6-Jul-2016
FLNRO-117	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 278. *Where winter use of roads is required and snow clearing activity will occur, it is assumed that gaps in snowbanks will be created…..* This should be an EA Condition that all roads maintained by the proponent (including the sections of the ORAR), gaps in snowbanks will be created to facilitate wildlife movement.	A commitment to manage snowbank heights on Project roads to provide escape pathways to allow wildlife to exit the plowed road is identified in the Wildlife Management Plan. This strategy can be extended to the northern portion of the ORAR maintained by AuRico.	6-Jul-2016
FLNRO-118	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 279. Habitat loss and alteration was identified as potential cumulative effects for olive-sided flycatcher and hoary marmot. What sort of on-site restoration or offsetting is planned to account for this?	A habitat loss of 454 ha and alteration of 1,099 ha of suitable hoary marmot BEC units represents 0.03% and 0.08% of the general RSA respectively, thus offsetting is not proposed. Similarly, A loss of 3,855 ha and alteration of 58,543 ha of suitable olive-sided flycatcher represents 0.3% and 4% of the RSA respectively, and is not considered a residual cumulative effect. Thus no offsetting is proposed. On-site restoration (Chapter 6) will occu as mitigation for wildlife habitat loss.	6-Jul-2016
FLNRO-119	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 280. For the calculation of the amount of habitat altered, did this include the ORAR, given winter maintenance and clearing is directly linked to this project?	The amount of habitat lost or altered related to project related use of the ORAR is assessed separately in Appendix 15-C.	6-Jul-2016
FLNRO-120	20-Jun-2016	Kevin Hoekstra, FLNRO	Wildlife and Habitat	• The first thing is that they are unverified models so this is particularly critical when considering impacts that might be on the border of threshold. The inaccuracy of the model may not indicate a high magnitude of effect, when there actually might be	It is acknowledged that habitat models have not been verified in the field for this Project, however algorithms have been extended from other projects in the northwest of BC where models have been evaluated against wildlife observations and they have been able to predict use to a greater degree than Sittler et. al. (2015) with caribou use of HEWR having 95% agreement with the ERM models (e.g. Rescan 2006), moose winter habitat use having nearly 80% agreement (e.g. Rescan 2010 and Rescan 2013), and mountain goat use having over 90% agreement (e.g. Rescan 2010 and Rescan 2013). Rescan. 2013. Brucejack Gold Mine Project: Wildlife Habitat Suitability Report. Prepared for Pretium Resources Inc. by Rescan Environmental Services Ltd.: Vancouver, British Columbia. Rescan. 2010. KSM Project: 2009 Wildlife Habitat Suitability Baseline Report. Vancouver, BC: Prepared for Seabridge Gold Inc. by Rescan Environmental Services Ltd. Rescan/RTEC 2006. Galore Creek Wildlife Habitat Ratings and Enhanced Habitat Suitability Models for Six Focal Species, 2004 to 2005. Prepared for NovaGold Canada Inc., Vancouver BC	6-Jul-2016
FLNRO-121	20-Jun-2016	Kevin Hoekstra, FLNRO	Wildlife and Habitat	• Caribou – I would disagree with model in general as there is minimal rating adjustment for disturbance or consideration of proximity (this comment applies to all the modelled species). Without considering the indirect effects of disturbance there is risk of an over estimation of functional habitat.	See memorandum **20160706 KUG Comment FLNRO-121, 122_Caribou_Memo.**	7-Jul-2016
FLNRO-121.1	6-Sep-2016	Kevin Hoekstra, FLNRO	Wildlife and Habitat	The memo does not address the concerns around not considering disturbance in the model. The memo states that "FLNRO is concerned that habitat suitability modelling, not taking into account disturbance, may have resulted in an over estimation of functional habitat. If this is the case, then the assessment is a more conservative approach to identifying suitable habitat and considering the effects of habitat loss due to the Project." I would disagree with the statement. By not including disturbance there would be more moderate to high value habitat available; therefore the percent impacted would be less. If disturbance is included, the total available moderate to high value habitat available would likely be less; therefore the impacts could be greater because the habitat is more limiting.	To clarify, the main existing disturbance in the wildlife LSA was reflected in the habitat suitability models. The RIC (1999) standard for habitat suitability ratings indicates that "final capability and suitability map products may incorporate 1) landscape heterogeneity and connectivity; 2) habitats adjacent to significant anthropogenic disturbance regimes (e.g., roads, settlements); 3) interspersion of different structural stages within the landscape. Adjustments will typically increase or decrease suitability value by a single class". Existing disturbance in the LSA includes Kemess South disturbed areas (Tailings Storage Facility, airstrip, other previously cleared areas, and site access roads; Figure 1.7-1 in Appendix 15-B and Figure 5.1-1 in Chapter 5, Project Description), the ORAR and its use, mining exploration roads (shown on figures in Appendix 15-B), and activities associated with the care and maintenance of Kemess South. Habitat directly disturbed, i.e. where vegetation was removed, within the existing Kemess South Project areas was given either a low suitability rating (e.g. moose early and late winter; Figures 3.2-1 and 3.2-2 in Appendix 15-B) or a nil rating (remaining species, see Figures in Appendix 15-B). Habitat suitability ratings for areas adjacent to the ORAR, Kemess South site roads, existing airstrip, and mining exploration roads that have indirect disturbance such as noise and visual disturbance were not reduced by a single class value as given as an option in the RIC (1999) standard referenced above. Disturbance is described as a "non-habitat" factor in the RIC (1999) standard which also states that "Factors other than habitat quality also affect animal density and amount of use, but are generally excluded in assigning ratings." The use of existing roads and the airstrip was not considered a "significant anthropogenic disturbance" RIC (1999) due to low and seasonal traffic volumes and infrequent flights. As such habitat suitability ratings were not adjusted for adjacent habitat.	20-Oct-2016
FLNRO-122	20-Jun-2016	Kevin Hoekstra, FLNRO	Wildlife and Habitat	o Additionally the model is inconsistent with the modelling completed by Sittler et al (2015). I recommend that the proponent review their report and rectify the discrepancies and amend their effects assessment accordingly. Here is the report: http://www.env.gov.bc.ca/wildlife/wsi/reports/5218_WSI_5218_RPT_2015.PDF	See memorandum **20160706 KUG Comment FLNRO-121, 122_Caribou_Memo.**	7-Jul-2016
FLNRO-122.1	6-Sep-2016	Kevin Hoekstra, FLNRO	Wildlife and Habitat	Although it would be preferable that the proponent incorporate the most current data into their modelling it is understandable that the habitat suitability model was completed to provincial standards. Therefore the comment is addressed.	The Proponent acknowledges the comment.	20-Oct-2016
FLNRO-123	20-Jun-2016	Kevin Hoekstra, FLNRO	Wildlife and Habitat	• Moose – It is not clear how thermal and security habitat was considered in the model. The species account assumption speaks to attributes considered for thermal and security but the model appears to be forage driven. The rating adjustment are very vague and provide no transparency on how they were applied.	Moose winter habitat models in the northwest are substantially driven by the availability of winter forage (e.g. Yazvenko et al 2002). Cover is incorporated into the habitat suitability ratings of polygons based on structural stage and canopy closure. Models based on this method of habitat suitability mapping have been able to predict nearly 80% of moose observations made during winter inventory flights (e.g. Rescan 2011 and Rescan 2013), suggesting they are adequate for assessing effects of the project on winter habitat. Yazvenko, B. S., G. F. Searing, and M. W. Demarchi. 2002. Wildlife Habitat Assessment in the Nass Wildlife Area. Smithers, BC: Ministry of Sustainable Resource Management.	6-Jul-2016
FLNRO-124	20-Jun-2016	Kevin Hoekstra, FLNRO	Wildlife and Habitat	• Mountain Goat – a rating adjustment that was applied was adjacency to escape terrain (generally up to 400m) which is consistent with literature; however, the adjustment that is in Table 2.3-8 would automatically put any habitat greater than 200 m from escape terrain in a low rating class based on Table 2.3-9. This may under-estimate the amount of high value habitat, which would under estimate the effects, which generally only consider mod-high as losses of functional habitat.	The goat model that was incorporated in this assessment is based on algorithms used for other projects in the northwest and it has been evaluated for projects close to the Kemess study areas (Rescan 2011, Rescan 2013) where it has been able to predict approximately 90% of winter and summer goat locations from inventory. This level of accuracy is considered to be sufficient for the effects assessment.	6-Jul-2016
FLNRO-125	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	• Grizzly bear – They speak to security habitat in the species account and the ratings assumptions, but it not defined or articulated how it was measured or influence the rating.	Spring, summer and fall habitat models were based on forage production as described in the methods of the habitat suitability modelling report (Appendix 15-B, pg. 2-11). This is consistent with other grizzly habitat modelling projects in the northwest BC (e.g., Rescan 2009 Rescan 2010, Rescan 2013, Rescan/RTEC 2006). Rescan. 2013. Brucejack Gold Mine Project: Wildlife Habitat Suitability Report. Prepared for Pretium Resources Inc. by Rescan Environmental Services Ltd.: Vancouver, British Columbia. Rescan. 2009. Northwest Transmission Line Project: Wildlife Habitat Suitability Baseline Report. Prepared for British Columbia Transmission Corporation by Rescan Environmental Services Ltd. Updated October 2009. Rescan/ RTEC 2006. Galore Creek Wildlife Habitat Ratings and Enhanced Habitat Suitability Models for Six Focal Species, 2004 to 2005. Prepared for NovaGold Canada Inc., Vancouver BC	6-Jul-2016
FLNRO-126	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 9. ORAR was scoped out of the Section 11 Order without any Landbase Stewardship (FLNRO) input. It is our opinion it should have been scoped in as significant amounts of the northern parts (168km) of the road are maintained and cleared linked directly to this proposed project. If this project were not to go ahead, there would not be active winter clearing.	Comment acknowledged, noting the Section 11 Order is issued by the BC Environmental Assessment Office. This topic was discussed with AuRico, EAO and FLNRO, and on November 12, 2015, it was concluded that a qualitative assessment of the northern portion of the ORAR where AuRico is the sole industrial user would be undertaken to capture this concern. The qualitative assessment is found in Appendix 15-C.	6-Jul-2016
FLNRO-127	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 18. In addition to U-7-007 and U-7-015, U-7-025 is also located within the RSA.	U-7-025 was approved on May 24, 2016 with a public notice date of June 1, 2016, following completion of Application in January 2016. The UWRs within the RSA where only use of the ORAR will occur (U-7-025 and U-7-029) include an exception for road permits. The orders indicate in their Appendices that the order does not apply if a road permit was entered into before the order takes effect. This would apply to AuRico as permits for use of the ORAR were already obtained prior to May 2016 when these UWRs were approved. See memo **20160706 KUG Comment FLNRO-016, FLNRO-017, FLNRO-018, FLNRO-127, FLNRO-128, FLNRO-134_UWR_Memo** for revised figures of UWRs in the wildlife study areas.	6-Jul-2016
FLNRO-128	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 24. Of note the UWR for mountain goat is established in the LSA, and mountain goat are blue listed in BC.	The UWR for mountain goat within the LSA was considered in the assessment as proposed UWR. The UWR was approved on May 24, 2016 and made publically available on June 2, 2016 following completion of the Application in January 2016. See memo **20160706 KUG Comment FLNRO-016, FLNRO-017, FLNRO-018, FLNRO-127, FLNRO-128, FLNRO-134_UWR_Memo** for revised figures of UWRs in the wildlife study areas.	6-Jul-2016
FLNRO-129	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Of note, we have recent reports of Mountain Goats off the ORAR through the Lay Creek canyon.	Comment acknowledged.	6-Jul-2016
FLNRO-130	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 27. *On average, it is anticipated that 12 vehicles will be using the ORAR during Operations on a daily basis to support the Project, with an average of one vehicle per hour assuming 12 round trips per day.* Is there an estimate of none project traffic that will be using the upper parts of the ORAR during winter months based on the clearing done during Kemess south operations?	There is no estimate available, but it is expected to be limited due to the distance (>300 km) from MacKenzie.	6-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
FLNRO-131	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 31. Most of the traffic discussion relates to project employees. What amount of recreational use occurs off the upper 1/3 of the ORAR in winter, based on information collected during Kemess south operations?	There is no estimate, however it is expected to be minimal as there is limited opportunity for recreation due to the Project's distance from communities. AuRico has committed to recording incidental observations of recreational activities once the project commences construction (Section 4.2.3 of Appendix 15-C).	6-Jul-2016
FLNRO-132	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page. 37. Table 5.7-2. Does U-7-025 or U-7-026 not show up in this table? They are not identified but it is unclear if they were assessed as part of this exercise.	The approval of these UWRs was made public June 2, 2016 after the completion of the Application in January 2016. As such they were not included. The UWRs within the RSA where only use of the ORAR will occur (U-7-025, U-7-026, and U-7-029) include an exception for road permits. The orders indicate in their Appendices that the order does not apply if a road permit was entered into before the order takes effect. This would apply to AuRico as permits for use of the ORAR were already obtained prior to May 2016 when these UWRs were approved.	6-Jul-2016
FLNRO-133	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	5.2.2.2. *Indirect mortality due to increased wolf predation may occur in association with increased recreational snowmobile access into habitat along the northern portion of the ORAR; however, while it is unknown how much snowmobile use may increase, the remoteness of the area and the implementation of mitigation measures to restrict snowmobile activity are expected to result in a negligible increase in snowmobile activity* Given this is a threatened caribou herd and much of the project area lies in critical habitat identified by Environment Canada, this remains a concern.	As stated in Section 4.2.4 of Appendix 15-C, the distance from the most local communities and with consideration of mitigation proposed, it is expected that the increase in the number of recreational snowmobilers accessing the Omineca Resource Access Road will be limited.	6-Jul-2016
FLNRO-134	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 41. Were UWR U-7-029 and U-7-030 considered as part of this assessment?	The UWR for mountain goat (U-7-030) within the LSA was considered as a proposed UWR as shown on Figure 3.1-1 in Section 3.1 of the Application, although UWR-7-029 was not considered. The orders for both U-7-029 and U-7-030 indicate in their Appendices that the order does not apply if a road permit was entered into before the order takes effect. This would apply to AuRico as permits for use of the ORAR were already obtained prior to May 2016 when these UWRs were approved. See memo **20160706 KUG Comment FLNRO-016, FLNRO-017, FLNRO-018, FLNRO-127, FLNRO-128, FLNRO-134_UWR_Memo** for revised figures of UWRs in the wildlife study areas.	6-Jul-2016
FLNRO-135	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Indication that monitoring reports to be submitted to MFLNRO on an annual basis. This meets the needs of MFLNRO. Does this need to be an EA Condition?	Providing a summary of data collected as part of the ORAR monitoring program to TKN and FLNRO on an annual basis is a commitment already identified in the Access Management Plan.	6-Jul-2016
FLNRO-136	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	As part of the Access Management Plan, is there a need for an Adaptive Management component that if issues with access along the northern part of the ORAR or on site access identify issues with wildlife and fisheries, components of the plan will be amended?	The Omineca Resource Access Road Wildlife Monitoring Program (24.19) considers an adaptive management approach in partnership with the province and TKN if wildlife mortality along the ORAR occurs due to wildlife-vehicle collisions. This could include provisions such as reduced vehicle speed in certain segments of the ORAR and additional warning signs for greater vigilance for wildlife. The monitoring program will be used to identify high conflict areas, which may then be used as part of an adaptive management plan to further mitigate conflicts between road users and wildlife.	6-Jul-2016
FLNRO-137	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Is there a need for an independent environmental monitor to be on site during construction activities to assess environmental compliance with the management plans, but specifically, this management plan?	AuRico employs two TKN Environmental monitors who will be provided with training opportunities in sediment and erosion control monitoring. There will be a TKN environmental monitor scheduled to be on site at all times. Please note that the actual total Project footprint in previously undisturbed areas, is anticipated to be less than 100 ha, almost half of which is related to subsidence. Additional buffer areas were included in the assessments in order to account for final siting changes as well as habitat alteration due to construction activities around the infrastructure.	6-Jul-2016
FLNRO-138	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 141. Mountain Goat are blue listed in BC, not yellow listed.	Acknowledged that mountain goat is a blue-listed species.	6-Jul-2016
FLNRO-139	20-Jun-2016	James Jacklin, FLNRO	Wildlife and Habitat	Page 153. Reporting requirements outlined. Request EA Condition that this information be tabulated and submitted to Omineca FLRNO on an annual basis.	Comment is acknowledged.	6-Jul-2016
FLNRO-139.1	6-Sep-2016	James Jacklin, FLNRO	Wildlife and Habitat	Condition required?	This response will be covered in the document prepared by EAO.	20-Oct-2016
MEM-005	12-Jun-2016	Michael Cullen, MEM	Geotechnical	The application indicates that the extent of surface subsidence used in the effects analysis is based on the results from numerical modelling. The specific value of the angle of fracture and angle of subsidence used could not be located. Please provide the angles or direct the reviewer to the location in the application where this information is presented.	While standard terminology for subsidence recognise 3 "types" of subsidence (refer to industry standard subsidence zones for empirical methods), the subsidence influenced zone is rather continuum that sharply defined zones with attributed angles. From that point of view, using displacement values such those in Itasca model are better way to illustrate the effect of subsidence. The angle of fracture is normally quantified as the angle between the horizontal and a line connecting the edge of the footprint to the limit on ground surface where visible tensile cracks appear. In the FLAC3D modelling approach to caving and subsidence, this has been found to correspond well to the location where total strain (sum of all components of the strain tensor) exceeds 0.5% (Cavieres et al, 2003). For the Kemess caving simulations utilizing a 1.5 strength reduction, the angle of fracture defined by these limits is 72 degrees to the North, East and South of the cave and 82 degrees to the West. The angle of subsidence is normally quantified as the angle between the horizontal and a line connecting the edge of the footprint to the limit of continuous subsidence on ground surface. In practice, it is necessary to base this limit on the nature of disturbance that is relevant to the project (e.g. damage to surface buildings) and what is deemed as an acceptable level of disturbance (e.g. minor cracks in exterior brickwork). These project-specific acceptability criteria were not defined within the scope of work Itasca conducted but specific limits relevant to the Kemess project could be defined and extracted from the existing models on request. Cavieres, P., S. Gaete, L. Lorig and P. Gómez. "Three-Dimensional Analysis of Fracturing Limits Induced by Large Scale Underground Mining at El Teniente Mine," in Soil and Rock America 2003 (Proceedings, 39th U.S. Rock Mechanics Symposium, Cambridge, Massachusetts, June 2003), pp. 893-900. P. J. Culligan et al., Eds. Essen: Verlag Glückauf, 2003.	14-Jul-2016
MEM-006	12-Jun-2016	Michael Cullen, MEM	Geotechnical	The angle of subsidence (determined by numerical simulation) used in the effects assessment is significantly less than that predicted by empirical methods, or typical values observed at mines. e.g. empirical methods indicate that the caving angle should be in range 70 degrees for a 600m deep undercut. Mining experience (for example see the UBC block caving subsidence database at https://www.eoas.ubc.ca/personal/erik/e-papers/13EE_IJRMMS-EmpiricalDatabase.pdf) suggests a value of 55 degrees is typical for subsidence angle. Please provide additional documentation that supports the use of the numerical simulation as the basis for project design and environmental effects assessment.	It is difficult to define a "typical value" for subsidence. Subsidence angles depend on number of parameters, rock properties etc and have to be considered for specific case similarly as nobody can use average rock mass strength from world rock strength database. Since there in no infrastructure in immediate vicinity of potential subsidence at Kemess, more relevant is estimated extend of elastic relaxation and fractured zone than crater from hydrogeology point of view. In fact, several recently commissioned caves had subsidence angles steeper than predicted by Laubscher's empirical method, mainly because the method was developed and calibrated in much weaker rock masses, and also because subsidence estimates in studies are often conservative to cater to uncertainty. Several recent caves, eg. Northparkes E26/1,2 E48, Cadia East, Ridgeway & Ridgeway deeps, Palabora - had very steep subsidence angles or overhangs. The referenced paper does not differ from any other subsidence database and when one looks at the subsidence (Fig 8-9 in UBC report) for similar rock mass and depth e.g. Northparkes or Henderson the subsidence angles are similar, 70 degrees and steeper. Note that some of the information in that paper is incomplete in terms of specific caves (e.g. Northparkes has 3 caves, each with different depth and angles, same Henderson, El Teniente and others).	14-Jul-2016
MEM-007	12-Jun-2016	Michael Cullen, MEM	Geotechnical	The application suggests that there is a factor of safety of 1.5 associated with the subsidence cone prediction which is derived from a numerical simulation that utilized a 1.5 strength reduction in assumed material properties. Our understanding is that the subsidence cone prediction is also based on a 0.5m vertical movement cutoff. Itasca state that 0.5m is a commonly accepted value for assessing the subsidence limits. However, ground with vertical subsidence between 0m and 0.5m will also be affected. Please provide additional documentation that supports the use of the numerical simulation, and a 0.5m movement cut-off as the basis for project design and environmental effects assessment.	The Itasca model also illustrates other isosurfaces than 0.5 m vertical movement - see their Flac3D cross-sections. Ground with vertical subsidence between 0 m and 0.5 m indeed may also be affected, as noted by the reviewer, but the significance of the impact depends strongly on the nature of disturbance that is relevant to the project (e.g. damage to surface buildings) and the level of disturbance that is deemed to be acceptable (e.g. minor cracks in exterior brickwork). If project-specific acceptability criteria have been defined for ground surface disturbance at the Kemess project, these can be extracted from the existing models on request. Cavieres, P., S. Gaete, L. Lorig and P. Gómez. "Three-Dimensional Analysis of Fracturing Limits Induced by Large Scale Underground Mining at El Teniente Mine," in Soil and Rock America 2003 (Proceedings, 39th U.S. Rock Mechanics Symposium, Cambridge, Massachusetts, June 2003), pp. 893-900. P. J. Culligan et al., Eds. Essen: Verlag Glückauf, 2003.	14-Jul-2016
MEM-007.1	18-Jul-2016	Michael Cullen, MEM	Geotechnical	In order to better understand the extent of the area that will be affected by caving and subsidence (and the potential affects on surface water, ground water, and terrain), please provide plans, and representative sections showing anticipated surface subsidence contours. At a minimum subsidence contours should be provided for the expected, optimistic, and worst case scenarios. The plans should also show surface topography, streams, other relevant features, and proposed extent of mining. The proponent is welcome to propose a minimum "acceptable" subsidence value, however, we suggest indicating to 0mm subsidence value with appropriate contour intervals. We recognize that the 0mm value is somewhat fictitious and may include a very large area, and that affects close to the 0mm value will be negligible. Michael Cullen MEM 15-Jul-2016	The Response is provided in memo **20161110 KUG Comment MEM-007.1 008.1_Subsidence_Memo**	10-Nov-2016
MEM-008	12-Jun-2016	Michael Cullen, MEM	Geotechnical	Do the predicted effects on groundwater, surface water, terrain stability, change if more conservative values (e.g. those estimated from empirical assessment) are used for the angle of cave and angle of subsidence?	A sensitivity analysis was performed using the groundwater model whereby a larger than anticipated subsidence zone was simulated (120 ha surface expression, versus expect 35 ha) to determine if mine contact water pathlines would report to Amazay Lake were the cave zone larger than expected. Virtually all pathlines reported to East Cirque Creek (Section 7.4 of Appendix 9-B). The sensitivity of modeled groundwater fluxes (i.e. underground inflows, East Cirque/Central Cirque Creek discharge rates) to angle of cave/angle of subsidence has not been undertaken. Conservative groundwater fluxes for the purpose of providing an 'upper case' to the water quality effects model were derived assuming higher recharge (less evapotranspiration) over the subsidence zone (Section 9.6.1.1. and Section 7.3 of Appendix 9-B, Section 2.6 of Appendix 9-D).	8-Jul-2016
MEM-008.1	18-Jul-2016	Michael Cullen, MEM	Geotechnical	response adequately addresses groundwater question only. Do the predicted effects on surface water and terrain stability change if more conservative (worst case) values are used for extent of caving and subsidence? Response should be combined with that to MEM-007.	The effects assessment conclusions for surface hydrology, surface water quality, and terrain stability would not change. Sensitivities were run for the predictive surface water balance and water quality models that incorporated the groundwater model sensitivity case described in MEM-008 (Sections 2.2.3, 2.4 and 3.4 of Appendix 11-D of the Application). These water balance and water quality model sensitivities were considered in surface hydrology (section 10.6.1.1) and surface water quality effects assessment (section 11.6.1.2) presented in the Application. The terrain stability assessment considered potential subsidence within the 250 m buffered area around the 0.5 m vertical displacement expected case subsidence. The 0.1 m vertical displacement conservative case lies completely within the buffered area considered in the Application (see memo **20161110 KUG Comment MEM-007.1 008.1_Subsidence_Memo**). A residual effect of decreased terrain stability within the subsidence area was assessed as and determined to be not-significant in relation to land and resource management plan objectives and public risk. This is primarily due to the local nature of the effect, the current occurrence of terrain with low stability in the immediate area of subsidence, the remote location, and restricted public access to AuRico's mineral lease area.	10-Nov-2016
MEM-009	12-Jun-2016	Michael Cullen, MEM	Geotechnical	The application references Jakubek 2015. Details of the reference are not provided in the document nor is it clear if this is a general reference of project specific. Please provide citation or document.	Workshop presentation: Jakubec,J., KEMESS UNDERGROUND CAVE MINING –SUBSIDENCE WORKSHOP Project Number: 2CA046.000, August 2015	14-Jul-2016
MEM-010	12-Jun-2016	Michael Cullen, MEM	Geotechnical	The numerical modeling suggests breakthrough to surface at about 1.5 years. The hydrogeological model assumed a breakthrough after 5 years. What is the impact (if any) on the groundwater model results of the time of cave breakthrough to surface?	Breakthrough at the ground surface is predicted to occur 1.5 years after the completion of the gallery, according to Itasca (Appendix 5-B). Completion of the gallery and initial cave production is anticipated in Project Year -1; therefore, breakthrough should occur in by the end of Project Year +1. The groundwater model was developed to include the Construction Phase (includes advancement of declines plus gallery development) that occurs between Project Year -5 and Project Year -1 (see Section 2.6.1, Appendix 9-B). Changes to bedrock hydraulic properties are initiated in the groundwater model in Project Year 1 (Operations) with enhanced recharge over the subsidence zone starting in Project Year 2 (Operations) and are thus consistent with the caveability numerical modeling.	8-Jul-2016
MEM-011	12-Jun-2016	Michael Cullen, MEM	Geotechnical	The application notes that there is potential for mud rushes and that appropriate monitoring and standard operating procedures will need to be developed to mitigate the risk. The information presented is adequate for the EA and the MAPA. Developing standard operating procedures will be a condition of any Mines Act Permit issued.	The comment is acknowledged and will be addressed in the permitting phase	8-Jul-2016
MEM-012	12-Jun-2016	Michael Cullen, MEM	Geotechnical	The application notes that air blasts may occur in caving operations but does not provide an assessment of the likelihood at KUG. The information presented is adequate for the EA. Additional information will be required for the MAPA.	The comment is acknowledged and will be addressed in the permitting phase.	8-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
MEM-013	12-Jun-2016	Michael Cullen, MEM	Geotechnical	Reviewer was not able to locate drawings associated with Appendix 5E *Kemess Underground Project Feasibility Study Surface Infrastructure Design Report Kemess Mine by* amec foster wheeler. Please provide location.	The drawings are provided in memo **20160706 KUG Comment MEM-013, 014_AMEC Designs_Memo**	14-Jul-2016
MEM-014	12-Jun-2016	Michael Cullen, MEM	Geotechnical	Reviewer was not able to locate appendices associated with Appendix 5E *Kemess Underground Project Feasibility Study Surface Infrastructure Design Report Kemess Mine by* amec foster wheeler. Please provide location.	The drawings are provided in memo **20160706 KUG Comment MEM-013, 014_AMEC Designs_Memo**	14-Jul-2016
MEM-015	12-Jun-2016	Michael Cullen, MEM	Geotechnical	The design for the rock cuts above the south and north access road portals state that no support or local rock bolt support is required which will be determined at the time of construction. No head cover is planned. Generally accepted engineering practice is to have a head cover or to drape mesh over the rock face above a portal. The information presented is adequate for the EA. Additional information will be required for the MAPA to support the proposed rock cut design.	The comment is acknowledged.	7-Jul-2016
MEM-016	12-Jun-2016	Michael Cullen, MEM	Geotechnical	The design for the rock cuts above the decline portals indicate that only rock bolt support is needed which will be determined at the time of construction. No head cover is planned. Generally accepted engineering practice is to have a head cover or to drape mesh over the rock face above a portal. The information presented is adequate for the EA. Additional information will be required for the MAPA to support the proposed rock cut design.	The comment is acknowledged.	7-Jul-2016
MEM-017	12-Jun-2016	Michael Cullen, MEM	Geotechnical	The feasibility level design for the TSF east dam is adequate for the EA. Additional information and detailed design will be required for the MAPA to support the design. Please note that revisions to the Health Safety and Reclamation Code around TSF design, construction and operation are expected to come into force in the near future and will need to be considered in the design.	The comment is acknowledged.	7-Jul-2016
MEM-018	12-Jun-2016	Michael Cullen, MEM	Geotechnical	The use of plugs to control water in mines is common. When properly investigated, designed, and constructed they can be relied upon to be geotechnically stable. The very conceptual plug designs presented is adequate for the geotechnical review of the EA. Hydraulic design will be assessed by others. Feasibility level designs will be required for the MAPA. It is recognized that the information required for detailed design will not be available until after the declines are driven.	The comment is acknowledged.	7-Jul-2016
MEM-019	12-Jun-2016	Michael Cullen, MEM	Geotechnical	No ground control management plan is provided. Appendix 5D merely states that a GCMP will be required. The information presented is adequate for the EA. A ground control management plan will be required for the MAPA.	The comment is acknowledged.	7-Jul-2016
MEM-020	12-Jun-2016	Michael Cullen, MEM	Geotechnical	Only conceptual designs for the water management ponds, ditches and other structures was located. No information on geotechnical design or stability (as was specified in AIR) was located. As these are common engineering structures we consider that the information provided is adequate for the EA. Detailed information consistent with the requirements of the Health Safety and Reclamation Code for Mines in BC will be required for the MAPA.	The comment is acknowledged.	7-Jul-2016
MEM-021	15-Jun-2016	Sean Shaw, MEM	Geochemistry	The datasets and results of investigations conducted as part of the Kemess North EA or the Kemess South closure plan are referenced but not provided in a number of sections and appendices of the EA. While MEM has access to these reports, the exact location (report name, section or appendix number, etc…) was not provided for easy reference. Additionally, other reviewers may not have access to these documents. In future, when referencing documents, please provide the data and results directly.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-022	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Is the waste rock material to be excavated from the Access Tunnel included in the estimate of the total amount of waste rock reporting to the KUG TSF per year in Table 5.11-1 (Section 5.11.1.1)? If not, please provide an estimate of the amount of waste rock that will be produced from excavation of the Access Tunnel.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-022.1	18-Jul-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Partially resolved. Please provide a breakdown of the waste rock produced by year based on i) source and ii) rock type.	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-023	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Section 2.3.1.1 in Appendix 7-E states: *"The Carb-NP is subsequently compared with the Sobek-NP for each sample, where the smaller of the two values is conservatively used for the calculation of the net potential ratio."* However, in Appendix A of Appendix 7-E, the higher of the Sobek-NP and Carb-NP values are used (in almost all cases) to calculate the NPR for Gossan, Takla, Toodoggone, BLI and Decline waste rock types. Please clarify this conflict and provide the recalculated values if required.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-023.1	18-Jul-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Partially resolved. Were the errors carried over to the summary tables and figures presented in the body of Appendix 7-E and Section 7? If so, please provide the revised tables.	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-024	15-Jun-2016	Sean Shaw, MEM	Geochemistry	The number of Gossan samples indicated in Appendix 7-E Table 2-2 do not correspond to the number of samples included in Appendix A of Appendix 7-E (for example n = 136 for Total Sulphur values while n = 54 is indicated in Table 2-2). Please clarify and provide an update to Table 2-2.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-025	15-Jun-2016	Sean Shaw, MEM	Geochemistry	The number of waste rock samples tested in the 2005 EA (Table 4.6, Appendix 5) does not correspond to the number of samples summarized in Table 7.3-3 of the EA. Please provide an explanation for the discrepancy. Please provide a rationale for excluding samples from the current dataset.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-026	15-Jun-2016	Sean Shaw, MEM	Geochemistry	It appears that Figure 2-24 to Figure 2-30 are mis-labelled as Takla waste rock and should instead be labelled as BLI.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-027	15-Jun-2016	Sean Shaw, MEM	Geochemistry	Section 24.11.4.1 indicates that if NPAG waste rock is recovered from the Access Tunnel it will be used for construction purposes. Segregation of PAG/NPAG waste rock during operations will require a defined methodology, of which NP measurement is a key component. MEM acknowledges the use of the lower value of the Sobek-NP and Carb-NP is a conservative approach. However, if segregation of waste rock for construction purposes will be conducted, AuRico needs to demonstrate a more fulsome understanding of the differences between Sobek-NP and Carb-NP, specifically: a. A summary of the Sobek-NP and Carb-NP results for the Gossan, Takla, Toodoggone, Decline and Access Tunnel samples included in Appendix 7-E Table 2-2, Appendix 7-E Table 2-3 and Appendix 7-F Table 2-2; b. A plot of Sobek-NP and Carb-NP values for each waste rock type, and c. A discussion of the differences between values and a rationale for the NP methodology chosen.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-027.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Resolved. A detailed segregation plan, supported by ABA results, will be required during Mines Act permitting in order to demonstrate that Access Tunnel and Decline waste rocks are suitable for construction purposes.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-028	15-Jun-2016	Sean Shaw, MEM	Geochemistry	Further to Comment #7, a detailed protocol and management plan will be required at the permitting stage for operational characterization, segregation of PAG/NPAG waste rock, including detailed sampling and analytical procedures.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-028.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Resolved. A detailed segregation plan, supported by ABA results, will be required during Mines Act permitting in order to demonstrate that Access Tunnel and Decline waste rocks are suitable for construction purposes.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-029	15-Jun-2016	Sean Shaw, MEM	Geochemistry	The Access Tunnel metal content data is omitted from the detailed summary of the materials (Section 2.3.2, Appendix 7-F). Additionally, the full ABA and metal content datasets are not included in the appendices. Please provide a summary and interpretation of the metal content results and the full ABA and metal content dataset(s).	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-029.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Resolved. Full ABA and SFE datasets for each waste rock type (BLI and Asitka) provided in Attachment #5 of the 20160706 KUG Comments Lorax_MEM Geochem_Memo.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-030	15-Jun-2016	Sean Shaw, MEM	Geochemistry	Please breakdown and summarize the data presented in Table 2-3 (Appendix 7-F, Section 2.3.2) according to waste rock type.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-030.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Resolved. The original comment referred to Table 2-3 of Section 2.3.2 (Appendix 7-F), which was an error. MEM had meant to refer to Table 2-3 of Section 2.3.3 (Appendix 7-F). However, that data was provided by the proponent in Attachment #1 of the 20160706 KUG Comments Lorax_MEM Geochem_Memo.	The Proponent thanks the reviewer for the feedback	28-Oct-2016
MEM-031	15-Jun-2016	Sean Shaw, MEM	Geochemistry	Section 2.3.1.6 (Appendix 7-F) indicates that the Decline Tunnel Takla waste rock samples are predominantly NPAG; however, in Figure 2-34 these samples plot above the NPR = 1 trendline. Please clarify the statement.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-032	15-Jun-2016	Sean Shaw, MEM	Geochemistry	All roadways, roadway embankments and any other mine site infrastructure incorporating waste rock in their construction should only use NPAG material. Appropriate confirmatory sampling protocols will be required at permitting.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-033	15-Jun-2016	Sean Shaw, MEM	Geochemistry	An on-site laboratory will conduct various analyses on materials requiring segregation and on non-deposit rocks. These on-site laboratory facilities will be required at the initiation of construction activities. MEM will require that all analytical results from the on-site lab are verified by an external accredited laboratory, until the lab is verified to be operating properly.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016

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ID #	Comment Date (i.e. 22-May-16)	Reviewer Name / Agency (i.e. Alex Kwang, MEM)	Subject (See "instructions" tab)	Comment (Include Memo reference as applicable)	Proponent Response (Include Memo reference as applicable)	Response Date
MEM-034	15-Jun-2016	Sean Shaw, MEM	Geochemistry	Please provide the supernatant water quality values for the three super composite tailings samples outlined in Table 2-5 of Appendix 7-F.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-034.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Partially resolved. i) According to Northgate (2005), the combined super composite sample SCO2 was selected on the basis that it was "representative blend of material that may be milled during the life of Kemess North". The super composite samples SC-1 through SC-6 originate from core samples collected over the entire depth of the proposed Kemess North open pit. However, the KUG ore will predominantly be extracted from the BLI horizon (quartz diorite/monzonite in Northgate, 2005). Based on these differences, please demonstrate how the SCO2 sample from Northgate (2005) is representative of the tailings that will be produced for KUG. ii) It is understood by MEM that new metallurgical testing has been completed or is being completed on ore material that will be mined from the KUG deposit. Specifically, what type of static and kinetic testing has been conducted on these samples? Does AuRico intend to substitute this new dataset for the SCO2 dataset included in the EA? If so, when will the results and data interpretation be provided?	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-034.2	29-Nov-2016	Sean Shaw, MEM	Geochemistry	The new tailings testwork results and the associated changes to the water quality model will be required at permitting (MA Permit Requirement)	AuRico acknowledges further discussion on the comment is deferred to permitting.	21-Dec-2016
MEM-035	15-Jun-2016	Sean Shaw, MEM	Tailings and Waste Rock Management	A NPAG tailings cover has been proposed for the KUG TSF tailings beach. Please provide additional information for the proposed NPAG tailings, including source material, geochemical and geotechnical characterization and conceptual design information.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-035.1	18-Jul-2016	Sean Shaw, MEM	Tailings and Waste Rock Management	Partially resolved. When will the results and data interpretation be provided?	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-035.2	29-Nov-2016	Sean Shaw, MEM	Tailings and Waste Rock Management	The new tailings testwork results and the associated changes to the water quality model will be required at permitting (MA Permit Requirement)	AuRico acknowledges further discussion on the comment is deferred to permitting.	21-Dec-2016
MEM-036	15-Jun-2016	Sean Shaw, MEM	Geochemistry	More information is required to provide a better understanding of the ore stockpiles during the Construction, Operations and Closure phases. Please provide a summary of the pile dimensions, the anticipated amount and timing of ore reporting to the stockpiles and a comparison of storage time and the time to the onset of acidic conditions.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-036.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Partially resolved. The dimensions and general layout of the temporary ore stockpile in the Portal area is outlined in Section 3.4.2 of Appendix 5-E. However, there is no information provided on the ore stockpile located at the milling and processing facility. i) How long will ore be stockpiled at the milling and processing facility? What are the dimensions of the stockpile area? How is seepage contained and collected from the stockpile area? ii) For the temporary ore stockpile in the Portal Area, how is seepage contained and collected?	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-036.2	29-Nov-2016	Sean Shaw, MEM	Geochemistry	A contigency plan for each of the ore stockpiles in the event of mine closure is required at permitting (MA Permit Requirement)	AuRico acknowledges further discussion on the comment is deferred to permitting.	21-Dec-2016
MEM-037	15-Jun-2016	Sean Shaw, MEM	Geochemistry	Were any soil and/or overburden samples collected from within the planned mine footprint? If so, please provide the sampling locations and results. If not, please provide a rationale for their exclusion from the sampling program.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-037.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Unresolved. Section 6.4.2 indicates that there is approximately 37,000 m3 of recoverable soil within the Portal area. Section 3.3.4 and 3.4.2 of Appendix 5-E indicate that clearing and grubbing of the roadway areas will be required. Furthermore, a 535 location soil survey was undertaken throughout the proposed study area. The stockpiling of overburden can lead to elevated concentrations in runoff and seepage. Please indicate how the soil/overburden stockpiles have been accounted for in the site water quality model.	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-038	15-Jun-2016	Sean Shaw, MEM	Geochemistry	A soil/overburden stockpile is proposed to be located just west of the KUG TSF in Figure 6.4-1. Please provide a summary of this stockpiles proposed dimensions and estimated material volume(s) similar to those presented for the remaining stockpiles in Table 6.4-2.	The soil/overburden stockpile located immediately west to the Kemess open pit will be approximately 70 m x 70 m to accommodate the storage of 10,000 m^3 of salvaged soil.	5-Aug-2016
MEM-039	15-Jun-2016	Sean Shaw, MEM	Geochemistry	Will a low-grade ore stockpile be developed and maintained during the Operations phase? If so, what are the contingency plans in the event that the low-grade ore is not milled? How have these plans been incorporated into the Water Quality Model?	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-039.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Partially resolved. Please provide a MEM with a clear understanding of how the dataset used to represent the ore stockpile loadings in the water quality model was developed from the available geochemical data.	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-040	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	How will seepage from the plant site ore stockpile be collected and where will it report?	The plant site ore stock pile will be re-established on the former Kemess South ore stock pile site. The ore will be placed on a compacted earth base, sloped to facilitate seepage to a central location. Any seepage water will be directed to the Process Facility. Design details will be included with Permit applications.	6-Jul-2016
MEM-040.1	18-Jul-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Partially resolved. Has seepage to groundwater from the ore stockpile been accounted for in the facility design? Has this been incorporated into the water quality and/or groundwater model?	The response is provided in the memo **20161017_KUG Comment MEM-040.1_Round 2_Stockpiles_Memo**	17-Oct-2016
MEM-041	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	In the descriptions of the transfer of contact water from the underground workings to the surface, separate statements indicated that this water would report to the Transfer Pond and the Sedimentation Pond. Please clarify to which water management structure the water will report.	The uderground contact water will be directed to the surface Transfer Pond and subsequently pumped to the KUG TSF. The Sedimentation Pond will receive surface run-off water from the local catchment area.	6-Jul-2016
MEM-042	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Both the selenium and metals water treatment plants will be operated at full capacity (50 L/s and 120 L/s) throughout the Operations and Closure phases, or more than 20 years. Are there any plans for one or both plants to be taken off-line during this time period? Please outline the contingency plans for water management should the plants go offline or are unable to operate at full capacity.	There is no plan to take the treatment plants off line during operations, nor while required during the closure period. Of note, the plants will be operated seasonally (6 months) for discharge to Attichika Creek. Contingency plans, for if the plants go off line, is to cease discharge and utilize the available storage capacity within the KUG TSF until the necessary repairs/adjustment have been made.	6-Jul-2016
MEM-042.1	18-Jul-2016	Sean Shaw, MEM	Water (Quality & Treatment)	What will be the available storage capacity of the KUG TSF during each year of operation? In other words, what will be the capacity (both in total volume and in mill operating time) for the KUG TSF to store contact water should the water treatment plant(s) be offline for an extended period?	The response is provided in memo **20161116_A.1 KUG Comment MEM-042.1_Round 2_TSF Storage_Memo**.	17-Oct-2016
MEM-043	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	The ultimate disposal method for the water treatment waste solids have not been outlined; although, the options of placing them into the KUG TSF or trucking off-site are discussed in Appendix 5-C. The conceptual plans for disposal of these wastes are required at the EA stage.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-043.1	18-Jul-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Partially resolved. When will the results and data interpretation be provided?	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-044	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	A detailed accounting of the production schedule, amount and geochemical characterization of the selenium and metals treatment plant by-products will be required at permitting.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-045	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Detailed designs and capital and operating costs will be required at permitting for the metals and selenium treatment plants.	The comment is acknowledged.	7-Jul-2016
MEM-046	15-Jun-2016	Sean Shaw, MEM	Geochemistry	Please provide a summary of the Decline Tunnel waste rock SFE results for each waste rock type (Table 3-2, Appendix 7-E). Additionally, please provide the full SFE dataset.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-047	15-Jun-2016	Sean Shaw, MEM	Geochemistry	Section 4.3.4.1 (Appendix 7-E) indicates that an updated Groundwater Flow Model will be used to update the assumptions made for lateral seepage through the subsidence zone (pg 4-18). Is this new model available and are updated predictions being provided.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-048	15-Jun-2016	Sean Shaw, MEM	Geochemistry	At closure it is assumed that water quality reporting to East Cirque Creek from the subsidence zone will be controlled primarily by groundwater within the fractured gossan material (Section 4.5, Appendix 7-E); however, this is not thoroughly explained. Please provide a rationale for not considering the potential influence of the fractured Takla and/or BLI zones on the quality of water reporting to East Cirque Creek.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-048.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Partially resolved. Both selenium and sulphate are substantially higher in post-closure water quality estimates for the Takla unit compared to Gossan. Has any sensitivity analyses been conducted to determine at what percentage contribution the deep groundwater would have an impact on East Cirque Creek (or other water bodies) surface water quality? If not, could you please provide additional discussion of the results with a focus on selenium and sulphate concentrations and how the deeper groundwater could potentially influence the water quality reporting to East Cirque Creek or other receptors?	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
MEM-049	15-Jun-2016	Sean Shaw, MEM	Geochemistry	During the Construction and/or Operations phases, will any of the existing waste rock and/or tailings in the Open Pit be exposed above water? If so, how much and for how long and has it been incorporated in to the Water Quality model?	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-050	15-Jun-2016	Sean Shaw, MEM	Geochemistry	The geochemical source terms for the waste rock that will be deposited into the KUG TSF during the excavation of the Access Tunnel and Decline Tunnels, outlined in Appendix 11-D Table 3.3-1, were not explicitly developed in either Appendix 7-E or 7-F. Please provide a summary of the source term assumptions, calculations and results.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-050.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Partially resolved. While a source term was incorporated into the water quality model, the assumptions and calculations used to develop the source term were not demonstrated within the report. i) Please provide a summary of the assumptions and an example of the calculations used to develop the waste rock source terms provided in Attachment 8. If these have already been provided within the EA, please reference the specific location(s) that they can be found. ii) Are the monthly masses summarized in Attachment 8 applied to all 12 months of the year within the water quality model?	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-051	15-Jun-2016	Sean Shaw, MEM	Geochemistry	The geochemical source terms for surface runoff from the East Dam , outlined in Appendix 11-D Table 3.3-1, were not explicitly developed in either Appendix 7-E or 7-F. Please provide a summary of the source term assumptions, calculations and results.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-051.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	According to Section 3.1 of Appendix 7-F, the tailings supernatant source term was derived from the 2005 SCO2 tailings aging test results. However, it is unclear of exactly what values were used for the seepage assumed to be migrating from the proposed East Dam. i) Are the East Dam seepage source terms assumed to be equivalent to the tailings supernatant aging test source term provided in Table 3.1 (Appendix 7-F)? ii) Please provide a revised summary table (Table 3.1, Appendix 7-F) that includes the expected and upper estimates for all constituents analyzed as part of the tailings supernatant aging test. iii) To confirm, the source term derived from monitoring station WQ-SRP is used to represent the KUG-TSF seepage prior to the addition of waste rock and tailings from KUG operations?	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-052	15-Jun-2016	Sean Shaw, MEM	Geochemistry	The geochemical source terms for seepage from the KUG TSF tailings were based on the 90 day aging test conducted on tailings for the 2005 Kemess North EA application. Please provide a summary of the experimental setup, sample collection and analyses conducted. Additionally, please provide the full dataset and summary table and show a comparison to the KS TSF seepage water quality dataset.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-053	15-Jun-2016	Sean Shaw, MEM	Geochemistry	Please provide a rationale for excluding potential loadings from the new waste rock from the KUG TSF seepage source term.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-053.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Partially resolved. While a source term was incorporated into the water quality model for the Access Tunnel and Decline waste rock that will be placed in the KUG TSF, the assumptions and calculations used to develop the source term were not provided within the report. i) Please provide a summary of the assumptions and an example of the calculations used to develop the waste rock source terms for the waste rock originating from the Access Tunnel and Declines. If these have already been provided within the EA, please reference the specific location(s) that they can be found. ii) Please provide a summary table of the waste rock source terms inputted into the water quality model.	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-054	15-Jun-2016	Sean Shaw, MEM	Geochemistry	The geochemical source terms for seepage from the temporary ore stockpile in the portal area, outlined in Appendix 11-D Table 3.3-1, were not explicitly developed in either Appendix 7-E or 7-F. Were source terms calculated for the proposed soil/overburden stockpiles? If not, please provide a rationale for their exclusion.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-054.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Partially resolved. The potential loadings from the overburden/soil stockpiles planned for the portal and other areas of the mine should be incorporated into the water quality model at the EA level. If they are to be excluded from the water quality model, please demonstrate how the expected loadings will be minimal relative to other inputs. Please provide a summary of the constituent source terms for the ore stockpiles that will be inputted into the water quality model or provide a reference to where this summary is already provided in the EA.	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-055	15-Jun-2016	Sean Shaw, MEM	Geochemistry	Geochemical source terms were not developed for the overburden stockpiles or the overburden that will potentially be used to cover the KUG TSF beach post-closure. These source terms should be developed or a rationale for their exclusion should be provided.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-056	15-Jun-2016	Sean Shaw, MEM	Geochemistry	For the Pit Wall source terms, a stored load was calculated for the yearly exposed wall surface area; however, the potential loadings contributed to the KUG TSF from the submergence of the Pit Walls and bench talus does not appear to be included. If this is the case, please include this source term or provide a rationale for its exclusion.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-056.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Partially resolved. The outstanding questions MEM has regarding the assumptions and calculations used to calculate the Highwall source terms would be better dealt with through an in-person or phone conversation. This can be accomplished at the planned geochemistry sub-working group meeting.	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-057	15-Jun-2016	Sean Shaw, MEM	Geochemistry	What time period does the 'first flush' for the BLI trickle leach columns used in the Gallery Lateral Flow calculations represent? Please provide a summary of the calculations and results.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-058	15-Jun-2016	Sean Shaw, MEM	Geochemistry	The KUG TSF management plan indicates that an exposed tailings beach will be present for approximately 10 years prior to placement of an NPAG cover material. Geochemical characterization studies indicate that the tailings are considered PAG; however, source terms have not been developed for the contribution of the tailings beach to KUG TSF loadings. Please develop these source terms or provide a rationale for their exclusion.	The response is provided in memo **20160706 KUG Comments Lorax_MEM Geochem_Memo**	6-Jul-2016
MEM-058.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Partially resolved. Please provide a summary of the assumptions and calculations used to develop the source terms for the NPAG discussed in the response to the original question. Please provide a summary of the assumptions and calculations used to develop the source terms for the PAG beach tailings prior to the placement of the NPAG cover.	The response is provided in the memo **20161109_KUG_Comments_MEM_Geochem_Lorax**	10-Nov-2016
MEM-059	15-Jun-2016	Sean Shaw, MEM	Geochemistry	The potential loadings reporting to the KUG TSF from the Access Tunnel were discounted as being insignificant based on the estimated flow rates (~ 1 L/s) into the tunnel from the surround rock material. In order to demonstrate this assumption, please provide an estimate of the monthly loadings that will be produced from the Access Tunnel and provide a comparison to other loading sources reporting the KUG TSF.	For all relevant Project phases, mine dewatering flows were included in the surface water model and represent the predominant underground load to the KUG TSF. During operations, loadings to the KUG TSF are dominated by tailings deposition. The potential loadings from the Access Tunnel were discounted as insignificant because the estimated flow rates (~1 L/s) represent less than 2% of the flows during the low flow period of Operations.	5-Aug-2016
MEM-059.1	18-Jul-2016	Sean Shaw, MEM	Geochemistry	Please demonstrate how the Access Tunnel flows represent 2% of total flows during the low flow period of Operations. What percentage of total flows to the KUG TSF do the flows represent post-closure? Please provide an estimate of the monthly loadings.	The response is provided in memo **20161024_KUG Comment MEM-059.1_AccessTunnel_Memo.**	28-Oct-2016
MEM-059.2	29-Nov-2016	Sean Shaw, MEM	Geochemistry	As outlined in the response memo, inclusion of contact flows and associated loadings from the proposed Access Tunnel will be expected to be incorporated into the site models at permitting (MA Permit Requirement)	AuRico acknowledges further discussion on the comment is deferred to permitting.	21-Dec-2016
MEM-060	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	MEM believes that the simplifying assumptions included within the Water Quality Model are reasonable and generally conservative. At permitting and during mine operations, the assumptions incorporated into the Water Quality Model should be re-evaluated and updated as required as more information becomes available through ongoing testing and operational monitoring.	The comment is acknowledged.	7-Jul-2016
MEM-061	15-Jun-2016	Sean Shaw, MEM	Geochemistry	Concentration units should be identified for all tables and figures. Units were not included in Tables 3.2-3 to 3.2-6 and Tables 3.5-3 to 3.5-16.	The comment is acknowledged. All values in Tables 3.2-3 to 3.2-6 and Tables 3.5-3 to 3.5-16 are in mg/L.	5-Aug-2016
MEM-062	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	The British Columbia Pollution Control Objectives for Mining are no longer applicable. Please select a different set(s) of more recent values (such as Aquatic Life or Drinking Water guidelines) for comparisons and provide a justification for their use.	BC Pollution Control Objectives (1979) were used as benchmarks for evaluating predicted effluent quality. The proponent understands that these objectives have been rescinded; however, they represent a useful tool for assessing the likelihood of achieving permittable effluent limits. BC Pollution Control Objectives have recently been used in other approved BC Applications , including Murray River, KSM and Brucejack projects, for benchmarking effluent quality. The proponent understands that discharge limits that consider site-specific conditions including available low flow dilution will be established during permitting.	6-Jul-2016

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MEM-063	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	For all tables presented in Appendix 11-D Section 3.5 (Water Quality Model Results), please include a comparison to applicable guidelines as a reference.	The tables in Section 3.5 of Appendix 11-D include a comparison to applicable guidelines as a reference. Please refer to the table footnotes for details.	6-Jul-2016
MEM-064	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	For the predicted water quality model results presented in Appendix 11-D Section 3.5, please provide concentration vs. time graphs (Construction through Post-Closure) for key constituents for the nodes summarized in Tables 3.5-1 to 3.5-16. Additionally, please include applicable guidelines as a reference.	Concentration vs time graphs for key constituents at various model nodes are presented in Section 11.6 of the Application. These graphs include applicable guidelines as a reference.	6-Jul-2016
MEM-065	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	For the predicted water quality model results for the six sensitivity scenarios, please provide a summary of the results for key constituents for the model nodes included in Appendix 11-D Section 3.5. Additionally, provide a discussion of any significant differences of these results from the base case results.	A summary of the results of the base case and six sensitivity scenarios is provided in Table 11.6-9 in Section 11.6 of the Application. A discussion of the results, including any differences from the base case results, is included in Section 11.6.2 in Section 11.6 of the Application.	6-Jul-2016
MEM-066	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Please provide a graphical summary, for each key constituent, of the relative contribution to the total loadings for each source, including background loadings, reporting to the KUG TSF during the Construction, Operations, Closure and Post-Closure phases (similar to the graphs presented for the KUG water quality predictions for mine workings in Appendix 7-E Section 5.2).	Response is provided in the memo **20160805_KUG Comment MEM-066_WQ_memo.**	5-Aug-2016
MEM-067	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Similar to comment #46, please provide a graphical summary of the relative contribution of each source, including background loadings, reporting to Attichika Creek, East Cirque Creek and Attycelley Creek during the Construction, Operations, Closure and Post-Closure phases.	The response is provided in memo **20160805_KUG Comment MEM-067_WQG_Memo**.	5-Aug-2016
MEM-067.1	18-Jul-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Resolved. However, this could be a question for the WG meeting next Monday - What is causing the spike of underground loadings at approximately year 2070 in East Cirque Creek (KN-12) (Figures 15-21; '20160805_A.1 KUG Comment MEM_067_WQ_memo.pdf')	The memo **20160805_KUG Comment MEM-067_WQG_Memo** presents the source loading (mg/s) as well as the relative contribution of each source (%) for each water quality parameter for key assessment nodes and the KUG TSF in a series of figures. Figures 15 through 21 present results for East Cirque Creek (Node: KN-12). There is no spike/abrupt increase in absolute loadings (mg/s), as can been seen in the top panel for each parameter. The apparent 'spike' in bottom panel graphs (i.e., the relative loading results) corresponds to the shift in the relative importance of background non-contact water versus loadings from the flooded underground mine to predicted water quality at KN-12 for those timesteps.	28-Oct-2016
MEM-068	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	In Appendix 11-D, the Post-Closure phase is defined as the phase where active water treatment is no longer required, which was determined from the predicted water quality for the KUG TSF. However, no clear discussion or results were provided to demonstrate why the Closure period is assumed to occur between Years 14 and 19. Please provide the water quality criteria used to make this determination and present the rationale and/or evidence that demonstrates that these criteria were met at Year 19.	As described in Section 3.5.1 of the Application, the Post-Closure phase is defined as the phase when water in the KUG Tailing Storage Facility (TSF) is of suitable quality for direct untreated discharge. Suitable water quality was determined by minimizing predicted exceedances of water quality guidelines in Waste Rock Creek by optimizing the discharge and water treatment schedules. Table 3.5-2 of Appendix 11-D presents predicted KUG TSF water quality for post-closure indicating that water quality during that period is likely to meet expected permitted discharge limits.	6-Jul-2016
MEM-068.1	18-Jul-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Unresolved. The table referenced in the reply shows the average water for post-closure, but does not demonstrate how the closure and post-closure periods were determined. It remains unclear from the response how the closure period was determined to be between years 14 and 19. This question would be best resolved during the geochemistry sub-working group meeting scheduled in August.	The response is provided in memo **20160805_KUG Comment MOE-052_WQG_Memo.**	28-Oct-2016
MEM-069	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	A detailed surface water monitoring plan, including sample locations, collection schedule, parameter list and reporting requirements will be required at permitting.	The comment is acknowledged.	7-Jul-2016
MEM-070	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	A detailed breakdown of the costs associated with Closure will be required at permitting in order to determine the appropriate bonding.	The comment is acknowledged.	7-Jul-2016
MEM-071	15-Jun-2016	Sean Shaw, MEM	Water (Quality & Treatment)	Water quality model results indicate that treatment of KUG TSF discharge water will be required for six years once operations cease; however, the proponent will be required to commit to an extended water treatment timeframe should it be required.	The comment is acknowledged.	7-Jul-2016
MEM-072	15-Jun-2016	Sean Shaw, MEM	Geochemistry	At permitting, information on the long term monitoring and maintenance required for the hydraulic plugs installed in the declines will be required along with a detailed cost estimate.	The comment is acknowledged.	7-Jul-2016
NRCan-001	15-Jun-2016	Jessica Coulson, Natural Resources Canada	Terrain and Soils	The proponent states: "Based on the existing seismicity information pertaining to the site, it has been estimated that the dam stability would not be compromised by the 10,000-year recurrence-interval earthquake (AMEC 2012a)". Other than this statement, NRCan did not find any background information regarding the 10,000-year recurrence-interval earthquake. The Probabilistic Seismic Hazard Assessment (PSHA) conducted by Klohn-Crippen (2005) only provides hazard for the 2,475-year recurrence interval. NRCan requests that the proponent provide the hazard assessment that underpins the dam stability assessment for the 10,000-year recurrence-interval earthquake.	As per the Canadian Dam Association (CDA) 2007 Dam Safety Guidelines, the Maximum Credible Earthquake (MCE) is taken to be equivalent to the 10,000-year recurrence interval seismic event. Therefore, if dam stability would not be comprimised by the MCE, it would be similarly uncomprimised by the 10,000-year recurrence interval earthquake. Appendices D and E of AMEC 2012a provide the stability assessments that demonstrate satisfactory stability and deformation in response to the MCE. However, as the TSF design is based upon a deterministic seismic hazard assessment, its calculation of MCE does not have an associated recurrence interval. Therefore, the statement of satisfactory performance under the 10,000-year recurrence interval earthquake, while technically correct, is inaccurate in its terminology, and Amec Foster Wheeler apologizes for the ambiguity that arises from it.	8-Jul-2016
NRCan-002	15-Jun-2016	Jessica Coulson, Natural Resources Canada	Terrain and Soils	The proponent noted that, based on the historical catalogue, two earthquakes of magnitude 6.0 occurred near the Rocky Mountain Trench (RMT) over 400 km away. Does the proponent suggest that the RMT is an active structure (fault)? And if so, are they aware that this structure passes within 80 km to the east of the Kemess mine site? What might this mean for their estimates of the Maximum Credible Earthquake (MCE) that might affect the site?	Amec Foster Wheeler is not aware of any published reports of evidence of Holocene seismic activity on the Rocky Mountain Trench (RMT), nor of any evidence that the reported earthquakes were directly associated with the RMT itself. Descriptions of previous earthquakes being near the RMT were purely geographic and were not intended to imply any seismic association with the RMT. However, it is noted that the MCE assumed for the design is an earthquake 20 km away from the Kemess site, which is significantly closer than the closest point of the RMT.	8-Jul-2016
NRCan-003	15-Jun-2016	Jessica Coulson, Natural Resources Canada	Terrain and Soils	NRCan notes that the Probabilistic Seismic Hazard Assessment (PSHA) conducted by Klohn-Crippen (2005) is now 11 years old. Many advances in seismic hazard assessments have been made since this assessment and these advances are likely to affect the final hazard calculations (e.g., updated earthquake catalogues and improved ground-motion models). Furthermore, NRCan has recently provided its updated seismic hazard values as calculated for the 2015 National Building Code of Canada (http://www.earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/index-en.php). The inputs used in NRCan's national hazard assessment are provided in *Halchuk et al. (2014)* and *Halchuk et al. (2015)*. NRCan recommends that the proponent update their site-specific PSHA to reflect recent advances in seismic hazard modelling techniques and new data. Halchuk, S., T. I. Allen, J. Adams, and G. C. Rogers (2014). Fifth generation seismic hazard model input files as proposed to produce values for the 2015 National Building Code of Canada, Geological Survey of Canada Open File 7576, 15 pp, doi:10.4095/293907. Halchuk, S., T. I. Allen, G. C. Rogers, and J. Adams (2015). Seismic Hazard Earthquake Epicentre File (SHEEF2010) used in the Fifth Generation Seismic Hazard Maps of Canada, Geological Survey of Canada Open File 7724, 16 pp, doi: 10.4095/296908.	While the feasibility-level design of the KUG TSF aknowledges the Klohn 2005 PSHA, it does not rely upon it for any design basis. Instead, the design basis for site seismicity employed for the KUG TSF (and the existing Kemess South TSF) was a deterministic analysis which determined the MCE to be a M6.0 earthquake corresponding to a PGA of 0.19g. Klohn (2005) noted that "the adoption of 0.19g PGA associated with a magnitude 6 event…is conservative based on the current database and understanding of site seismicity." Futhermore, comparison of the 1 in 2475 year National Building Code (NBC) interpolated seismic hazard values of PGA for the Kemess site indicate that NBC calculated seismic hazard has remained relatively unchanged from 2005 to 2015. The interpolated value of PGA for the 1 in 2475 year hazard was 0.059g in 2005, whereas in 2015 it was lower at 0.049g. This reinforces that the PSHA for the Kemess region have changed little or become more conservative in the intervening decade, as well as reinforcing the conservatism employed in the original deterministic assessment for the Kemess South TSF.	8-Jul-2016
NRCan-004	15-Jun-2016	Jessica Coulson, Natural Resources Canada	Terrain and Soils	The proponent supplies PGA estimates for three deterministic scenarios for the Kemess mine site based on the Klohn-Crippen (2005) report. As per the 2015 seismic hazard model of Canada (*Halchuk et al, 2014*), the Northern British Columbia (NBC) seismic source zone, in which the mine is located, assumes that an earthquake up to M7.2 can occur anywhere within the zone. NRCan has concern that the Maximum Credible Earthquake (MCE) scenario of a M 6.0 earthquake at 20 km is too small. NRCan recommends that seismic deaggregations be performed to determine the earthquake magnitude and distance that contributes the most to the long-period (T > 1.0 s) seismic hazard. These deaggregations will help determine which earthquakes are the most appropriate for deterministic hazard assessments. Furthermore, given the site's proximity to the RMT (which is not explicitly defined in the NRCan model), a deterministic scenario should be conducted assuming a large-magnitude earthquake (e.g. M7.0) on this structure.	Within 500 km of the Kemess site, only three earthquakes larger than M5.0 have been recorded. All of these were more than 250 km away, and the largest was a M5.4 over 400 km away. Given the paucity of recorded earthquakes in the region, a deterministic approach to seismic hazard was favoured in design compared to a probabilistic one, and that assessment determined a M6.0 earthquake, 20 km away, to present the most significant seismic hazard to the Kemess site. However, the specific magnitude selected as the design earthquake is of less importance than the associated ground acceleration. In response to this review comment, the ground acceleration from the MCE used in design (0.19g) was compared with other available data. In AMEC 2012a, it is noted that the design value used is conservative in comparison to the values predicted by the 2005 Klohn PSHA, which recommended a ground acceleration of 0.13g be used for the MCE. To obtain further comparison, the 2015 National Building Code of Canada (NBCC) Site Class C seismic hazard was queried for the Kemess site. As recommended as a screening level approach for determining the 1 in 10,000 year seismic hazard (assumed to be the MCE per CDA Guidelines), the values for 5%/50 year and 2%/50 year were extrapolated on a logarithmic scale. For the Sa(1.0), Sa(2.0), and PGA, the estimated ground accelerations were 0.088g, 0.052g, and 0.082g, respectively, less than half the design value of 0.19g used for the KUG TSF. Though this is only a screening level approach, given that the value used in design is significantly higher, and also higher than the value from the 2005 Klohn PSHA, the conservatism of the design value is demonstrated.	8-Jul-2016
NRCan-005	15-Jun-2016	Jessica Coulson, Natural Resources Canada	Tailings and Waste Rock Management	It is NRCan's view, that PGA is a poor predictor of likely impact for large structures such as tailings dams. Please confirm whether longer-period ground-motion information was used to a undertake a seismic risk assessmsnt for the tailings dam. If not, these studies should be conducted.	As the East Dam of the KUG TSF will primarily be composed of free-draining, non-liquefiable rockfill, only screening level assessments of seismic effects on the dam were undertaken. These consisted of pseudo-static stability analyses, as well as estimates of permanent seismic deformations using the Makdisi-Seed and Bray-Travasarou methodologies. These analyses indicated satisfactory seismic performance; a pseudo-static calculated Factor of Safety (FoS) of 1.6 versus a target FoS of 1.0, and seismic deformations of 3 cm or less under the design earthquake. For all of these analyses, it is considered the state of practice to use the PGA as the seismic input, and not any longer period ground motion. Futhermore, as described in the response to ID NRCan 4, the ground motion for PGA used (0.19g) is significantly higher than estimates of long-period ground motion from a screening level extrapolation of the 2015 National Building Code of Canada (NBCC) seismic hazard model. Given the robust predicted seismic response of the dam, and the conservatism of the ground acceleration value assumed in design when compared to available data, it is the opinion of Amec Foster Wheeler that the existing seismic hazard assessment performed to date is satisfactory for a feasibility-level design. It is anticipated that review of the seismic hazard assessments performed to date will be carried out as part of detailed design, and if necessary further assessments will be carried out, taking into account new available data.	8-Jul-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
NRCan-006	15-Jun-2016	Jessica Coulson, Natural Resources Canada	Water (Ground)	The mine development requires dewatering which will necessarily result in modification of the groundwater quantity and quality. At shallow depths, the groundwater is relatively young freshly recharged water, whereas deeper groundwater is rich in ion concentrations. The monitoring wells used for determination of the baseline groundwater quality are up to 150 mbgs deep. Please confirm how the quality of the groundwater sampled in these wells is representative of the groundwater quality that will be encountered in the cave gallery located approximately at a depth of 550 m below ground surface at an elevation of about 1160 m. In addition, could the Proponent provide information on the expected groundwater quality at 550 m below ground surface and information on how they expect the water from the dewatered underground mine will impact the receiving environment.	The reviewer correctly indicates that the deepest monitoring wells sampled for water quality are on the order of 150 m deep. In addition to the monitoring wells, water quality samples have also been collected from a flowing artesian exploration hole KN10-03 in East Cirque, located immediately adjacent to the predicted surface expression of the panel cave (insets of Figure 9.4-2 and Figure 9.4-4 in Section 9.4 of the Application). The hole was drilled to 500 m, but the depth to which it remains open is unknown. The water quality from this hole is discussed in Section 9.4.4.5 of the Application (and Chapter 4 of Appendix 9-A). Kinetic testing data on gossan material (lab based trickle leach, saturated column testing, field bins) correlates well with water quality measured at KN10-03 (Appendix 7-E, Section 4.5, pg: 4-38). The source term water chemistry associated with the ore zone is described in Section 7.3.5.2 of the Application and is presented based on the various stages of operations and closure; it is also summarized in Section 9.6.2.1 of the Application. The conceptual model of groundwater flow as it relates to contact water evolution is depicted in Figures 9.6-14 and 9.6-15 of the Application. Predictions of contact water quality within the cave zone were developed using multiple data sources including kinetic testwork from Northgate (2005) and kinetic testwork conducted in 2014. The 2014 program established laboratory trickle leach columns and field bins that were designed (based on the conceptual models presented in Figures 9.6-14 and 9.6-15 of the Application) to evaluate the reactivity and loading of each of the major units affected by break-up from the cave gallery to surface (see Section 7.3 and Appendix 7-E). Predictions of contact water quality in the cave zone did not utilize groundwater quality measured at wells. For the purposes of developing conservative predictions of underground water quality, geochemical testing and water quality modelling predictions are based on results from fully oxic column and field bin testwork and have therefore conservatively assumed fully oxic conditions from surface to +600 m depth.	8-Jul-2016
NRCan-007	15-Jun-2016	Jessica Coulson, Natural Resources Canada	Geotechnical	The EIS contains limited information on the substrate (bedrock and unconsolidated sediments) of the proposed East Dam for the TSF. Please confirm whether there has been any geotechnical drilling done at the site of the dam to assess the physical properties of the substrate. The presence of advance-phase glacial lake sediments has been noted south of the tailing ponds (Appendix 12B section 2.6.2.1). Advance-phase glacial lake sediments can cause slumping, as observed in the study area (Appendix 12-B, section 2.6.2.2). Similar sediments could be present underneath the till where the East Dam is to be located. The strength and the response of such sediment to overloading should be assessed prior to the construction of the dam. Failure of the dam would have an important environmental impact on Kemess and Attichika creeks and downstream into Thutade Lake (Appendix 4-C).	Geotechnical investigations of the East Dam foundation were carried out in the fall of 2011, consisting of six diamond drill holes (three each in bedrock and overburden, respectively), and six overburden test pits. A summary of the investigations carried out and their results can be found in Appendix B of the KUG Feasibility Study Mine Waste and Water Management Design Report, dated 9 November 2012. Drawings KUG.TSF.009 through KUG.TSF.014 of the above referenced report indicate the locations and general stratigraphy from the 2011 investigations in section and plan view. Glaciolacustrine silt and clay sediments were observed in two boreholes and three test pits near the toe of the proposed East Dam. However, all the observed glaciolacustrine sediments were shallow, and it is the intent of the feasibility level design to remove these sediments during initial stripping and foundation preparation, as discussed in Section 7.2.2 of the above referenced report.	8-Jul-2016
NRCan-008	15-Jun-2016	Jessica Coulson, Natural Resources Canada	Other	Please add "and its Regulations (2013)," as follows: Explosives transportation, storage and use will be consistent with the requirements of the federal Explosives Act ~~(1985),~~ (1985) and its Regulations (2013), Transportation of Dangerous Goods Act (1992), and the provincial Health, Safety and Reclamation Code for Mines in British Columbia (BCMEMPR 2008).	The Proponent ackowledges the comment.	8-Jul-2016
NRCan-009	15-Jun-2016	Jessica Coulson, Natural Resources Canada	Other	Please add "and its Regulations (2013)," as follows: Explosives will be transported by qualified contractors following the strict requirements of the federal Explosives Act (1985) and its Regulations (2013), and the Transportation of Dangerous Goods Act (1992) and the Transportation of Dangerous Goods Regulations (2001).	The Proponent ackowledges the comment.	8-Jul-2016
MOE-002	14-Jun-2016	Graham Veale, MoE	Air Quality	Re. Dustfall Objectives: The BC Pollution Control Objectives were rescinded in 2006. The associated dustfall objectives are outdated and no longer supported for use except in limited circumstances. The criteria values (1.75 & 2.9mg/dm2/day) should not be understood to provide human or environmental health protection (see memo ID 0614_MoE_Dustfall	Comment noted, the MOE internal document is appreciated. It is acknowledged that the PCO are not currently supported guidelines, but were used as a benchmark value in the absence of other guideline values.	6-Jul-2016
MOE-003	14-Jun-2016	Graham Veale, MoE	Air Quality	The location of several emission sources, as described in the text, is unclear. Please provide a site map (e.g. updated Fig. 7.1-1) showing the location of the diesel generator/ventilation decline; heater & fan/fresh air decline 1; heater & fan/freshair decline 2 as listed in Table 7.1-7 AND the return air decline & return air raise as listed in Table 7.1-14.	A map indicating these sources is provided in memo **20160706 KUG Comment MOE-003_Emission Sources Location_Memo**	7-Jul-2016
MOE-004	14-Jun-2016	Graham Veale, MoE	Air Quality	Re. use of diesel generators during construction phase: why are they necessary when an existing power transmission line is connected to the site? Does the line require upgrading or additional site infrastructure? Please provide a detailed rationale to support the use of diesel generators	Diesel generators will be used during the Construction phase in the area of the Kemess Lake Valley infrastructure until the existing transmission line can be extended to that area from the existing Kemess South facilities. To be conservative it was assumed that the diesel generators would be operated throughout the construction phase, though it is anticipated that the transmission line would be completed within the first year of the five year Construction phase.	6-Jul-2016
MOE-005	14-Jun-2016	Graham Veale, MoE	Air Quality	The BC Pollution Control Objectives were rescinded in 2006 and should not be cited as "relevant standards"	Comment noted, this will be considered in development of a more detailed management plan to support the permit process.	6-Jul-2016
MOE-006	14-Jun-2016	Graham Veale, MoE	Air Quality	The BC Environmental Management Act and associated Waste Discharge Regulation should have been included under `Relevant standards`- the project will require an air permit issued under the EMA.	AuRico does expect that a waste discharge permit will be required under the Environmental Management Act for air emissions associated with the project. Updates to the conceptual management plan presented in the EAC Application will be made to support the permitting process.	6-Jul-2016
MOE-007	14-Jun-2016	Graham Veale, MoE	Air Quality	The BC Open Burning Smoke Control Regulation is cited in the section pertaining to fugitive dust mitigation. The OBSCR does not mitigate fugitive dust - it is focussed on management of smoke from disposal of vegetative debris. It would have been more appropriately placed under `General Mitigation Measures`` and linked to smoke management. The OBSCR should also have been cited under `Relevant standards in section 24.3.2.1.	Comment noted, this will be considered in development of a more detailed management plan to support the permit process.	6-Jul-2016
MOE-008	14-Jun-2016	Graham Veale, MoE	Air Quality	While air quality monitoring requirments may include dustfall (assuming the objectives of the monitoring are clearly defined), there is also a need to confirm the modelling predictions for other pollutants. There are considerable uncertainties associated with the estimates of fugitive dust and subsequent modelling. Confirmatory monitoring of the identified pollutants will likley be a permit requirement, at least until it can be established that the theoretical modelling was representative of actual operating conditions.	AuRico looks forward to additional discussions with the MOE on air quality monitoring requirements as part of the permitting process.	6-Jul-2016
MOE-009	14-Jun-2016	Graham Veale, MoE	Air Quality	Adaptive management and need for corrective actions should also include `monitoring data showing concentrations greater than those predicted by the dispersion modelling`as a trigger.	Comment noted, this will be considered in development of a more detailed management plan to support the permit process.	6-Jul-2016
MOE-010	20-Jun-2016	Warren McCormick, MoE	Air Quality	The tables shown in the Section 7.1.5.1 are difficult to follow in a logical manner. Please reorganize them so that they start with the summary table and break it down into detailed tables or start with the detailed tables and roll it up to the summary. Either way the reader should be able to follow the emission's numbers from one table to the next.	The response is provided in the memo **20160706 KUG Comments MOE-010, 011_Air Quality_Memo**	6-Jul-2016
MOE-011	20-Jun-2016	Warren McCormick, MoE	Air Quality	Review of detailed emission inventory Excel files provided by ERM as part of their submission of the dispersion modelling files: 1. In the operational spreadsheet (named "0.4 Operation_road dust") there seems to be an error in the Summary tab; Line 9 labelled 'Underground Development' refers to row 13 (Z to AG) in the Equipment tab. However, row 13 in the Equipment tab is simply one of the haul trucks in the fleet. I believe the cells that Line 9 should be referring to is row 37 in the Equipment tab starting at Z. 2. Followiing on from bullet 1 above, the Summary tab Line 10 labelled 'Vehicles' refers to the sum of rows 14 to 17 in the Equipment tab, I believe this should be 13 to 17. Please review and determine if the project operational emissions have been underestimated and, if so, whether this error was carried forward into the dispersion modelling assessment.	The response is provided in the memo **20160706 KUG Comments MOE-010, 011_Air Quality_Memo**	6-Jul-2016
MOE-012	15-Jun-2016	Erin Rainey, MOE	Water (Surface)	On page 10-4, there is an incorrect reference to MOE (2013) in the second paragraph; it should read EAO (2013).	The comment is acknowledged.	7-Jul-2016
MOE-013	15-Jun-2016	Erin Rainey, MOE	Water (Surface)	MOE does not agree with the "not significant" determination for Waste Rock, East Cirque and West Cirque Creeks. These three water bodies meet the majority of the criteria defined by the "significant" determination on page 10-56 (i.e. high magnitude, long-term and irreversible). However, MOE does not feel that the siginifcance determination for surface water quantity as a VC alone is meaningful; the changes to surface water quantity as a result of the project need to be put into context of the other VCs that interact with streamflow to determine their respective significance determination.	The response is provided in memo **20160706 A.1 - KUG Comments_MOE-013,014,015,017,018, 070_SW_WQ**	6-Jul-2016
MOE-013.1	18-Jul-2016	Erin Rainey, MOE	Water (Surface)	MOE acknowledges that although the flow changes to the three smallest tributaries of Waste Rock, East Cirque and Central Cirque Creeks were predicted to be high in magnitude, they are localized and not readily detectable at the next downstream model node; therefore the "not significant" determination appears reasonable. The response is adequate to address this comment, no further action required.	AuRico acknowledges the comment.	20-Oct-2016
MOE-014	15-Jun-2016	Erin Rainey, MOE	Water (Surface)	The water balance model results presented inTables 10.6-2 to 10.6-5 do not provide an adequate assessment of the changes to the existing stream flow regime as the results are presented as the arithmetic mean of all years in each Project phase. The "averaging" approach could be discounting more substantial flow changes in specific months/years of each Project phase. MOE requests that percent change in monthly stream flow from baseline be provided for all years in each phase of the Project, in particular the years deemed "sensitive" in the water quality model (Appendix 11-D, Section 2.4), i.e. Construction (2020), Operations (2021), Closure (2034) and Post-Closure (2044). Based on the updated information, any changes greater than +/- 5% in any given month of each year should then be carried forward to the residual effects analysis for the relevant VCs.	The response is provided in memo **20160706 A.1 - KUG Comments_MOE-013,014,015,017,018, 070_SW_WQ**	6-Jul-2016
MOE-014.1	18-Jul-2016	Erin Rainey, MOE	Water (Surface)	The supplementary figures included in the Lorax memo dated July 6, 2016 provide the predicted flow changes for each year of the mine life at five key model nodes, as requested by MOE. These figures demonstrate the progression of the change in flow, particularly in East and Central Cirque Creeks. Baseflows in these creeks are predicted to decrease as a result of the underground mine dewatering during operations and then increase in East Cirque Creek as the underground mine fills and overflows in post-closure. Baseflow from Central Cirque Creek in post-closure is predicted to contribute to the East Cirque Creek catchment. The changes in flow in Attichika Creek, predicted at successive nodes "Attichika ds Effluent" and "Attichika at Mouth", during all phases are not localized like the smaller tributaries and the same pattern of change in flow can be seen at both nodes. However, these changes in flow are generally low in magnitude, i.e. within the +/- %5 threshold (Chapter 10 of the EA). Accordingly, these changes in flow do not necessitate being carried forward to the residual effects assessment for surface water hydrology and/or other relevant VCs. The response is adequate to address this comment, no further action required.	AuRico acknowledges the comment.	20-Oct-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
MOE-015	15-Jun-2016	Erin Rainey, MOE	Water (Surface)	The current hydrometric data collection at the project site does not meet the minimum standard of practice expected by MOE, as outlined in Manual of British Columbia Hydrometric Standards – Version 1.0 (RISC, 2009). While some components of the program do meet expected RISC standards, others do not. For example, Grade B requires a minimum of 3 benchmarks, at least 1 (or more) benchmark level surveys and 3 (or more) discharge measurements conducted per year. None of the project site stations meet the minimum Grade B standard for number of benchmarks and only annual benchmark surveys were reported to be conducted at the Kemess North stations (KEM-) as of 2012. As presented in Appendix E.3, MOE does not agree with the assignment of the standards grade to the project hydrology stations. MOE requests a more detailed assignment and discussion of the standards grade for each station considering the RISC standards (2009) criteria: instrumentation, stream channel condition, field procedures and data calculation and assessment.	The response is provided in memo **20160706 A.1 - KUG Comments_MOE-013,014,015,017,018, 070_SW_WQ**	6-Jul-2016
MOE-015.1	18-Jul-2016	Erin Rainey, MOE	Water (Surface)	MOE acknowledges the discussion of standards grade for all stations in the Lorax memo dated July 7, 2016. Section 5.2 of the memo provides a general overview of the hydrometric data grades but does not provide a detailed assignment of standard grade for each station as requested. In addition, Table C.1 provides a summary of benchmark information for all stations but highlights that all stations fail to meet the Grade B minimum standard of 3 benchmarks and annual benchmark surveys. As noted in the original review comments (MOE-015 and MOE-016), the current hydrometric data collection at the project site does not meet the minimum standard of practice expected by MOE, as outlined in Manual of British Columbia Hydrometric Standards – Version 1.0 (RISC, 2009). MOE recommends that the ongoing data collection program be designed and implemented with the intent of achieving at least the Grade B data grade. In the permit application, MOE will require the hydrometric data to be graded and a discussion of quality and accuracy included in the hydrometric data analysis. No further action required for the EA; this issue will be raised again in the EMA permit application stage.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-016	15-Jun-2016	Erin Rainey, MOE	Water (Surface)	The current hydrometric data collection program will not be sufficient in the permitting phase for long-term monitoring at the project site. MOE recommends that ongoing data collection programs be designed and implemented with the intent of achieving a minimum of Grade B standard at all stations.	The comment is acknowledged and the long-term hydrometric data collection program will be designed during permittting.	7-Jul-2016
MOE-016.1	18-Jul-2016	Erin Rainey, MOE	Water (Surface)	Comment; refer to response for MOE-015. No further action required for the EA.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-017	15-Jun-2016	Erin Rainey, MOE	Water (Surface)	For comments based on the rating curve and measured streamflow analyses, refer to memo "0615_MOE_rating curve review_ERainey_final-signed.pdf".	The response is provided in memo **20160706 A.1 - KUG Comments_MOE-013,014,015,017,018, 070_SW_WQ**	6-Jul-2016
MOE-017.1	18-Jul-2016	Erin Rainey, MOE	Water (Surface)	Thank you for the clarification and additional information related to rating curve development and hydrometric data analysis methodology provided in the Lorax memo dated July 7, 2016. Point of zero flow – as requested the memo provides an estimated zero-flow stage elevation for each hydrometric station in Table 4-1. As a first step, the theoretical zero-flow elevations were referenced to benchmark (BM) #1 (arbitrary elevation of 10 m) based on survey data. Then the zero-flow elevations were fine-tuned using a curve fitting approach (RISC, 2009). It was noted that the values for KEM-01 and KEM-02 were switched in Table 4-1, which was clarified by MOE with Lorax. The zero-flow stage elevation was then used as the gauge datum for each station, set to 0 m. Adjusted stage values – the arbitrary stage values on the rating curve figures presented in Appendix A of the memo were adjusted based on the offset between the staff gauge readings (gauge height) recorded at the time of each discharge measurement and the gauge datum. The offset for each station was established based on the benchmark surveys, as listed in Tables C-1 and C-2. The continuous stage data for each station was then also adjusted relative to this offset. Benchmark surveys – as noted in the response to comment MOE-015, the ongoing hydrometric data collection program should include at least annual benchmark surveys using a minimum of 3 benchmarks per station. The current hydrometric program uses a staff gauge at each station to determine gauge height during site visits. Staff gauges can be susceptible to movement due to extreme weather conditions during a year, therefore regular benchmark surveys which relate the staff gauge to 3 stable benchmarks is paramount to ensure continuity of data from season-to-season. The memo response is adequate to address this comment, no further action required for the EA	AuRico acknowledges the comment.	20-Oct-2016
MOE-018	15-Jun-2016	Erin Rainey, MOE	Water (Surface)	The coefficient of determination (R^2) statistic, as presented in Appendix F.4 on the seasonal ranked regression plots, is not applicable to describe goodness of fit for ranked regression results as the ranking of data invalidates these values. A statistical test that is more applicable for comparing the measured and synthesized flows is the Nash-Sutcliffe efficiency method (NSE), as provided in Table 4.3-1. NSE values for a monthly timestep model > 0.75 indicate the modelled values are "very good" in terms of evaluating the goodness of fit between the measured and synthetic streamflows (Moriasi et al, 2007).	The response is provided in memo **A.1 - KUG Comments_MOE-013,014,015,017,018, 070_SW_WQ_20160706**	6-Jul-2016
MOE-019	15-Jun-2016	Erin Rainey, MOE	Water (Model)	Table 2.1-1 lists the 17 water quantity prediction nodes included in the water balance model. The runoff modelling approach at each model node was defined by two types of watersheds (Section 2.3): 1) Watersheds with baseline synthetic streamflow records that will not experience any surface disturbance due to the project, and 2) Watersheds that either do not have a baseline synthetic streamflow record or will be impacted by surface disturbance due to the Project. MOE requires clarification of which of the 17 model nodes fall into each watershed type based on the runoff modelling approach.	At WQ-13, KEM-01, KEM-02, KEM-03, KEM-04, KEM-07, and Attycelley d/s East Cirque, flows were based on synthetic time-series for runoff. At WQ-01, WQ-03, WQ-04, WQ-05, and Waste Rock Creek, flows were based on the precipitation-runoff module. The remaining five nodes (i.e., KEM-05, Attichika d/s Kemess, Attichika d/s effl, Attichika at mouth, and Thutade Outflow were affected by both upstream precipitation-based flow estimates and incremental runoff values based on time-series for runoff.	5-Aug-2016
MOE-020	15-Jun-2016	Erin Rainey, MOE	Water (Model)	For the precipitation-runoff module used in the water balance model, MOE requests clarification on whether sublimation from the snowpack was accounted for?	The model uses snow pack depth instead of snow fall. Therefore, there is no need to deduct sublimation, which is inherently considered in snow pack values.	5-Aug-2016
MOE-021	15-Jun-2016	Erin Rainey, MOE	Water (Model)	Figures 2.5-1 to 2.5-4 present the predicted monthly flows for select mine years based on different water quantity modelling sensitivity scenarios for the water balance model. MOE requests that the plotted lines on each figure be clarified, as there is insufficient information on the figure legends to differentiate the plotted lines other than the 25 Ensemble of Variable Flows scenario.	The figures show the Base Case (blue, bold, solid line), Average Flow (black, bold, solid line), 100-Year Wet (black, bold, longdash-dot line), 100-Year Dry (black, bold, dashed line), and ensemble of 30 variable scenarios (colored, normal, solid lines). Unfortunately, due to the large number of scenarios, the legend was truncated during publishing of the Application.	5-Aug-2016
MOE-022	15-Jun-2016	Erin Rainey, MOE	Water (Model)	Figures 2.5-1 to 2.5-4 present predicted monthly streamflow for the Base Case as well as the Sensitivity Cases for water balance model. As shown on the figures, the upper or lower bound of the predicted results appear to be governed by at least one variation of the "ensemble of variable flows" scenario (variable precipitation and runoff). Therefore, MOE requests that the water quality effects assessment present predictions for a model scenario that assumes the "ensembe of variable flows" scenario for surface flows to capture the full range of expected natural streamflow variability in the Project area. The water quality model effects assessment (Chapter 11) currently only considers the "Base Case" surface water flow scenario (variable precipitation and runoff), which assumes a single variable case to represent a typical realization.	Base case model predictions for the Water Quality Model were based on the variable annual precipitation, base case groundwater inflows, and expected base case geochemical source terms. Contrary to what the reviewer has stated, the water quality model and associated effects assessment considered multiple sensitivity cases with respect to water quantity (water balance model), which are summarized in Table 3.4-1 of Appendix 11-D. That is, beyond base case (variable precipitation and runoff-off), water quality sensitivity cases included average precipitation and runoff, 100-Year Wet precipitation and runoff, 100-Year Dry precipitation and runoff and high groundwater inflows which sufficiently cover the climate variability during the life of mine and is consistent with other recent mine EAC applications in BC. Inclusion of water quality results for an ensemble of 30 scenarios would not provide information beyond which is already included in the Application.	5-Aug-2016
MOE-023	15-Jun-2016	Erin Rainey, MOE	Water (Model)	Water quality assessment node, IDZ-WQ-17, on Attichika Creek downstream of the KUG TSF discharge point is assumed to be the location at which the effluent is fully mixed. MOE requires clarification on how full mixing at this point was determined and how far downstream of the discharge point is this node assumed to be located?	Within the water balance and water quality model, it is assumed that full mixing occurs at IDZ-WQ-17, within a reach of Attichika Creek between the effluent discharge point and confluence with Waste Rock Creek (approximately 1 km). Attichika Creek does not receive major inflows between the effluent discharge point and Waste Rock Creek. Incremental catchment area between these two points is less than 0.5% of the Attichika Creek catchment area at the effluent discharge point (i.e., 458 km²). The dimensions of the IDZ, and exact location of IDZ-WQ-17 within the abovementioned reach of Attichika Creek, will be established during Environmental Management Act permitting. The proponent is aware that acute toxicity cannot occur anywhere in the IDZ. Detailed diffuser design that demonstrates achievability of a clear fish migration corridor will be established during permitting.	5-Aug-2016
MOE-023.1	5-Sep-2016	Erin Rainey, MOE	Water (Model)	Based on additional information received at the August 23, 2016 water sub-working group meeting, MOE understands that the water quality model node IDZ-WQ-17 is located approximately 500 m downstream of the proposed discharge location into Attichika Creek. This node represents fully mixed conditions of the effluent with Attichika Creek. Further modelling and details of the initial dilution zone (IDZ) will be provided at the permitting stage, along with details of the diffuser design for construction and operations. [EA Comment Closed, EMA Permit Requirement]	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-024	15-Jun-2016	Erin Rainey, MOE	Water (Model)	MOE requires clarification on why the KUG-TSF was not defined as an "assessment" node within the water quality model? The water quality in the TSF pond prior to discharge and treatment was predicted on a monthly timestep based on the mass balance within the TSF pond , correct?	Surface water quality assessment nodes represent receiving environment sites that could be directly or indirectly affected by the Project and are named for the water quality monitoring station that informed existing conditions, as applicable. Potential residual effects on water quality in the receiving environment were identified through the screening of predicted concentrations at assessment nodes against existing concentrations and applicable BC MOE water quality guidelines (working and approved). In contrast, the KUG TSF represents mine infrastructure and as such is not assessed for residual effects in the Water Quality Effects Assessment (Chapter 11) and, so being, is not identified as an 'assessment node" in the Application. Water quality of the KUG TSF is predicted on a monthly timestep , the results of which, in turn informed predictions at the downstream assessment nodes.	5-Aug-2016

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MOE-025	15-Jun-2016	Erin Rainey, MOE	Water (Model)	Section 2.5 and Appendix 1 of Appendix 11-D present monthly predicted streamflow results from the water balance model. MOE requires additional predicted streamflow results in order to adequately assess the water quantity and water quality predictions from the model, particularly water quality model nodes that do not correspond to water balance nodes and/or hydrometric stations. MOE requests the following monthly and annual flow (or volume) results be provided for all phases of the mine life for at least the Base Case model: - Predicted KUG TSF pond volume for all phases of the mine life (figure and table) - Predicted KUG TSF overflow volume via the spillway in Post-Closure (table) - Predicted monthly overflow rates from the Western and Southern Collection Pond to Waste Rock Creek (table) - All water quality assessment nodes that are carried forward in the Surface Water Quality residual effects assessment (Chapter 11) (table)	The Response is Provided in memo **20160805 KUG Comment MOE-025, 026_Water Balance_Memo**	5-Aug-2016
MOE-025.1	5-Sep-2016	Erin Rainey, MOE	Water (Model)	Thank you for the additional monthly streamflow results provided in the ERM memo (2016). The response is adequate for the EA, however additional information will be required to support the EMA permit application, see permit recommendations in the latter part of this memo. [EA Comment Closed, EMA Permit Requirement]	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-026	15-Jun-2016	Erin Rainey, MOE	Water (Model)	In additional, there is limited information provided on the KUG TSF water balance itself, i.e. what flow paths are assumed as inputs and discharges/losses from the facility. MOE requests a detailed schematic of the inputs and outputs considered in the KUG TSF water balance model.	The Response is Provided in memo **20160805 KUG Comment MOE-025, 026_Water Balance_Memo**	5-Aug-2016
MOE-027	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Please provide clarification whether PAH's in sediment and the water column were sampled. Are there any potential sources of PAH's (i.e., spills)? If PAH's were not sampled, then please sample the water column and aquatic sediments prior to construction. It's critical to properly assess the ambient conditions before potential effect(s) from the KUG Project occur (i.e., baseline monitoring). Sampling locations for PAH's can be discussed further with MOE.	Baseline concentrations of PAHs were not assessed, given negligible ambient (natural) concentrations of these compounds are expected to occur in the vicinity of the Project and given no local coal or oil deposits. Although some PAHs (like, for example, chlorinated dioxins) may be present naturally in local waters due to combustion products of forest fires and diagenic decay of aquatic plants (e.g., retene), these are expected to occur at low concentrations relative to guidelines for protection of aquatic life. Mine activities are not expected to affect waterborne PAH concentrations except in the event of a fuel spill to local water bodies, in which case downstream PAH concentrations and any related guideline excursions would necessarily be considered to be spill-related, with an alternative spill-assessment hypothesis that such concentrations may be natural in origin not required or appropriate as a monitoring assumption or management response. However, background concentrations of parent and alkylated PAHs can be measured in strategically selected locations in advance of the Project proceeding, to confirm absence of naturally high PAHs in local receiving environments, following further discussions with MOE to determine appropriate locations.	6-Jul-2016
MOE-027.1	29-Jul-2016	Tracy Henderson, MOE	Water (General)	Addressed in the permitting stage of the project (no additional information required at this time). Please sample for PAH's in the water column and aquatic sediments prior to construction. It's critical to properly assess the ambient conditions before potential effect(s) from the proposed project occur (i.e., baseline monitoring). Sampling locations for PAH's can be discussed further with MOE during permitting stage of the project.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-028	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Please provide clarification for why there is no baseline water quality data for fluoride and bromide. Please ensure fluoride and bromide is analysed in any future sampling efforts.	Fluoride and bromide analyses are not included as a requirement in the Kemess South water quality monitoring program and therefore were not included in the KUG monitoring programs. AuRico will ensure that fluoride and bromide are included in future monitoring efforts.	6-Jul-2016
MOE-028.1	29-Jul-2016	Tracy Henderson, MOE	Water (General)	Addressed in the permitting stage of the project (no additional information required at this time). Please ensure fluoride and bromide is included in future monitoring efforts. It's critical to properly assess the ambient conditions before potential effect(s) from the proposed project occur (i.e., baseline monitoring).	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-029	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Please provide a summary master table for where aquatic resource sampling efforts occurred (i.e., sediment, periphyton, and benthic invertebrates) to ensure correct sampling efforts were achieved per site. Specifically, please include the aquatic resource sampling required to support the KUG Project baseline data (i.e., 2014 to 2015). Areas of interest include Waste Rock Creek, Attichika Creek and Thutade Lake.	See response in the memo **20160706_A.1 KUG Comment MOE-029_aquatic data_Memo.**	6-Jul-2016
MOE-029.1	29-Jul-2016	Tracy Henderson, MOE	Water (General)	Require further information to resolve. The provided table was very helpful. Please also provide sampling ID's that correlate with water quality modelling ID's (i.e., WQ14, WQ17, WQ18, ect).	The response is provided in the memo **20161007_KUG Comment MOE-029.1_Round 2_aquatic_Memo**	20-Oct-2016
MOE-030	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Please provide clarification that enough samples were collected for aquatic biota, for example periphyton. A discussion of power analysis or critical effect size is required to determine whether sufficient baseline data was collected to assess potential impacts.	Power analysis is appropriate for variance-based hypothesis testing of a specified, meaningful difference between two populations. While some aquatic-resource assessment programs undertaken at Kemess over time have employed power analysis for a priori determination of sample sizes (e.g., federal EEM studies of fish health and benthos, Se-based benthic invertebrate studies in Waste Rock Creek), many other programs have not used an ANOVA-based, hypothesis testing design for which statistical power analysis was applicable. For periphyton specifically, algal biomass data have been collected for two design purposes: for long-term trend monitoring at specific locations; and as supporting habitat data to assist interpretation of benthic invertebrate community and/or fish health data. For periphyton and benthic sampling data, within-site replication and number and location of sites sampled was previously determined through discussion and approval of MOE staff during design of each long-term monitoring program that contributed baseline data to support the Kemess Underground project. Given power analysis cannot be applied to all appropriate study designs in aquatic monitoring (e.g., CABIN, or some time-series designs), we would be pleased to discuss the application of power analysis and MOE recommendations/expectations regarding appropriate critical effect sizes for use in design of future monitoring programs for the Kemess Underground Program.	6-Jul-2016
MOE-031	15-Jun-2016	Tracy Henderson, MOE	Water (General)	It is recommended in the 'Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BC MOE, 2012)' that proponents use the standardized CABIN sampling approach to collect benthic invertebrate community data. The proponent used a Hess sampler to collect benthic invertebrates. There is CABIN analytical model available for the BC Central/North Coast, which was updated in 2015. This model contains data from 273 reference sites in this area and could be used to support site assessment for the KUG Project. Please provide rational and supportive information to support the proponent's decision in using different field methods, as outlined in the baseline mining document.	Baseline benthic invertebrate data have been collected for several years continuously in the Kemess area, following study designs and methods approved by BCMOE EPD staff (B. Carmichael). Discussions were held with BCMOE staff (L. Gaber) in 2010 about using CABIN at Kemess but a decision was made to continue to use Hess, partly due to data availability and partly due to concerns that sufficient suitable reference sites were not available in the model for the subalpine setting of Kemess. Transition to CABIN could be done in future, although this would result in the loss of over a decade of comparable historical data at many long-term monitoring sites.	6-Jul-2016
MOE-031.1	29-Jul-2016	Tracy Henderson, MOE	Water (General)	Addressed in the permitting stage of the project (no additional information required at this time). Follow-up discussions regarding the sampling methodologies can be discussed further with MOE during permitting stage of the project.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-032	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Sampling methodologies (i.e., sediment, periphyton and benthic invertebrates) have changed between the KS and KUG Projects. Please provide a summary of any explicit differences in sampling methodologies. Potential sampling methodology differences can impact the quality of the sampling results and is required to determine if sampling results are comparable over time.	Sampling methodologies for sediment, periphyton and benthos were maintained as consistent between the KS and KUG projects, wherever sampling targets remained consistent (e.g., all erosional benthos was sampled using Hess sampler), to ensure continuity of data with historical studies. Where changes have occurred over time in methods (e.g., elimination of use of McNeil cores and pebble counts in provincial EEM studies), this was specifically because of a change in sampling targets and program rationale (e.g., in that case, change in program focus away from sedimentation of erosional substrates, based on review of long-term results with MOE representatives). KUG-related studies sometimes include expanded spatial scope and sometimes expanded analytical scope (e.g., full metal scans instead of Se-specific scans), but used consistent sampling methods.	6-Jul-2016
MOE-032.1	29-Jul-2016	Tracy Henderson, MOE	Water (General)	Addressed in the permitting stage of the project (no additional information required at this time). If required, sampling methodologies can be discussed further with MOE during permitting stage of the project.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-033	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Please provide the raw and summarized (i.e., statistics) water quality baseline data in an excel format.	Raw data and summary statistics for the water quality baseline data has been provided in Excel to MOE.	6-Jul-2016
MOE-034	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Please provide clarification for how any relative percentage difference exceedances were dealt with as part of the QA/QC protocol.	See 3.5.1.1 of the baseline report "For field replicate samples, the relative percent difference (RPD) between sample analytical results was calculated. The RPD (expressed as a percentage) was calculated as the difference in an analytical value divided by the average of the duplicate values. A RPD value of less than 25% was applied by AuRico's environmental staff (as adopted by the Maxxam Analytics laboratory acceptance criteria". No criteria was applied when both A and B were less than 5 times the Detection Limit. There were no duplicate samples that exceeded the RPD criteria identified in the baseline data. When differences in total metals are recorded, they are typically related to variation in suspended sediment concentration between samples. Small differences in TSS can result in more significant differences in total metals concentrations.	6-Jul-2016
MOE-035	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Please provide clarification on sampling methods with regards to sediment quality, for example the grain size analyzed (<63 um fraction).	Depositional sediment quality chemistry at Kemess has been undertaken on whole sediments to allow for comparison of baseline conditions with sediment-quality guidelines (which are not applicable to separated fine fractions only), and because in sediments, concentrations of selenium (unlike many metals) are strongly correlated with TOC rather than particle size (e.g., see Figures 5 to 7 in the 2015 Se Status Report for a comparison of Se relationship with TOC vs. fine fractions). Targeting of whole sediments vs. <63 µm-fraction-only was discussed extensively between Hatfield and MOE (B. Carmichael) in 2011, with a decision to continue to collect whole sediments given the strong TOC-Se relationship observed and the importance of Se as a target analyte in Kemess aquatic monitoring.	6-Jul-2016
MOE-035.1	29-Jul-2016	Tracy Henderson, MOE	Water (General)	Addressed in the permitting stage of the project (no additional information required at this time). Follow-up discussions regarding the sampling methodologies can be discussed further with MOE during permitting stage of the project.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-036	15-Jun-2016	Tracy Henderson, MOE	Water (General)	It is unclear if the full two years of baseline water quality data, including periods of low flow, was collected for all parameters (i.e., full suite of parameters – not KS permit requirements). Please provide clarification to whether the proponent achieved the baseline sampling requirements, for example provide a table showing number of collection programs per month over the calendar year for the full sample period (i.e., full suite of parameters – not KS permit requirements). For example, Table 11.4-5 indicates that mercury was only analysed four times in Q4 for existing conditions (2011 to 2014). The proponent should be aware that baseline study requirements to support the KUG Project take precedence over KS permit requirements. Furthermore, does the Application contain all baseline water quality data used in the modelling of receiving water quality or has subsequent water quality been collected? If required, additional data collected will need to be used to supplement water quality modelling.	The number of samples collected per month per year is presented in Appendix 11-A, with additional data collected in Thutade Lake in 2015 provided in Appendix 11-C. The Application contains all baseline water quality data used in the modelling of receiving water quality as described in Table 11.4-3 in Chapter 11 and in the response to MOE-033. The data used in water quality predictive modelling is described in Appendix 11-D. Generally all parameters are available for each sample, with the exception of total and dissolved mercury at some sites between October or November 2013 and September 2014. Mercury was not identified as a COPC for KS Mine and has not been identified as a COPC for KUG Project; it was not always measured in baseline water quality samples. The BC MOE Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (available on the BC MOE website at: http://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/water_air_baseline_monitoring.pdf) indicates that one full year of monthly sampling is required to establish baseline data, although generally current practice is that two years of data is recommended. There is adequate baseline data available to use in water quality modelling and for evaluation of potential effects. The influence of KS Mine during that mine's operation phase was considered when selecting appropriate water quality data to represent existing conditions in the water quality effects assessment and water quality modelling (see Appendix 11-D, Section 3.2.1).	5-Aug-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
MOE-037	15-Jun-2016	Tracy Henderson, MOE	Water (General)	BC WQG is missing from Table 11.2-1.	The comment is acknowledged.	6-Jul-2016
MOE-038	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Throughout many sections, the Application uses the BC aquatic life WQG for molybdenum (2 mg/L). However, the most sensitive water user for molybdenum is wildlife (0.05 mg/L). I was unable to locate any discussion of potential molybdenum exceedances (i.e., impacts to wildlife) in the Application, including Chapter 15. Please update the assessment accordingly.	Section 11.6.1.3 (Screening of Contaminants of Potential Concern) of the Application states: "The scope of the water quality effects assessment is restricted to parameters with an approved or working BC water quality guideline for freshwater aquatic life (including 30-day average and maximum guidelines), drinking water, wildlife water supply, and livestock water supply." Section 15.5.2.2 (Screening Results for Chemical Hazards to Wildlife) of the Application states: "With the exception of molybdenum, aquatic life guidelines are generally equivalent to or lower than wildlife guidelines." Thus the BC MOE WQG for wildlife (0.05 mg/L) was used for COPC screening in the assessment as shown in Table 15.5-4 of the Application as part of the wildlife effects assessment. As described in Section 15.5.2.2 of the Application, molybdenum concentrations exceeded the BC MOE wildlife guideline (0.05 mg/L) in the TSF during all Project phases and in Waste Rock Creek (node location WQ-14F) during May of the Post-Closure phase. Therefore, molybdenum was considered for potential residual effects for terrestrial wildlife and the assessment is provided in Sections 15.6.2.4 and 15.6.3.6 of the Application.	6-Jul-2016
MOE-039	15-Jun-2016	Tracy Henderson, MOE	Water (General)	The Application uses a Pollution Control Objective limit for silver as 5 mg/L (upper limit in Table 11.6-3). The correct upper limit Pollution Control Objective is 0.5 mg/L. Also, the Pollution Control Objectives have been recanted and should not be used in the assessment (see additional comments).	A response to this comment is pending. BC Pollution Control Objectives (1979) were used as benchmarks for evaluating predicted effluent quality. The proponent understands that these objectives have been rescinded; however, they represent a useful tool for assessing the likelihood of achieving permittable effluent limits. BC Pollution Control Objectives have recently been used in other approved BC Applications , including Murray River, KSM and Brucejack projects, for benchmarking effluent quality. The proponent understands that discharge limits that consider site-specific conditions including available low flow dilution will be established during permitting.	6-Jul-2016
MOE-040	15-Jun-2016	Tracy Henderson, MOE	Water (General)	The Application didn't use the BC aquatic life WQG for total phosphorus (lakes; 5 to 15 µg/L). Please update the assessment accordingly.	The guideline for total phosphorus was not applied in the water quality effects assessment. It would only apply to Thutade (and Amazay) Lakes. Frequently, the detection limits for total phosphorus in baseline water quality samples were higher than the guideline since ICP-MS was used to measure phosphorus (as opposed to the colourimetric method typically used to analyze phosphorus as a nutrient). This resulted in a skewed understanding of total phosphorus concentrations at some baseline sites. Similarly, geochemical and other samples that were used to derive source terms used in the water quality predictive model also typically used ICP-MS to measure total phosphorus, resulting in concentrations that were below detections limits (but well above the concentration that defines an ultra-hypereutrophic lake); this skewed the results for total phosphorus for some nodes in the water quality predictive model. There are not expected to be any significant inputs of total phosphorus into waterways due to the Project. An aquatic effects monitoring plan will be developed for the Project during permitting, as required by the federal Metal Mining Effluent Regulation and the Environmental Effects Monitoring program associated with the provincial Environmental Management Act for effluent discharge. Changes to the aquatic environment due to nutrients (including phosphorus) would be identified and adaptively managed as needed throughout the phases of the Project.	5-Aug-2016
MOE-040.1	5-Sep-2016	Tracy Henderson, MOE	Water (General)	The total phosphorus lake water quality guideline should be used in the permitting stage of the project (no additional information required at this time).	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-041	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Concentrations exceeding the BC aquatic life WQG for selenium (0.002 mg/L) should be highlighted grey in Table 11.4-5.	The comment is acknowledged and will be considered in graphs prepared during the Application review.	6-Jul-2016
MOE-042	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Please provide clarification on which hardness concentrations were used to determine guidelines for both baseline and modelled water quality predictions. When possible, the hardness determination should use the dissolved form (i.e., dissolved concentrations of calcium and magnesium). In cases where dissolved concentrations of calcium and magnesium are unavailable, estimates of hardness may be determined using total (unfiltered and acid digested) concentrations of calcium and magnesium. Even though predicted hardness concentrations are expected to increase due to Project related activities, the background hardness concentration should be used to determine guidelines. It's noted that there is very little or no background hardness for some streams/lakes before KS. In that case, background hardness could represent the lowest KS operating or existing conditions. Using background hardness to calculate WQG is the preferred approach as it represents the lowest level of risk to the designated water uses at the site. Induced hardness can change the WQG ranges, for example sulphate. Please update the assessment accordingly.	Existing conditions for water quality are described in Section 11.4.3 of the Application. In the tables in that section, guidelines were calculated using annual median hardness, as described in the notes below each table. Predicted water quality is presented in Section 11.6 of the Application. In the tables in that section, guidelines were calculated using annual median hardness of the existing conditions. In the graphs in that section, guidelines were calculated using the dissolved calcium and dissolved magnesium concentrations from the model background, as described in Section 10.6.1 in Appendix 11-D. COPC screening was carried out using guidelines calculated using the dissolved calcium and dissolved magnesium concentrations from the model background, as described in Section 10.6.1 in Appendix 11-D.	6-Jul-2016
MOE-042.1	29-Jul-2016	Tracy Henderson, MOE	Water (General)	Require further information to resolve. Please provide clarification on which annual median hardness were used as the Tables just include the standard guideline formula, for example, was a different annual median hardness calculated per each water system, such as Waste Rock Creek and Attichika Creek?	Yes, site-specific annual median hardness (existing conditions) values were calculated for each assessment node to support guideline comparisons presented in Table 11.4-3. That is, the annual median hardness values applied in guideline derivation in Table 11.4.3 were different for Waste Rock Creek (WQ-14F) versus Attichika Creek (e.g., WQ-17).	20-Oct-2016
MOE-043	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Please provide clarification on how annual means were calculated throughout the Application, for example how was an annual mean calculated from a mixture of monthly samples and 5 in 30 samples (to prevent bias of data sampled during those dates)? If means were calculated with bias (not weighting the samples), then the issue can be addressed in the permitting stage (i.e., any future calculations for annual means, such as during operational sampling, should be weighted to account for a mixture of monthly and 5 in 30 samples).	Samples were not weighted in the calculation of means; however, since the effects assessment is based on incremental change from the baseline included in the water quality model, this approach will not have biased Contaminants of Potential Concern (COPC) selection. Sample weighting can be revisited in the permitting stage as suggested by MOE.	6-Jul-2016
MOE-043.1	29-Jul-2016	Tracy Henderson, MOE	Water (General)	Addressed in the permitting stage of the project (no additional information required at this time). Annual means, with a mixture of monthly and 5 in 30 samples, should be calculated by weighting the samples to prevent bias. Please ensure any future calculations for annual means, such as during operational sampling, are weighted to account for a mixture of monthly and 5 in 30 samples; thus, ensuring the data is statistically accurate	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-044	15-Jun-2016	Tracy Henderson, MOE	Water (General)	The Application frequently labels total aluminum guideline as BC (on Figures 11.6-3 to 11.6-18 and 11.6-28). The guideline should be labelled as CCME.	The comment is acknowledged and will be considered in graphs prepared during the Application review.	6-Jul-2016
MOE-045	15-Jun-2016	Tracy Henderson, MOE	Water (General)	The Application is missing the BC WQG for lead (0.003 mg/L) in Table 3.1.	The comment is acknowledged and will be considered in graphs prepared during the Application review.	6-Jul-2016
MOE-046	15-Jun-2016	Tracy Henderson, MOE	Water (General)	The Application uses the formula to calculate the BC WQG (maximum) for lead (Table 3.1) = 3.31 + e(1.273 ln (mean hardness) - 4.704). The correct formula is e(1.273 ln (hardness) -1.460).	The correct formula [e^(1.273 x ln(hardness) – 1.460] was used for COPC screening. An incorrect formula was reported in Table 3.1 of Appendix 11-A.	6-Jul-2016
MOE-047	15-Jun-2016	Tracy Henderson, MOE	Water (General)	The Application frequently uses Pollution Control Objectives and Metal Mining Effluent Regulations to describe the proposed effluent quality. Pollution Control Objectives have been recanted and should not be used in the assessment. The Application frequently states the discharge (end of pipe) meets relevant discharge quality. This statement is misleading as the Pollution Control Objectives have been recanted and the discharge quality (inclusive of treatment; Table 11.6-3) exceeds numerous WQG. The proposed effluent quality (inclusive of treatment; Table 11.6-3) should be compared to relevant WQG and any exceedances should be highlighted (see additional comments below).	BC Pollution Control Objectives (1979) were used as benchmarks for evaluating predicted effluent quality. The proponent understands that these objectives have been rescinded; however, they represent a useful tool for assessing the likelihood of achieving permittable effluent limits. BC Pollution Control Objectives have recently been used in other approved BC Applications , including Murray River, KSM and Brucejack projects, for benchmarking effluent quality. The proponent understands that discharge limits that consider site-specific conditions including available low flow dilution will be established during permitting. The applicability of WQG to effluent quality is discussed in response to the additional comments below.	6-Jul-2016
MOE-047.1	29-Jul-2016	Tracy Henderson, MOE	Water (General)	Require further information to resolve. The proposed effluent quality (inclusive of treatment; Table 11.6-3) should be compared to relevant WQG and any exceedances should be highlighted. Potential exceedances within the IDZ should be discussed in the effects assessment. The discharge should not be acutely toxic in the initial dilution zone.	AuRico understands that effluent cannot be acutely lethal to aquatic organisms either at end-of-pipe or within the IDZ and is committed to ensuring that effluent is not acutely lethal to aquatic life. Modelling of parameter concentrations in the IDZ and an effects assessment will be conducted during the permitting stage of the Project as part of the application for an effluent discharge permit under the Environmental Management Act. Please refer to the following memorandums for additional discussion of the IDZ and applicable guidelines: **20160805_A.1 KUG Comment MOE-048_EOP toxicity_Memo** and **20160909_A.1 KUG Comment Round 2 MOE-048.1_EOP toxicity_Memo.**	20-Oct-2016
MOE-048	15-Jun-2016	Tracy Henderson, MOE	Water (General)	The proposed effluent quality (inclusive of treatment; Table 11.6-3) should be compared to relevant WQG and any exceedances should be highlighted. This approach would highlight contaminants of concern in the initial dilution zone (IDZ). Furthermore, the discharge (end of pipe) should cause acute toxicity anywhere within the IDZ (as required by the Federal Fisheries Act). A quick comparison of the proposed effluent quality (Table 11.6-3; Base Case) to the WQG indicates acute exceedances. Please update the assessment accordingly (including a comparison/discussion on the upper case).	See memorandum **20160805 KUG Comment MOE-048_EOP toxicity_Memo.**	5-Aug-2016
MOE-048.1	23-Aug-2016	Tracy Henderson, MOE	Water (General)	Provide data from Table 2.2-1 in memo response to MOE-048 for upper case; comparison to guideline is not required.	The response is provided in **memo 20160909_A.1 KUG Comment Round 2 MOE-048.1_EOP toxicity_Memo.**	9-Sep-2016
MOE-049	15-Jun-2016	Tracy Henderson, MOE	Water (General)	The methodology used to screen contaminants of potential concern (COPC) involves removing constituents from the list if they do not exceed current predicted conditions or WQG by greater than 10%. This process may remove COPC even if they currently exceed WQG, or are predicted to exceed WQG in the future. Based on this, any guideline exceedance could potentially result in impacts to aquatic organisms. Due to the level of conservatism (i.e., safety factors) built into WQGs, a guideline exceedance indicated that predicted concentrations needed to be further investigated to determine potential effects, rather than being an indication of degraded water quality (i.e., guidelines are not a level to contaminate up to). Furthermore, a lack of a BC or CCME guideline does not necessarily mean that the parameter has no impacts. It could be that there is insufficient data to support a guideline, for example, there isn't a hardness guideline, but recent research has indicated potential issues with increased hardness. A more conservative approach to identifying potential COPC would be to include all parameters predicted to increase as a result of the Project, or all constituents exceeding the BC WQGs. Please update the assessment accordingly.	The methodology used to screen COPCs involved a two-step process as outlined in Figure 11.6-1 in Section 11.6 of the Application. The first step included identifying parameters that are predicted to increase in concentration above existing conditions by greater than 10%. This comparison identifies parameters that are predicted to increase in concentration due to the Project (i.e., a Project-related effect). The second step used the parameters identified in the first step and compared them to water quality guidelines (WQGs). This process focusses the effects assessment on parameters that are predicted to exceed WQGs due to the proposed Project and therefore warrant further investigation to determine potential effects. Existing guideline exceedances are not a Project-related effect; however, if parameters that currently exceed guidelines are predicted to increase by more than 10% due to the Project, this screening methodology would select them as COPCs. The scope of the of the effects assessment focused on parameters with an approved or working BC water quality guideline for freshwater aquatic life (including 30-day average and maximum guidelines), CCME guideline for the protection of aquatic life (freshwater), Health Canada drinking water guidelines and BC MOE wildlife water supply. Water quality guidelines are determined by the BC MOE to be protective of freshwater biological receptors; water quality parameters without available guidelines (including hardness) were screened out of the assessment as there is no current direction from BC MOE on an appropriate benchmark for these parameters. Monitoring of water quality will be conducted through the Fish and Aquatic Effects Monitoring Plan (Section 24.7 of the Application), which will allow for identification and adaptive management of any effects on aquatic life.	6-Jul-2016
MOE-050	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Some parameters were predicted to exceed median background concentrations and guidelines only at a single model time-step and were not further characterized for significant residual effect. However, some of these effects on creeks during mine phases are likely due to seepage; there may be areas in the stream that may not readily mix with oxygenated water. A slight and short term guideline exceedance of the chronic, but not the acute guideline may have much less potential for significant effects than an exceedance of the acute guideline. Even short term and slight acute guideline exceedances could result in aquatic life toxicity. Furthermore, some of these time-steps occur during critical events, such as fish mitigation. Please update the assessment accordingly.	The exclusion of potential effects due to predictions concentrations of some parameters at a single model time-step from further characterization was not due to the lack of potential for aquatic life toxicity. These parameters were not identified as COPCs as predicted concentrations are within the natural range of variation in the existing environment. These single time-step events were excluded because ongoing operational water management optimization to respond to monitoring results of streamflows, seepage quality and quantity, and effluent discharge quantity and quality is expected to avoid such events.	6-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
MOE-050.1	29-Jul-2016	Tracy Henderson, MOE	Water (General)	Require further information to resolve. Any model predictions that exceed BC WQG due to project related impacts, even at a single model time-step, should be characterized for significant residual effect. Even short term and slight acute guideline exceedances could result in aquatic life toxicity. Furthermore, some of these time-steps occur during critical events, such as fish mitigation.	Predictive surface water quality modelling represents a tool to inform mitigation and management strategies as well as to generate predictions to inform the effects assessment. Residual effects to water quality are characterized in the Application, including, but not exclusive to, water quality predictions. COPCs identified in single time-step events are not anticipated as ongoing operational water management optimization to respond to monitoring results of streamflows, seepage quality and quantity, and effluent discharge quantity and quality is expected to avoid such events. AuRico understands that effluent cannot be acutely lethal to aquatic organisms either at end-of-pipe or within the IDZ and is committed to ensuring that effluent is not acutely lethal to aquatic life. Modelling of parameter concentrations in the IDZ and an effects assessment will be conducted during the permitting stage of the Project as part of the application for an effluent discharge permit under the Environmental Management Act. It is not clear which timesteps the reviewer is referring to wherein predicted water quality is indicated to be outside of the baseline system variation and above acute aquatic life toxicity guidelines during times of fish migration. For example, no base case water quality predictions for Attichika Creek, Waste Rock Creek, Attycelly Creek, Thutade Lake, Finlay River and Kemess Creek are greater than acute guidelines for the Protection of Aquatic Life. In Central Cirque Creek and East Cirque Creek, currently existing concentrations of many water quality parameters are greater than applicable acute guidelines for the protection of aquatic life; existing guideline exceedances are not a Project effect and predicted concentrations of water quality parameters within the baseline range of variation of the existing environment were not identified as significant residual effects.	20-Oct-2016
MOE-051	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Only four parameters (i.e., TSS, total aluminum, dissolved aluminum and total selenium) are graphed to display existing water quality conditions (KS post closure: 2011 to 2014). It would be helpful to provide figures for any parameter currently exceeding BC WQG and/or exhibiting an increasing trend. The Application states, 'total selenium concentrations have exhibited minor improvement'. However, the provided graph appears to show selenium concentrations increasing during KS post-closure. A quick comparison of nitrate data also appears to show an increasing trend. Please provide clarification whether any parameters, including selenium and nitrate are increasing during post-closure.	Response is provided in the memo **20160729 KUG Comment MOE-051_WQ_memo.**	5-Aug-2016
MOE-051.1	5-Sep-2016	Tracy Henderson, MOE	Water (General)	Six parameters were identified as exhibiting an increasing trend during the KS post-closure period at least one monitoring location: pH, chloride, sulphate, barium, molybdenum, and uranium. It's still unclear how an increasing trend for a particular parameter was incorporated into the water quality model. Please provide clarification that the modelled predictions are not overly conservative for parameters experiencing increasing trends.	To support predictive modelling, water quality data incorporated as source terms to represent existing conditions were restricted to data collected since KS mine entered post-Closure (April 2011 to December 2014) for stations within Kemess Creek, Waste Rock Creek, and Attichika Creek. Input values to the model represented monthly median values (base case) or 95th percentile values (sensitivity case 6, see section 3.4 of Appendix 11-D of the Application). Base case and sensitivity case 6 served to bracket currently existing conditions to support the effects assessment. Increasing trends over the April 2011 to December 2014 for these six parameters were not specifically incorporated into the predictive model. Increasing trends during the KS post-closure period at at least one monitoring location were statistically identified for pH, chloride, sulphate, barium, molybdenum, and uranium. Note that for pH, while statistically significant, the magnitude of the increase over time is 15% (inside range of analytical uncertainty) and largely undiscernible (see Figure 1 of 20160729 KUG Comment MOE-051_WQ_memo). Further, the statistical significance of the increasing trends in chloride and molybdenum concentrations (Figure 2 and Figure 5 of 20160729 KUG Comment MOE-051_WQ_memo) is heavily weighted by the observed single peak in concentrations in late 2013, which subsequently decrease. These peaks in concentrations are captured in the effects assessment (sensitivity case 6). Monitoring at these locations is currently ongoing; the existing conditions represented in the water quality model will be reviewed and updated to incorporate additional baseline data beyond that used to inform the EA water quality model and effects assessment to support the permitting stage of the Project.	20-Oct-2016
MOE-052	15-Jun-2016	Tracy Henderson, MOE	Water (General)	I disagree with the statement that Waste Rock Creek discharge is clean water and/or suitable for discharge as it wouldn't cause exceedances in Attichika Creek. Water quality in Waste Rock Creek should not be allowed to be degraded (i.e., in order to protect Attichika Creek) and the discharge should not cause acute toxicity in the initial dilution zone. A quick comparison of the proposed effluent quality (Table 11.6-4; Base Case) to the WQG indicates the discharge will cause many parameters to increase and/or cause exceedances. Furthermore, none of the Waste Rock Creek WQ Model data was graphed. Please update the assessment accordingly (including graphs and table/discussion on the upper case).	The response is provided in memo **20160805_KUG Comment MOE-052_WQG_Memo**.	5-Aug-2016
MOE-052.1	5-Sep-2016	Tracy Henderson, MOE	Water (General)	Further discussions and review of current and/or predicted Waste Rock Creek conditions will be done in the permitting stage of the project (no additional information required at this time).	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-053	15-Jun-2016	Tracy Henderson, MOE	Water (General)	Please provide clarification on whether the Nitrogen to Phosphorus Ratio for receiving environments, such as Waste Rock Creek, Attichika Creek and Thutade Lake was calculated? The ratio is required to assess potential impacts, for example shifts in the N:P ratio can cause increases in periphyton biomass and higher periphyton density. Even though concentrations may not exceed guidelines, potential increases can cause shifts in the N:P ratio.	N:P ratios were not calculated for the receiving environments (with the exception of Kemess Lake) given that nitrogen and phosphorus species were frequently below laboratory detection limits and considered co-limiting with respect to periphyton growth. Although shifts in N:P can cause changes in periphyton biomass, this would only occur at higher nutrient concentrations (which are not expected to occur) when one or more species is not limiting. Potential effects related to nutrient loading and increased biomass, including mitigation measures, are discussed throughout section 14.	7-Jul-2016
MOE-053.1	29-Jul-2016	Tracy Henderson, MOE	Water (General)	Require further information to resolve. Please calculate the Nitrogen to Phosphorus Ratio (paired and the combined NO3, NO2, NH3 compared to TDP) for receiving environments, such as Waste Rock Creek, Attichika Creek and Thutade Lake for both existing and modelled conditions. The ratio is required to assess potential impacts, for example shifts in the N:P ratio can cause increases in periphyton biomass and higher periphyton density. Even though concentrations may not exceed guidelines, potential increases (including below 10%) can cause shifts in the N:P ratio. Discussion should include if the systems are Phosphorus limited are for which seasons (i.e., time periods). Furthermore, the BC aquatic life WQG for total phosphorus (lakes; 5 to 15 µg/L) should also be used in the discussion for Thutade.	The response is provided in memo **20160914_A.1_KUG Comment MOE-053 and MOE-075 Round 2_N_P Ratios_Memo**	20-Oct-2016
MOE-054	15-Jun-2016	Tracy Henderson, MOE	Water (General)	I disagree with the statement that, 'There are no identified sampling difficulties, data gaps, or water quality data uncertainties that limit the assessment for surface water quality'. Parameters such as fluoride and bromide were specifically removed from the WQ Model as receiving water data was not available. Furthermore there is very little background hardness data (i.e., before KS).	The comment is acknowledged.	6-Jul-2016
MOE-055	15-Jun-2016	Tracy Henderson, MOE	Water (General)	There are limited use of graphs to facilitate data interpretation, as only graphs were provided for the base case (i.e., not upper case). Please update the assessment accordingly.	Graphs were provided for the upper case in Section 11.6 of the Application.	6-Jul-2016
MOE-056	15-Jun-2016	Tracy Henderson, MOE	Water (General)	There are no use of graphs or figure to facilitate data interpretation for the assessment of aquatic resource data in Chapter 14. For example, data should be plotted over time and along with data from the other sites for comparison. An assessment should be made on potential value of reference sites. Please update the assessment accordingly.	Long-term trends in aquatic resources data (e.g., fish, benthos, periphyton, sediment, etc.) are included in annual reports submitted to MOE for long-term monitoring for Fish and Fish Habitat (produced by D. Bustard and Associates since the mid-1990s), Provincial Environmental Effects Monitoring (produced by Hatfield since 2006), and Selenium Monitoring (produced by Hatfield since 2007). All of these programs include reference sites in their designs except the selenium program, where provincial Se guidelines are used for reference comparisons. Readers are referred to the most recent (2015 annual reports, produced in early 2016) versions of these reports for long-term trend information.	6-Jul-2016
MOE-057	15-Jun-2016	Tracy Henderson, MOE	Water (Quality & Treatment)	The highest discharge rates occur during construction period when there is no proposed water treatment. Water treatment options should be considered during the initial withdrawal period (i.e., construction phase). The discharge cannot be acutely toxic in the initial dilution zone. Please provide rational and supportive information to support the proponent's decision in delaying water treatment until the operational period.	The numerous discharge alternatives and scenarios (including treatment options) that were assessed for all phases of the Project are described in Appendix 4-D. The rationale behind the selection of the preferred/proposed alternative is described in Section 6 of Appendix 4-D. The planned discharge schedule and proposed water treatments are summarized in Section 11.5.3 of the Application. Additional discussion of water treatment is presented in Chapter 5 (Project Description) of the Application, and Appendix 11-D (Water Balance and Water Quality Modelling Report). During Construction, water from the KUG TSF will be discharged into Attichika Creek from May through October. While the direct treatment of discharge from the KUG TSF to the receiving environment is not proposed for the Construction phase, contact water entering the KUG TSF from the existing KS waste rock dump selenium containment pond (SeCP) will undergo selenium ion-exchange treatment (Appendix 11-D and Chapter 11 of the Application). As reported in Section 11.5.3 of the Application, this represents the major loading of selenium to the KUG TSF during the Construction phase, and predictive modelling indicates this targeted treatment will result in substantial reduction of selenium concentrations in the KUG TSF (Appendix 11-D). In addition, KUG TSF discharge water during construction is predicted to remain below BC pollution control objectives (see comment response to MOE-47 regarding POCs) as well as below effluent limits for parameters subject to the MMER (Table 5.3.1 of Appendix 11-D). Furthermore, mitigation measures developed as part of the discharge alternatives assessment (Appendix 4-D), are expected to minimize the potential effects to the receiving environment during Construction (Section 11.5.3 of the Application).	6-Jul-2016
MOE-058	15-Jun-2016	Tracy Henderson, MOE	Water (Quality & Treatment)	Please provide clarification whether treatment causes potential impacts to other parameters, such as dissolved oxygen or pH.	For selenium treatment, there will be no impact to either pH or dissolved oxygen (DO). For metals treatment, there will be no impact to pH. The effluent DO is typically slightly lower than DO in the feed but with no impact on fish toxicity test results. If DO becomes regulated at the end of pipe then an additional aeration step maybe required.	6-Jul-2016
MOE-058.1	29-Jul-2016	Tracy Henderson, MOE	Water (Quality & Treatment)	No additionally information required at this time - addressed in the permitting stage of the project. The DO WQG must be met in the receiving environment; therefore, DO may need to be regulated at end of pipe.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-059	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide data (i.e., summarized tables) for predicted water quality in the KUG TSF, which includes all Project phases, with/without treatment and base/95th percentile. Additionally, please provide clarification on how the KUG TSF data was calculated for different Project phases (Table 11.6-3. and Table 11.6-4.). For example, the KUG TSF discharge during construction period changes from the initial pit dewatering to a tailings discharge to the east cell. The KUG TSF data provided is presented as the arithmetic mean of all years in each Project phase. The 'averaging' approach could be discounting degraded water quality in specific months/years of each Project phase. Please update the assessment accordingly.	The surface water quality model for the Project was developed using a mass-balance calculation approach in GoldSim to model the volume and flow of water and the concentrations and transport of chemical species as a function of time and is presented in Appendix 11-D. Section 3.0 of Appendix 11-D details the overall approach and assumptions regarding water quality predictions for the KUG TSF. Note, predictive modelling for all nodes, including the KUG TSF discharge water quality, is conducted on a monthly timestep with summary statistics of these results presented in summary tables in the Application (Table 11.6-3, Table 11.6-4; Table 3.5-1 and Table 3.5-2 in Appendix 11-D). 'Averaging' of predicted KUG TSF discharge quality did not occur prior to informing predicted water quality of downstream assessment nodes and thus there is no potential to discount or 'mask' potentially elevated water quality concentrations. Water quality predictions of discharge quality from the KUG TSF (Table 11.6-3, Table 11.6-4; Table 3.5-1 and Table 3.5-2 in Appendix 11-D) are inclusive of the proposed water management plan and proposed water treatment of KUG TSF discharges, summarized Section 3.2.4 pf Appendix 11-D. Predicted quality of KUG TSF discharge is inclusive of years that include water treatment as well as years when there is no proposed water treatment or partial by-passes of water treatment are expected to occur (see Section 3.2.4 and Figure 1.3-1 through Figure 1.3-6 in Appendix 11-D).	5-Aug-2016
MOE-059.1	23-Aug-2016	Tracy Henderson, MOE	Water (Model)	Response is pending information from AuRico, as discussed at Aug 23 Water Quality Working Group Meeting: Provide data in a yearly format to support the determination that 2020 is the most sensitive year for water quality; information should be in addition to first round response to MOE-059.	The response is provided in memo **20160907_B.1_KUG Comment MOE-059.1_Round 2_WQ CriticalYears_Memo**	9-Sep-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
MOE-060	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide justification for how the shallow water scenario (KUG TSF water chemistry: Table 3.2-2) was considered more conservative than the deeper scenario (i.e., sensitivity analysis performed). There also appears to be a typo/unfinished sentence on page 3-11, ' At depths greater than 25m, water (Appendix 2).	Section 3.2.1 and Table 3.3-2 of Appendix 11-D describe how existing conditions of the KS Open Pit (proposed KUG TSF) were represented in the predictive water quality model. Results of ongoing water quality monitoring of the KS Open pit indicate that existing water chemistry is consistent from surface through to 25m (Table 3.3-2) and, further, for some parameters, is distinct from water quality at depth (>25 m). Thus, the best estimate for source term for initial chemistry in the GoldSim Model was to include the relative contribution to the initial inventory of the KUG TSF from both existing deep water chemistry (> 25 m) and shallow water chemistry (< 25 m; See Section 3.3, Model Assumptions by Project Area). The sentence on page 3-11 should read "At depths greater than 25 m, water is generally consistent for most water quality parameters, Appendix 2".	5-Aug-2016
MOE-061	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide modelled hardness concentrations. The predicted changes to hardness in the receiving environments (over the pre-selected temporal snapshots), including calculated hardness levels based on predicted calcium and magnesium should be discussed in the Application.	A response to this comment is provided in memo **20160805_KUG Comment MOE-61 and 078_SWQ_Memo**.	5-Aug-2016
MOE-062	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide clarification regarding the approximate volume (i.e., loading) of discharge from the sewage treatment in KUG TSF (to maintain ponds freeboard). Please provide rational and supporting information to support the proponent's decision in not incorporating these inputs into the WQ Model.	The existing sewage treatment system discharges to the Green Pond, which is then allowed to discharge to the ground. During spring runoff, it is typical that water in the pond must be pumped out of the pond and eventually to open pit to maintain freeboard within the pond as a result as a result of snowmelt runoff into the pond. The voume of water that is typically pumped out of the ponds during freshet is not known. However, the current sewage treatment system is permitted to discharge up to 0.5 L/s, which may need to be increased to approximately 2 L/s during the Construction Phase. If all of the discharge was to report to the KUG TSF this would account for less than 2% of total inflow to KUG TSF; however for the majority of the year effluent from the sewage treatment system is allowed to discharge to the ground. Thus, actual inflow to the KUG TSF would be less than 2 L/s. As such this intermitent inflow to the KUG TSF was not represented in the model. Where Project components/activities are not expected to interact with the surface water quality VC either due to the inof direct nature of the interaction or effective well-established best management practices, these components and activities are considered to have no potential effects and are not considered further in the assessment. These include discharges to ground from sewage treatment system to the Green Pond.	5-Aug-2016
MOE-063	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Chapter 11 mentions that seepage from KUG TSF will interact with receiving waters in Waste Rock Creek during all Project phases. However, Figures (Figure 1.3-1 to 1.3-6) in Appendix 11-D only include seepage pathways until closure. Please provide clarification on seepage inputs into the model.	Seepage starts from the second year of operation (Figure 1.3-4 in Appendix 11-D) and continues through Closure (Figure 1.3-5 in Appendix 11-D) and Post-Closure (Figure 1.3-6 in Appendix 11-D).	6-Jul-2016
MOE-064	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide clarification regarding how IDZ_WQ17 was modelled (i.e., how far downstream from discharge, dilution ratio and the degree of mixing assessed).	See response to the comment MOE-023.	5-Aug-2016
MOE-065	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide clarification regarding how Waste Rock Creek was modelled during post closure (i.e., how far downstream from discharge, dilution ratio and the degree of mixing assessed).	At Post-Closure, the KUG TSF will overflow to Waste Rock Creek through a spillway (Figure 1.3-7 in Appendix 11-D). Given the turbulent spillway flow, full mixing with the ambient Waste Rock Creek flows were assumed in the water balance and water quality models.	6-Jul-2016
MOE-066	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	The Application uses 100 year wet/dry sensitivity instead of 7Q10. While the 100 year dry sensitivity analysis is acknowledged, it was not used for Sensitivity Case 5, which was used to support the effects assessment. Therefore, I don't believe that the most reasonable upper case was used in the effects assessment. Please update the assessment accordingly.	All water quantity sensitivity cases (variable, average, 100-year wet, and 100-year dry precipitation/runoff; increased seepage rates) were considered and assessed in the Application. Table 11.6-2 presents a summary of all sensitivity cases considered in the Surface Water Quality Effects Assessment; Table 11.6-9 and Table 11.6-10 presents summary of water quality predictions and identified Contaminants of Potential Concern (COPC) for Base Case and Sensitivity Cases 1 through 6 used to inform the residual effects assessment. As described in Chapter 11, Section 11.6.2.1, Sensitivity Case 5 was identified as the upper case to support the effects assessment because: 1. water quality predictions were most sensitive to model inputs values (i.e., source terms) informing existing receiving environment chemistry; and 2. this case was identified as the most appropriate upper case by First Nations and their consultants during consultation to support the discharge alternatives assessment (Appendix 4-D).	5-Aug-2016
MOE-066.1	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Response is pending information from AuRico, as discussed at Aug 23 Water Quality Working Group Meeting: Provide the significance determination for Base Case 6 of the water quality assessment.	The response is provided in memo **20160907_B.1 - KUG Comment MOE-066.1_Round 2_Significant Det_Memo**	9-Sep-2016
MOE-067	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	There are several errors in the Application of BC WQG in Tables, for example: Table 5.1-8 • The dissolved cadmium 30-day and maximum guidelines are in the wrong columns; • The equation for dissolved aluminum should be 3.327; Table 14.6-10 • The guideline for total aluminum is listed as 0.005 but should be 0.1 and • The guideline for dissolved aluminum for pH >/= 6.5 should be 0.1 mg/L.	There was an error in reported WQG in Table 14.6-10. The WQG for total aluminum should be 0.1 mg/L and dissolved aluminum for pH >/= 6.5 should be 0.1 mg/L, and can be updated in Table 14.6-10.	7-Jul-2016
MOE-068	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	It is noted that TSS was not modelled. Please provide clarification for how TSS was treated as source term. Is it assumed that the total metal load from these was 100% dissolved or was it assumed that 0% of the particulate fraction was released from those sources? If it is the former, that should offer a conservative estimate. However, if it was the latter that could result in underestimation of the total metals load to the environment and have repercussions for the screening and effects assessment.	Water quality indicators are assessed quantitatively in predictive modelling, semi-quantitatively using best available data, or qualitatively using professional judgement and experience (Sections 11.5 and 11.6). As described in Appendix 11-D, dissolved parameters are reported for geochemical loadings (i.e. model source terms) generated within the mine site; total concentrations in the KUG TSF and the receiving environment are predicted by adding the mine site dissolved components to the total concentrations of the natural catchment and existing conditions. Documentation of geochemical source term development are described in Appendices 7-E, 7-F Total suspended solids (TSS) and turbidity in and of themselves were not included in the predictive water quality model. As described in Appendix 11-D, these water quality indicators cannot be predicted with certainty as TSS loading from overland and stockpile runoff cannot be predicted with accuracy. Changes in turbidity, TSS, are qualitatively assessed using best available data, professional judgement, proposed discharge management and mitigation strategies for the Project, and expected conditions in the KUG TSF.	5-Aug-2016
MOE-069	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide clarification if tailings solids (i.e., TSS) in the KUG TSF are all assumed to remain on the bottom (i.e., stay within KUG TSF) during discharge. What if 100% of the tailings do not stay within the KUG TSF? Please provide justification supporting this assumption.	The closure design for the KUG TSF is a flooded impoundment, with approximately 5 metres of water cover and an above sand beach on the eastern extent adjacent to East Dam. The water spillway will be located on the southwest corner of the impoundment, therefore the maximum distance from the beach and at its maximum depth to help minimize resuspension of the fine fraction. For comparison the Kemess South TSF has a far greater wind fetch than the proposed KUG TSF and we do not see resuspension in this facility that would give us concern.	6-Jul-2016
MOE-070	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide justification and supporting rational for why portal seepage loads have not been modelled for El Condor Creek.	The response is provided in memo **20160706_A.1 - KUG Comments_MOE-013,014,015,017,018, 070_SW_WQ.**	6-Jul-2016
MOE-071	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide clarification for how the water quality for mine dewatering was determined.	The comment is acknowledged and will be addressed at the time of permittting.	6-Jul-2016
MOE-071.1	29-Jul-2016	Tracy Henderson, MOE	Water (Model)	Require further information to resolve. Please provide clarification for how the water quality for mine dewatering was determined, for example how was it incorporated into the model.	Contact water captured in the underground workings from dewatering activities will be directed to the KUG TSF. Appendix 7-E (*Geochemical Characterization, Source Term Development, and Water Quality Predictions for Underground Contact Waters*) presents the geochemical characterization of the underground workings and corresponding source term development for incorporation into the Water Quality Model. Appendix E of Appendix 7-E of the Application presents the tabulated basecase and uppercase source term values that were directly input into the water quality model. The water quality model developed for the Project (Appendix 11-D) is based on the principle of water and chemical mass balance and accounts for flows (e.g., underground mine dewatering rate) and chemical loadings (source term representing dewatering water quality) entering and leaving site components, such as the KUG TSF, as well as the downstream receiving environment. Generalized mass balance equations illustrating how source terms are incorporated into the model are presented in Section 1.3 of Appendix 11-D.	20-Oct-2016
MOE-072	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	The WQ Model used throughout the Application relies on key inputs into the mass balance model. My review was limited to the water quality model and is based on the assumptions that the geochemical source terms were accurate and conservative. MEM will provide input on the appropriateness on the geochemical source terms.	The comment is acknowledged.	6-Jul-2016
MOE-073	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	The Application contains an error with page numbers. The page numbers change from 14-57, 14-60 to 14-58. It appears that an entire section referring to baseline Waste Rock Creek analysis (i.e., sediment, benthic invertebrates, and periphyton) has been omitted. Please update the assessment accordingly.	No pages were omitted from the assessment, but, during the formatting, pages 14-58 and 14-59 (which shows fish population trends in Waste Rock Creek) were shifted in the PDF to after 14-60. We apologize for this formatting error. Page numbers in page footers do accurately indicate the flow of text (the sentence at the end of page 14-57 that begins "The stream is..." continues on identified page 14-58 as "...typically confined throughout...").	6-Jul-2016
MOE-074	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Water quality parameters are interrelated and changes in one parameter can cause impacts to others, for example there is potential for long term dissolved oxygen collective impacts due to changes diversions or flow reductions. Portions of the receiving environment may exceed instantaneous guidelines. Please address this potential in more detail to confirm significant impacts do not occur.	Project-related changes in flow (i.e., >5% change) are predicted during operations and closure for East Cirque and Central Cirque creeks flowing from the subsidence zone (decreased flow, particularly from fall to spring) and for Waste Rock Creek during closure (increase in flow year-round, particularly from fall to spring). Both Cirque creeks are non-fish-bearing, flow steeply from alpine areas, with significant turbulent flow and aeration along their lengths, and flow into larger, well-aerated receiving environments (i.e., Amazay Creek or Amazay Lake). Waste Rock Creek flows is fish-bearing, has a rifle-pool or cascade-pool morphology throughout its length, and increased flow would be expected to maintain or increase aeration of waters. All three creeks currently are well aerated. Predicted changes in flow are not expected to affect dissolved oxygen concentrations in these creeks that would cause adverse effects on fish or other aquatic biota.	6-Jul-2016
MOE-075	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	There is a potential for nutrient changes (nutrient management) for both creeks/lakes. Was the N:P Ratio calculated and how is it expected to change? Data should be paired and the combined NO3, NO2, NH3 compared to TDP. Even with the Explosives Management Plan, nitrate will still make its way into receiving waters. Nitrate concentrations well below WQGL (3 mg/L) can still cause shifts in the N:P ratio (i.e., into a stronger P limitation). Please address potential nutrient changes in more detail to confirm significant impacts do not occur.	As discussed above, N:P was not calculated for the receiving environments given that nitrogen and phosphorus species were frequently below laboratory detection limits and changes in any calculated ratios would not be expected to cause shifts in periphyton biomass. In addition, the predictive water quality model does not predict any COPCs associated with any nitrogen or phosphorus compounds in the Project area, with the exception of nitrate in Waste Rock Creek during closure and post-closure (page 14-127). Although changes in the N:P ratio may occur, specific concentrations of nitrogen and phosphorus species are predicted to remain within the range of natural variability and would not cause significant changes in periphyton biomass or changes in the trophic status of the receiving environments.	7-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
MOE-075.1	29-Jul-2016	Tracy Henderson, MOE	Water (Model)	Require further information to resolve. There is a potential for nutrient changes (nutrient management) for both creeks/lakes. Please calculate the Nitrogen to Phosphorus Ratio (paired and the combined NO3, NO2, NH3 compared to TDP) for receiving environments, such as Waste Rock Creek, Attichika Creek and Thutade Lake for both existing and modelled conditions. The ratio is required to assess potential impacts, for example shifts in the N:P ratio can cause increases in periphyton biomass and higher periphyton density. Even though concentrations may not exceed guidelines, potential increases (including below 10%) can cause shifts in the N:P ratio (see same comment as #53). Discussion should include if the systems are Phosphorus limited are for which seasons (i.e., time periods).	The Response is provided in memo **20160914_KUG Comment MOE-053.1, 075.1 Round 2_N_P Ratios_Memo**	20-Oct-2016
MOE-076	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	There is a potential for changes to DOC. Risks to aquatic life related to changes in concentrations of DOC are not toxicological, but typically cause reductions in primary productivity, while increasing susceptibility to toxic metals and acidification. Please address potential DOC changes in more detail to confirm significant impacts do not occur (i.e., synergistic effects related to increasing DOC concentrations in combination with elevated nutrient loadings (i.e., nitrate and phosphorus)).	DOC was not identified as a COPC and was not routinely measured in water quality samples. However, based on water clarity, pH, and ionic composition of watercourse and waterbodies in the Project area, DOC concentrations would be expected to be low. DOC in ambient waters in BC are generally less than 5 mg/L. There also were no indications that DOC would change as a results of the Project. Synergistic effects with nutrient loadings also would not be expected to occur given that nitrogen and phosphorus species are not predicted to exceed the range of natural variability in the Project area.	7-Jul-2016
MOE-077	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Some parameters are expected to increase due to the Project related activities. The interaction of multiple parameters of concern in a mixture may have additive, or synergistic effects, with impacts at concentrations lower than expected. There is likely an increased level of risk associated with combinations of individual contaminants identified as parameters of concern. Please address potential interactions for multiple parameters of concern to confirm significant impacts do no occur. Please consider synergistic effects when considering the residual effect rating.	Although effects of mixtures were not directly assessed, the residual and cumulative effects assessment identified several parameters that are expected to have residual effects in the receiving environments of some watercourses (e.g., TSS, conductivity, total Cd, Al, Cu, Mo and Se; Section 11.8). Mitigation measures summarized in Table 11.8-1 to reduce TSS will likely also reduce concentration of some metals, particularly ones that have a correlation with TSS concentration (i.e., Al). In addition, surface water guidelines often take mixtures into consideration when determining guideline values. For example, metal concentrations and ion concentrations (i.e., hardness), nitrite and chloride concentrations and aluminum and pH concentrations take into consideration the synergetic interactions of these analytes.	7-Jul-2016
MOE-078	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	The predicted changes to hardness in the receiving environments (over the pre-selected temporal snapshots), including calculated hardness levels based on predicted calcium and magnesium should be discussed in the Application. For example, shift in species composition is a potential effect of increased water hardness.	A response to this comment is provided in memo **20160805_KUG Comment MOE-61 and 078_SWQ_Memo.**	5-Aug-2016
MOE-079	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	The Application did not quantify potential changes in sediment quality. Please provide discussion about sorption of parameters of concern with sedimentary material and how the predicted water concentrations could be conservative (for all parameters that are expected to increase due to Project related activities). This is critical for parameters, such as arsenic, selenium and mercury that can bioaccumulate. There is also no discussion on potential impacts to sediment and benthos or bottom feeding birds in the effects assessment. The potential for increased concentrations should be considered in the assessment of impacts to aquatic resources. Please discuss potential sediment quality increases in more detail to confirm significant impacts do no occur.	Concentrations of bioaccumulative metalloids (As, Hg, Se) in water are not predicted to significantly increase in any waterbodies as a result of the Project; following mine closure, Se concentrations in Waste Rock Creek are predicted to decrease substantially from current (waste-rock-seepage-impacted) conditions, due to dilution from pit water released via this creek. Given waterborne concentrations of these chemicals are not predicted to increase, their sorption or other sequestration to sediments should remain similar or decrease (in the case of Se in Waste Rock Creek) due to mine activities.	6-Jul-2016
MOE-080	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	There is concern that the length of the initial dilution zone (IDZ) had not been established at this time and how the IDZ was modelled (see previous comments). Furthermore, the Attichika diffuser design will be built to extend as far as possible across the wetted width of the stream. The proponent should be aware that acute toxicity cannot occur anywhere in the IDZ. A clear migration corridor for fish will also be required. The proponent should provide discussion on how the IDZ was modelled, potential acute toxicity and design achievability (i.e., providing clear migration corridor).	See response to the comment MOE-023.	5-Aug-2016
MOE-080.1	5-Sep-2016	Tracy Henderson, MOE	Water (Model)	In general, the response provided at the Aug 23 Water Quality Working Group Meeting has addressed my concerns regarding how the IDZ was modelled. Additional details, such as modelling parameter concentrations in the IDZ and effects assessment will be required in the permitting phase. Please provide a detailed map downstream of Attichika discharge (i.e. from discharge to IDZ WQ17), which shows all potential and confirmed spawning habitat for all fish species (EA Information Requirement).	The response is provided in memo **20161018_A.1 - KUG Comment MOE-080.1, 081.1_Round 2_Aquatic_Memo**.	19-Oct-2016
MOE-081	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Olfactory response on bull trout migration may be an issue due to discharge in Attichika Creek. Please discuss potential olfactory effects on bull trout migration.	See response in the memo **20160706_A.1 KUG Comment MOE-081_bulltroout migration_Memo**	6-Jul-2016
MOE-081.1	29-Jul-2016	Tracy Henderson, MOE	Water (Model)	There is a potential impact to fish homing in Attichika Creek during discharge. This potential impact will vary depending on species, year class, and the extent that alterations in water chemistry. Therefore, a detailed review that includes significance of residual effect on homing of fish to Attichika Creek should be included within the Application, for example magnitude, duration, reversibility, and likelihood determine. The use of an adaptive management and monitoring program should provide options to deal with potential negative effects.	The response is provided in memo **20161018_A.1 - KUG Comment MOE-080.1, 081.1_Round 2_Aquatic_Memo**.	19-Oct-2016
MOE-082	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	The Application did not include any mitigation options for sulphate; instead it relies on dilution to reduce concentrations in the receiving environment. Discharge sulphate concentrations, to Attichika Creek, are extremely high (exceeding BC WQG) during operations (median=1225 mg/L, maximum 1423 mg/L). Please address potential sulphate mitigation options.	The BC WQG AL (or any other receiving environment guidelines) do not apply at end of pipe or within the IDZ. The proponent is committed to ensuring that effluent is not acutely lethal at end of pipe and that chronic toxicity does not occur at the end of the IDZ, consistent with BC MOE policy and practices for permitting of effluent discharges under the Environmental Management Act. Sulphate concentrations are predicted to be below the BC WQG AL at full mixing. The extent of the IDZ will be defined during permitting.	5-Aug-2016
MOE-083	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide a summary table for all parameters that are expected to increase due to Project related activities. Also, please include the anticipated percentage increase and if any are approaching WQG. It is not only important to assess whether Project related activities will cause guideline exceedances on their own, but it is also important to assess the potential cumulative effects on water quality in association with the Project. Even if a guideline is not exceeded, additional loadings (i.e., Attichika or Waste Rock Creek) may result in cumulative impacts. Any increases should be assessed in the effects assessment as to whether or not it may result in impacts on the receiving environment. Please update the assessment accordingly.	Water quality predictions for all parameters are presented in Appendix 11-D. However, consistent with other recent EA applications in BC, the methodology to support the effects assessment used a 2-step screening process to identify contaminates of potential concern (COPCs), as outlined in Figure 11.6-1 in Section 11.6 of the Application. The first step included identifying parameters that are predicted to increase in concentration above existing conditions by greater than 10%. This comparison identifies parameters that are predicted to increase in concentration due to the Project (i.e., a Project-related effect). The second step used the parameters identified in the first step and compared them to water quality guidelines (WQGs). This process focusses the effects assessment on parameters that are predicted to exceed WQGs due to the proposed Project and therefore warrant further investigation to determine potential effects. Existing guideline exceedances are not a Project-related effect; however, if parameters that currently exceed guidelines are predicted to increase by more than 10% due to the Project, this screening methodology would select them as COPCs. The scope of the of the effects assessment focused on parameters with an approved or working BC water quality guideline for freshwater aquatic life (including 30-day average and maximum guidelines), CCME guideline for the protection of aquatic life (freshwater), Health Canada drinking water guidelines and BC MOE wildlife water supply. Water quality guidelines are determined by the BC MOE to be protective of freshwater biological receptors; water quality parameters without available guidelines (including hardness) were screened out of the assessment as there is no current direction from BC MOE on an appropriate benchmark for these parameters. Monitoring of water quality will be conducted through the Fish and Aquatic Effects Monitoring Plan (Section 24.7 of the Application), which will allow for identification and adaptive management of any effects on aquatic life.	5-Aug-2016
MOE-083.1	5-Sep-2016	Tracy Henderson, MOE	Water (Model)	Please provide more information for how natural variation was determined when considering the magnitude for residual effects on Surface Water Quality (as seen in Chapter 11, Table 11.6-10). For example, how was the observed range (or limits) of natural variation calculated (i.e., were seasonal trends used, such as spring, summer, fall and winter).	The upper range of natural background concentrations for each assessment node presented in Table 11.6-5 through Table 11.6-8 was determined using the 95th percentile (MOE 2013) of existing conditions (see Section 11.4.3 and Section 3.2.1 of Appendix 11-D for additional discussion on existing conditions). For each water quality parameter, the 95th percentile was calculated on a monthly basis to account for potential seasonal trends in existing concentrations. Similarly, the lower range of natural background concentrations for each assessment node presented in Table 11.6-5 through Table 11.6-8 was determined using the 5th percentile of existing conditions. For each water quality parameter, the 5th percentile was calculated on a monthly basis to account for potential seasonal trends in existing concentrations. The natural range of variation for each assessment node, as defined above, was considered in the characterization of residual effects for the Project, summarized in Tables 11.6-9 and Table 11.6-10. Reference: MOE (Ministry of Environment). 2013. Guidance for the derivation and application of water quality objectives in British Columbia. Victoria, BC (CA): BC Ministry of Environment, Water Protection and Sustainability Branch. 146p. Accessed on-line at http://www.env.gov.bc.ca/wat/wq/pdf/wqo_2013.pdf	20-Oct-2016
MOE-084	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	The cumulative effects assessment of all stressors was poorly quantified. The water quality analysis focused on the potential for toxicity of individual constituents and this information was then passed to appropriate sections, including aquatic health. Within the aquatic health assessment toxicity was again assessed on an individual constituent basis. The application should consider an assessment of the cumulative impact on sensitive aquatic receptors for multiple contaminants. Potential might exist for cumulative effects within discharge plume(s). Please address this potential in more detail to confirm significant impacts do not occur.	For projects that require environmental assessments in BC, it is standard practice to use federal (i.e., CCME) and provincial (i.e., BC MOE) guidelines to assess water quality related effects. The guidelines take into account modifying factors (e.g., hardness and pH) for parameters in which toxicity is affected by modifying factors (e.g., copper and lead). Note, the environmental assessment used baseline modifying factors (e.g., hardness) for screening model predictions to the relevant guidelines; using baseline hardness to calculate water quality guidelines is the preferred and conservative approach as it represents the lowest level of risk to the designated water uses at the site. The water quality guidelines are inclusive of safety factors, built into guidelines vales to account for issues like potential mixture-toxicity and lab-to-field uncertainty. Furthermore, there are federal and provincial water quality guidelines for the parameters that tend to modify toxicity of other parameters (e.g., total dissolved solids, alkalinity). Therefore, the combined effects of water quality parameters were captured with the use of federal and provincial guidelines.	6-Jul-2016
MOE-085	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	The fish section compares tissue metal concentrations to selenium and mercury guidelines. Comparison should also be made to wildlife and human health guidelines as well, where these uses exist. Please confirm that this was assessed properly in the wildlife and human health section.	As shown in Tables 14.4-2 and 15.2-1 of the Application, both of the BC MOE tissue residue guidelines for the protection of wildlife/aquatic life (muscle, whole body, and eggs) for mercury and selenium were used in the COPC screening process. The screening of COPCs due to consumption of fish by wildlife is described in Section 15.5.2.2 of the Application. Sections 15.6.9.5 (Chemical Hazards on Raptors), 15.6.10.4 (Chemical Hazards on Waterbirds), 15.6.11 (Potential Residual Effects Assessment on Migratory Landbirds), and 15.6.12.5 (Chemical Hazards on Western Toad) of the Application provide further information on the assessment of the potential for bioaccumulation and toxicity of these compounds in wildlife. As shown in Table 18.2-1 of the Application, the BC MOE human consumption fish tissue guidelines for selenium and mercury were included in the assessment. Only selenium was identified as a COPC in fish tissue for human consumption (Section 3.6.1 and Tables 3.6-1 and 3.6-2 of Appendix 18-B). Therefore, the risk to human health from consumption of fish (as part of country foods) was evaluated in Section 18.5.2.5 of the Application.	6-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
MOE-086	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide contingencies for scenarios in which water treatment cannot occur due to malfunctions or if discharge quality is not acceptable (i.e., what is the KUG TSF capacity to store additional water). It is unclear how water quality will be impacted in Attichika Creek if treatment cannot occur.	Multiple layers of contingencies are available for water treatment. Specific discussion regarding the flexibility of treatment to changing conditions (i.e., flexibility of response to variation in flow rate for treatment, water composition, and climate) is discussed in Appendix 5-C. Further, during Construction and early stages of Operations, there is sufficient capacity to store inflows into the KUG TSF for multiple years. During the construction phase (up to 12 years of storage following maximum drawdown) and during operations, at year 7 (when the East Dam construction starts) there will be storage capacity for up to 2 years going forward without discharging it to Attichika Creek. The EA water quality model also assumed constant discharge volumes during dry, normal, and wet years. An additional contingency that has not been represented in the model is the possibility of additional discharge during wet years without exceeding water quality objectives. An additional measure if necessary would be cessation of mining activities, including cessation of pumping underground water to the KUG TSF until successful treatment for discharge is achieved. This would provide 7 months of storage of u/g waters, thereby further reducing the volume of water directed to the KUG TSF. Water quality monitoring of the KUG TSF and the receiving environment will be ongoing in Construction, Operations, and Closure and will service to validate water quality predictions. Further, if instances of short-term exceedances of water quality guidelines are indicated by ongoing monitoring, contingency measures can be initiated; for example, a temporary reduction of discharge and storage of water in the KUG TSF. If more prolonged exceedances are observed (i.e., upper geochemistry case selenium predictions), contingency measures could include increasing Se-IX™ treatment capacity, or adjusting MR treatment procedure; flexibility of treatment to changing conditions (i.e., flexibility of response to variation in flow rate for treatment, water composition, and climate) is discussed in Appendix 5-C.	5-Aug-2016
MOE-086.1	5-Sep-2016	Tracy Henderson, MOE	Water (Model)	Addressed in the permitting stage of the project (no additional information required at this time). A data summary for TSF discharge without treatment will be required during the permitting stage.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-087	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide contingencies for scenarios in which KUG TSF is not suitable for controlled discharge (i.e. overflow via a spillway) to Waste Rock Creek. Treatment options may be required to ensure the discharge is not acutely toxic.	The Post-Closure phase of the Project corresponds to the cessation of active water treatment and direct discharge from the KUG TSF to Waste Rock Creek. Water quality monitoring during the Closure phase will be used to validate water quality predictions and to confirm the timing of the cessation of treatment. Water treatment options will be adaptively managed and continue to be applied until water quality results meet discharge criteria.	6-Jul-2016
MOE-088	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Please provide clarification on how surface water will be managed at the site if a temporarily closure/reduction in staff occurs (i.e., period of care and maintenance). Would the proposed treatment still occur?	During a temporary closure/reduction in staff, water treatment of the KUG TSF water will still occur.	6-Jul-2016
MOE-089	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	The monitoring section was reviewed at a high level and will be reviewed in more detail during the permitting stage.	The comment is acknowledged.	6-Jul-2016
MOE-090	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	An evaluation of the potential for acute toxicity from the discharge was not completed. It is recommended that acute toxicity tests (i.e., 96hr LC50 for Rainbow Trout and 48hr LC50 for Daphnia magna) be included in the permit monitoring program for all discharge.	The comment is acknowledged and will be addressed at the time of permitttting.	6-Jul-2016
MOE-091	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	Monitoring of any clean water diversion ditches in construction and operation periods should be included in the permit monitoring program for at least TSS/turbidity until the ditches are confirmed to be of acceptable water quality.	The comment is acknowledged and will be addressed during the development of the permit monitoring program.	6-Jul-2016
MOE-092	15-Jun-2016	Tracy Henderson, MOE	Water (Model)	The Application characterizes potential impacts to aquatic life with individual constituents. However, the Application does not attempt to characterize the potential cumulative effects of multiple contaminants. The interaction of multiple contaminants in a mixture may have additive, or synergistic effects, with impacts at concentrations lower than expected. It is recommended that a chronic toxicity testing program be included in the permit monitoring program (i.e., receiving environment).	The comment is acknowledged and will be addressed during the development of the permit monitoring program.	6-Jul-2016
MOE-093	20-Jun-2016	Alan Gibson, MoE	Management Plans	The Ministry has a Technical Guidance 3 - Developing a Mining Erosion and Sediment Control Plan that the proponent needs to follow.	The comment is acknowledged.	6-Jul-2016
MOE-093.1	5-Sep-2016	Alan Gibson, MoE	Management Plans	No further action required for the EA process. Additional information on erosion and sediment control plans outlined in Technical Guidance 3 will be part of Environmental Management Act (EMA) permitting requirements.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-094	20-Jun-2016	Alan Gibson, MoE	Management Plans	The Selen-IX selenium treatment has never been used in a full scale treatment facility. What backup procedures will be used if the selenium treatment does not achieve BC Water Quality Guidelines at the discharge locations?	Several aspects of the project help mitigate the risk of the plant failing to reach BC-WQG at the discharge location. First, the plant is designed to reach < 1 µg/L selenium at the end of pipe, i.e. below the BC Water Quality Guideline of 2 µg/L applicable in the receiving environment. This added factor of safety provides an extra level of protection for compliance. Second, in 2015 a Selen-IX pilot was carried out to demonstrate the ability of the process to reach < 1 µg/L over approximately 2 months of continuous operation. In this program the pilot treated existing pit water to remove selenium. The existing pit water was spiked with additional selenium, sulphate and chloride in order to match the 98th percentile water quality expected during the life of mine. The water chemistry used for this pilot represents the most contaminated feed water that the full scale Selen-IX facility would be expected to treat. In this way, the risk of failure to reach the BC Water Quality Guidelines was mitigated through demonstration. Finally, the project timeline is such that selenium treatment is to start 2 years in advance of mine production. During this initial run-time, the Selen-IX plant can be optimized and any deficiencies can be corrected before production starts. For this period, effluent of the plant that does not meet discharge targets can be redirected back to the open pit prior to retreatment.	6-Jul-2016
MOE-094.1	27-Jul-2016	Alan Gibson, MoE	Management Plans	July 27: Information on the SelenIX pilot test design and results or refer to where in the EA application this can be found and reviewed. This information is needed for the EA and for permitting. **Aug 30: No further information required for the EA process. Additional information on the Selenium treatment process and long term disposal of sludge will be required for EMA permitting.**	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-095	20-Jun-2016	Alan Gibson, MoE	Management Plans	The application does not describe what metal treatment technology will be used. The proponent needs to describe what treatment technology will be use, where it has been used before, how does the site conditions where the treatment has been used compare to this site, what metals will be removed, what by-products will be created, are the by-products hazardous and where will the by-products be disposed of?	The metal treatment system for the project involves the use of sulphide and ferric iron addition in order to precipitate metal contaminants followed by flocculation and coagulation. This system will use multimedia filters to capture the precipitated solids and separate them from the treated water. This system was chosen based on analysis of the expected influent water chemistry and the discharge targets set by the BC Water Quality Guidelines. The feed to the metals treatment plant is expected to be circumneutral or alkaline water containing relatively low total dissolved solids (TDS). The influent metals concentrations are predicted to be in the low mg/L range while discharge targets are in the µg/L range. As a result, lime neutralization is not appropriate for this application and instead the combination of sulphide and ferric precipitation was chosen as much better technical fit that is also commercially proven. Sulphide and ferric precipitation have been employed for large scale water treatment by BioteQ at several mine sites in Canada and the United States including the Raglan mine (Glencore), the Minto mine (Capstone Mining), and Wellington Oro (Breckenridge, CO). Most recently this type of system was installed at the Silvertip mine in BC (JDS Mining). Each of these sites involves treatment of water similar to that of the Project – alkaline water containing low TDS and low mass load of metal requiring removal. Key metals being removed include nickel, zinc, copper and cadmium, each of which has a very strong affinity for sulphide. The by-product of treatment is a stable metal sulphide solid that blended with either the mine's concentrate product (Raglan, Minto) or is sent to a nearby smelter (in the case of Wellington Oro) or could be blended with tailings deposited subaqueously in a tailings pond as planned for the Project.	6-Jul-2016
MOE-095.1	27-Jul-2016	Alan Gibson, MoE	Management Plans	Thank you. Information on the sulfide treatment system as well as details on the charteristics of the influent and effluent, management, operation and maintenance of the system, including storage and disposal of byproducts will be needed for permitting.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-096	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	Has the spillage discharge and seepages from the Kemess South TSF into South Kemess Creek and North Kemess Creek been included into the water quality modelling?	Spillway discharge and seepage from the Kemess South Tailings Storage Facility (TSF) has been included in the water quality model as indicated in the conceptual model figures in Appendix 11-D, Figures 1.3-1 to 1.3-6.	6-Jul-2016
MOE-097	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	The modelling results refer to BC's Pollution Control Objectives for the Mining, Smelting and Related Industries. MOE rescinded all Pollution Control Objectives a long time ago and now use BC Water Quality Guidelines. When was the water quality modelling for the Kemess Underground project done? The Kemess Underground modelling results along with their comparison to BC Water Quality Guidelines need to be resubmitted.	The water quality modelling and effects assessment were completed in 2015 to support the Application. BC Pollution Control Objectives (1979) were used as benchmarks for evaluating predicted effluent quality. The proponent understands that these objectives have been rescinded; however, they represent a useful tool for assessing the likelihood of achieving permittable effluent limits. BC Pollution Control Objectives have recently been used in other approved BC mine Applications , including Murray River, KSM and Brucejack projects, for benchmarking effluent quality. The proponent understands that discharge limits that consider site-specific conditions including available low flow dilution will be established during permitting.	6-Jul-2016
MOE-097.1	27-Jul-2016	Alan Gibson, MoE	Water (Quality & Treatment)	Comparison to PCO is useful however, comparison to applicable BC Water Quality Guidelines is also needed for all scenarios modeled. **New Comment in the Table dated Aug 30: No further information required for the EA process. For the EMA permitting process, all water quality results will need to be compared to BC Water Quality Guidelines.**	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-098	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	Where is the analysis from the Selenium Collection Pond?	Existing water quality in the Selenium Collection Pond (also described as the Selenium Retention Pond) is presented in Table A2-2 in Appendix 11-D. Water quality in the drainage from the non-acid generating (NAG) waste rock dump, including the Selenium Collection Pond, is conservatively assumed not to improve over the life of the Project.	6-Jul-2016
MOE-099	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	What metal and selenium results were used in the modelling? Where are the modelling results for worst case scenarios?	Model inputs for existing geochemical loadings and background water quality concentrations of metals and selenium are presented in Appendix 2 of Appendix 11-D. Water quality predictions for sensitivity analyses (defined in Table 3.4-1 of Appendix 11-D) are presented in Appendix 4 of Appendix 11-D.	6-Jul-2016
MOE-100	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	I can not tell what was used as a baseline (background), the existing mine conditions or the conditions before Kemess South was built.	As described in Section 3.2.1 of Appendix 11-D, existing water quality in the proposed Project area has been influenced by the closed Kemess South Mine. Model inputs for watercourses downstream of the Kemess South Mine use water quality data available since April 2011, which corresponds to the post-closure period for Kemess South. For watercourses outside of potential influence from Kemess South, all available water quality data (1996 to 2015) was used. Model inputs for existing conditions including concentrations of metals and selenium are presented in Appendix 2 of Appendix 11-D.	6-Jul-2016
MOE-101	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	I am not sure if the modelling results are based on flows that use 100 % of metals and selenium removal or is the modelling based on metal removal of 120 L/s and selenium removal of 50 L/s?	As described in Section 1.3.4 of Appendix 11-D, water quality predictions include two water treatment processes: dissolved metals removal with a capacity of 120 L/s and selenium treatment with a capacity of 50 L/s. Discharge in excess of the treatment capacity was assumed not to be treated in the water quality model.	6-Jul-2016
MOE-101.1	5-Sep-2016	Alan Gibson, MoE	Water (Quality & Treatment)	No further information required for the EA process. As was discussed at the August 23, 2016 KUG Water Sub-Working Group meeting, the Ministry will be looking for Selenium to be treated to 120 L/s for EMA permitting.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-102	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	What flocculants will be used? Has any toxicity testing been done?	Magnafloc E10 will be used for metals treatment. This flocculant is widely used in mine water treatment. It is either non-ionic or very slightly anionic depending on the pH.	6-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
MOE-102.1	27-Jul-2016	Alan Gibson, MoE	Water (Quality & Treatment)	If available, please provide an assessment of the Magnafloc toxicity at the anticipated dosage. A Floc Management Plan, will also be needed for the permit application **New Comment in the Table dated Aug 30: No further information required for the EA process. Additional information will be required for EMA permitting.**	In a study completed by Vigneault et al. (2012), Magnafloc 10 was tested using the Metal Mining Effluent Regulations test species and recommended methods. The study reported the following findings: Sublethal endpoints showed higher sensitivity to Magnafloc 10 than did acute tests except for the least sensitive of the sublethal test organisms, P. promelas with a 7-d IC25 of 141 mg/L. The 96-h lethal concentration of Magnafloc 10 for rainbow trout was 58 mg/L. Daphnia magna was found to be the least sensitive of all the organisms tested, with only 10 % mortality observed at the highest concentration tested (48-h LC50 >903 mg/L) (Vigneault et al. 2012). In the proposed treatment at KUG, the expected concentrations of flocculent applied are from 0.5 to 3 mg/L. It is anticipated that the majority, if not all, of the flocculent applied will attach to the solids that precipitate out of the KUG water and will be removed via filtration. Therefore, the flocculent concentration in the final effluent is expected to be zero or very close to it. The key control parameter in the plant is the rate of flocculent addition which will be controlled automatically. A flocculent management plan will be developed for the permit application. Reference Vigneault, B., Desforges, M. and McGeer, J. 2012. Mining Reagents and By-Products (e.g. Thiosalts) As Potential Toxicants in Mine Effluents. Environmental Effects Monitoring Investigation of Cause Workshop for Metal Mining. Proceedings by The National Environmental Effects Monitoring Office, Environment Canada.	20-Oct-2016
MOE-103	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	Is the results in Table 3.2-7 the best case scenario? What is the predicted discharge quality for each year during low flow conditions?	Table 3.2-7 in Appendix 11-D presents the results of bench-scale water treatment testing that were incorporated as source terms to represent water treatment for the Se-IX™ and metals removal (MR) treatment plants in the predictive model. Predicted influent chemistry (i.e. feed concentration, 95th percentile values of base case predictions) was provided to BioteQ to inform laboratory-scale water treatment testing. Base case model predictions were based on the variable annual precipitation, base case groundwater inflows (see Section 2.2 of Appendix 11-D), and expected base case geochemical source terms (see Section 3.2 of Appendix 11-D). Flexibility of treatment to changing conditions (i.e., flexibility of response to variation in flow rate for treatment, water composition, and climate) is discussed in Appendix 5-C of the Application. It is noted that base case is considered to be the reasonably conservative best estimate considering to support the effects assessment for Project; it is not considered to represent the "best case" scenario. Note, water quality monitoring of the KUG TSF and the receiving environment will be ongoing in Construction, Operations, and Closure and will service to validate water quality predictions. Further, if instances of short-term exceedances of water quality guidelines are indicated by ongoing monitoring, contingency measures can be initiated; for example, a temporary reduction of discharge and storage of water in the KUG TSF. If more prolonged exceedances are observed (i.e., upper geochemistry case selenium predictions), contingency measures could include increasing Se-IX™ treatment capacity, or adjusting MR treatment procedure.	5-Aug-2016
MOE-104	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	All refuse including water treatment by-products need to be discharged into a properly designed industrial landfill.	The comment is acknowledged and will be addressed at the time of permitting.	6-Jul-2016
MOE-105	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	How does the water quality from the Western and Southern Collection Ponds compare to BC Water Quality Guidelines?	The Southern and Western collection ponds represent existing infrastructure of the former Kemess South (KS) Mine, which is currently under care and maintenance; these are included in the predictive water quality model for the Project as per the existing potential to interact with local surface water quality (Appendix 11-D). For model inputs, water quality data of monitoring site WR-S4 corresponds to the Southern Collection Pond, which receives surface runoff and seepage from the leach cap of NAG WRD. Water quality data of monitoring site WQ-WCSP corresponds to the Western Collection Pond which receives surface runoff and seepage from the non-leach cap of NAG WRD. This data is presented in Appendix 2 of the Water Balance and Water Quality Monitoring Report (Appendix 11-D). Though water quality in the collection ponds has been represented in the KUG EA water quality predictions, a direct comparison of water quality in the collection ponds against BC Water Quality Guidelines has not been completed as this is considered to be outside the scope of the KUG EA.	5-Aug-2016
MOE-105.1	5-Sep-2016	Alan Gibson, MoE	Water (Quality & Treatment)	No further information required for the EA process. The Ministry will be looking for Selenium to be treated from the Western Collection Pond and the Southern Collection Pond for EMA permitting.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-106	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	BC Water Quality Guidelines are not a target to pollute up to. It is expected that effluent will be treated to ensure contaminants of concern are below BC Water Quality Guidelines. This allows other industries and users (including future users) the ability to work in the area.	The comment is acknowledged. AuRico understands that specific discharge criteria will be established during permitting.	6-Jul-2016
MOE-107	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	At Post Closure, water treatment will be required until such time as the proponent can demonstrate the discharges meet BC Water Quality Guidelines.	At Post Closure, water treatment will be required until such time as the proponent can demonstrate the discharges meet permitted discharge limits.	6-Jul-2016
MOE-107.1	27-Jul-2016	Alan Gibson, MoE	Water (Quality & Treatment)	Receiving environment data will be compared to applicable BC Water Quality Guidelines and discharge will be compared to established permit limits. In some cases. based on the impact assessment, permit limits may be the same as BC Water Quality Guidelines. **New Comment in the Table dated Aug 30, 2016: No further information required for the EA process. Additional information will be required for EMA permitting.**	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-108	20-Jun-2016	Alan Gibson, MoE	Water (Quality & Treatment)	I am not sure what the following in Section 5.1 page 92 means "suitable water quality was determined by minimizing predicted exceedances of water quality guidelines in Waste Rock Creek due to KUG TSF overflow and optimizing the discharge scheme and water treatment plan as to prevent Project related exceedances of water quality guidelines in Attichika Creek". Could you please clarify?	As described in Appendix 11-D, the temporal boundary between the Closure and Post-Closure phases for the Project was determined by predictive water quality modelling, defined by the year it is predicted that the KUG TSF will be of suitable water quality to allow for uncontrolled discharge (i.e. overflow via a spillway to Waste Rock Creek). The proponent is committed to ensuring that effluent is not acutely lethal at end of pipe and that chronic toxicity does not occur at the end of the IDZ, consistent with BC MOE policy and practices for permitting of effluent discharges under the Environmental Management Act. A summary of Predicted KUG TSF water quality in the Post-Closure Phase of the Project is provided in Table 11.6-4 and indicates that predicted water quality is of suitable quality for discharge to Waste Rock Creek in Post-Closure. Water quality monitoring of the KUG TSF and the receiving environment will be ongoing in Construction, Operations, and Closure and will service to validate water quality predictions. Additional details regarding water quality predictions for Waste Rock Creek is presented in the memo **20160805_A.1 KUG Comment MOE-052_WQ_memo.**	5-Aug-2016
MOE-109	15-Jun-2016	Erin Rainey, MOE	Water (Ground)	The quality of the relationship between stage and discharge for a hydrometric station, referred to as the rating curve, defines the quality of the resulting measured streamflow record (Maidment, 1993). In general, development of stage-discharge relationships should not simply be a data fitting exercise, but should also consider the geometry and cham1el conditions of the control section at each hydrometric station. The following typical rating curve equation format considers physical characteristics of a station's channel geometry: $Q=C\ (h-a)^n$ Where: Q =discharge [m^3/s] C =coefficient derived based on channel characteristics h =stage [m] a = stage corresponding to point of zero flow [m] n = exponent related to geometry of channel section The coefficient, C, typically equals 0.5 to 2.5 times the channel width. The exponent, n, typically ranges from 1.6 to 3, depending on the cham1el shape with 1.6 corresponding to a more rectangular channel shape to 2.5 corresponding to a triangular cham1el shape (Maidment, 1993).	The comment is acknowledged	8-Jul-2016
MOE-110	15-Jun-2016	Erin Rainey, MOE	Water (Ground)	Appendix E.2 of Appendix 10-A presents the stage-discharge relationships for all stations on Figures E.2.1 to E.2.11. Many of these rating curve equations are in the from of a quadratic equation, presumably to achieve the best mathematical fit to the data points for each station. This approach may produce more desirable coefficient of determination (R2) values, but does not necessarily provide a meaningful fit to the data points when considering channel characteristics or the relative quality of the various measurements. In addition, with this form of equation, extrapolation beyond the range of the measured stage data points is more likely to result in erroneous predicted streamflow values, particularly at the lower end of the curve. For example, the rating curve for KEM-04 (Figure E.2.4) is defined as: $y = 27.992x^2-18.345x+3.3692$ Where: y =discharge [m^3/s] x =stage [m] Figure 1 (in letter "0615_MOE_rating curve review_ERainey_final-signed" dated June 15, 2016) illustrates the rating curve for KEM-04, with extrapolation of the curve for stage values less than 0.33 m (the inflection point of the curve). Using the curve in Figure 1 to predict the discharge at x = 0.1 m, the predicted discharge is 1.81 m^3/s, which is a higher discharge than could physically occur at such low water levels at this channel location. This example highlights the limitation of the KEM -04 rating curve as presented and how it will induce error and over predict discharge for measured stage values less than 0.33 m. The rating curves for 7 of the 11 stations (KEM-04, KEM-05, KEM-07, WQ-03, WQ-04, WQ-05, WQ-13) take the form of a quadratic equation and likely present the same limitation of extrapolation beyond the measured data points as shown above.	The comment is acknowledged	8-Jul-2016
MOE-111	15-Jun-2016	Erin Rainey, MOE	Water (Ground)	As noted in Section 4.3.2 of Appendix 10-A, the KUG stations continued to collect continuous stage data over the winter months (typically November to April) from 2003 to 2007. Winter discharge measurements were also conducted during this period. While winter data is useful for characterization of winter low flows, the measured data collected during these months is likely not reliable for use in the rating curve development (MOE, 2012). Ice accumulation, snow on the banks and freezing conditions can artificially increase stage and alter the channel shape at the control section. An example of this is shown in the streamflow time-series plots included in Appendix C of Appendix 1 0-A. The water levels at KEM -03 were artificially increased during periods of stream freezing and caused spikes in the corresponding measured streamflow record. Accordingly, the KEM-03 streamflow record is likely overestimated during these periods.	The comment is acknowledged	8-Jul-2016

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MOE-112	15-Jun-2016	Erin Rainey, MOE	Water (Ground)	The key issues discussed above cause unce1iainty in the predicted streamflow values at the project site, particularly with regards to low flows, which can have implications on related Valued Components (VCs) such as aquatic resources and water quality. Therefore, MOE requests the following information be provided for each of the 11 hydrometric stations: • Estimated point of zero flow for each station, i.e. stage at which streamflow is estimated to be zero. • Extrapolation of the rating curve for each station to the minimum (or point of zero flow) and maximum recorded stage value in the station period of record. • Correct or remove winter streamflow measurements from rating curves • Corrected stage record (time-series plots) for each station with anomalous winter data removed or corrected, and • Updated measured streamflow record (time-series plots), based on changes to the rating curve and/or the corrected stage record, as noted above.	A.1 - KUG Comments_MOE-013,014,015,017,018, 070_SW_WQ_20160706	8-Jul-2016
MOE-112.1	18-Jul-2016	Erin Rainey, MOE	Water (Ground)	Refer to response for comment MOE-017.	AuRico acknowledges further discussion on the comment is deferred to permitting.	20-Oct-2016
MOE-113	16-Oct-2016		Air Quality	Please clarify the source reference for the emission factors listed in Appendix F. The stated "Source: US EPA Chapter 9 - Storage Pile Wind Erosion" is unclear – which US EPA document is being referenced?	The reference to the emission factor listed in Appendix F should be updated as "Source: Western Regional Air Partnership's (WRAP) Dust Emission Joint Forum - Chapter 9 - Storage Pile Wind Erosion" (Link: http://www.wrapair.org/forums/dejf/fdh/ch9-storage.html)	27-Oct-2016
MOE-114	16-Oct-2016		Air Quality	The emissions estimation formula includes an assumed emission control efficiency of 75% based on "best practice measures". However these "measures" are not stated and no supporting rationale for the 75% assumption is provided.	The reference to "best practice measures" was not entirely accurate. The 75% control efficiency refers to a combination of factors. First, tailings are added to the storage area in slurry form such that part of the area will be wet and not subject to wind erosion. Second, an underlying feature of wind erosion emissions calculations is that wind events remove all erodible material from a storage area and that no material is available for further erosion until the area is disturbed again (i.e. bulldozing, vehicles traveling over the surface) to expose more erodible material - the tailings storage area will not be disturbed in this way. In addition, for much of the operational phase of the project, the exposed tailings will be substantively below the level of the rim of pit which will form the KUG TSF, thus providing a degree of wind-break compared to a storage facility that would be built above the surrounding grade. The control factor of 75% was selected in recognition of the unique nature of this storage area and the tailings material itself.	27-Oct-2016
MOE-114.1	16-Oct-2016	Graham Veale, MoE	Air Quality	Re. the assumed 75% control efficiency for the tailings beach emissions, I don't dispute that the factors stated would reduce the particulate emissions but the selection of 75% still seems arbitrary (Table 9-4 in the supplied reference "Western Regional Air Partnership's (WRAP) Dust Emission Joint Forum - Chapter 9 - Storage Pile Wind Erosion" indicates a 75% control efficiency for PM10 using a 3-sided enclosure but this does not seem to be representative of the KUG tailings beach situation). Also, the contention that "an underlying feature of wind erosion emissions calculations is that wind events remove all erodible material from a storage area and that no material is available for further erosion until the area is disturbed again" may not reflect the type of material deposited in a tailings beach. I would assume that most of the material would be of a fairly uniform small size and therefore provide a constant supply of erodible material. Section 9.1 of the WRAP document states that "Loose soils or other aggregate materials consisting of sand-sized materials act as an unlimited reservoir of erodible material and can sustain emissions for periods of hours without substantial decreases in emission rates." Experience at other mine sites has shown that tailings beaches can be a source of considerable dust impacts. Given the uncertainty associated with estimating fugitive dust emissions, selection of a more conservative mitigation percentage or even modelling with no emission mitigation at all, would have provided a greater comfort level that unacceptable impacts to air quality will not occur. However, I do not believe that a re-assessment of the tailings beach emission estimates/modelling would provide any further insight at this juncture in the EA process – emission estimates and model predictions would still be subject to debate. Concerns regarding fugitive dust from the project can be best addressed through development of an appropriate dust management plan coupled with associated monitoring as has already been committed to by the proponent.	The Proponent thanks the reviewer for the comment. No further action is required.	21-Dec-2016
ECCC-001	21-Jun-2016	Snehal Lakhani (ECCC)	Air Quality	ECCC notes that the quality of model predictions is dependent on the quality of the input data used in the model. To provide confidence in the air quality model predictions provided in the EIS, all input data, including meteorological fields, and selected model options and configurations should also be reviewed. ECCC therefore requests the input and control files used in the CALPUFF model to generate the air quality predictions presented in the EIS. All files should be in a format that can be used directly in CALPUFF, and all output files should be provided in the raw CALPUFF format.	All input data including meteorological fields, control files, selected model options and configurations used in the CALPUFF model will be provided in an external hard drive directly to ECCC on July 14, 2016.	6-Jul-2016
ECCC-002	21-Jun-2016	Eric Soprovich (ECCC)	Geology	The proponent refers to, and relies to variable degree upon, geochemical tests, data and analysis from earlier geochemical characterization, including Northgate (2005), in it's analysis of this project; however, only a subset of data from these earlier geochemical characterizations is presented, and almost exclusively in summary form. Given the importance of the earlier work(s) in deriving a conclusion on suitable test results for input into geochemical source terms, ECCC requests that the earlier referenced work be provided in its' entirety. While it appears that the proponent has provided some results from the earlier geochemical programs, the data tables are not well labelled (e.g., there is no notation of results representing whole rock analysis / solids content) and the source of the data is not referenced on the data tables (e.g., where data may be from other documents or reports). In order to assist with the interpretation of all the samples, ECCC requests the proponent provide tabulated information linking sample number (and geospatial information) with field observations of individual samples at the time of collection (i.e., recorded/logged information pertinent to geology/geochemistry including: geologic description / lithology / alteration, mineral presence and form, sample condition). ECCC also requests that cross section representations spatially detailing sample locations (including interval and/or sample identification number) in relation to major geologic units and project feature outlines be provided to support the selection and application of previous (and new) samples and data; this will further aid in understanding the geochemical characterization program and its' results.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-002.1	7-Oct-2016	Eric Soprovich (ECCC)	Geology	Information provided in Appendix 7-E with exception of Table B-2) only appears to link sample geospatial information to major lithology. The current tables do not provide information that would also link sample to rock type and alteration. A link to pertinent geologic observations (i.e., those which would have been provided by a Geologist's logging drill core or by a Qualified Individual collecting samples observations, e.g., mineral presence and form, fracture presence, and rock quality/competency), could not be found. Upon initial review of the plan and cross section diagrams, a number of significant errors have been identified in their rendering; for instance: i) while KN-11 (prefix) series drill hole intercepts are indicated on at least two cross sections and in the proponent's written response, there are no KN-11 series drill holes indicated on plan; ii) it appears that drill hole location and orientation are reversed 180 degrees to the geology, particularly in reference to the plan representation of outcrop/subcrop for cross section A-A' and B-B'; iii) surface geology and related features for cross sections E-E' and F-F' are not consistent with those described by the plan representation; iv) instances of questionable projections to select cross sections are noted (e.g., it is not clear why cross section F-F' contains a projection of KN-02-14, located 200m off line, and not KN-03-14 which is located on the cross section line according to plan information; also KN-03-11 and KN-02-55 are a considerable distance from cross section B-B', and thus of questionable value for that cross section); v) cross section F-F' appears to be missing mine development information (gallery/undercut). Sound geologic and geochemical characterization is required in order to evaluate potential impacts to water quality, therefore ECCC requests additional cross section coverage (e.g., closer line spacing across the mining footprint) to improve visual understanding and corrected cross sections.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-003	21-Jun-2016	Eric Soprovich (ECCC)	Geology	Geochemistry information is distributed amongst several appendices, a chapter of the main report, and various other documents that have not been made available to reviewers. In order to understand the full volume of data collected for geochemical characterization purposes for the Kemess Underground (KUG) project–, ECCC requests a stand-alone geochemical characterization report containing all pertinent data. Components of this document should include: data tables (including sample location and interval, sample mass, geologic description, static or kinetic results, and other pertinent information); plan and cross section figures detailing sample intervals in three dimensions (i.e., sample distribution), in relation to geologic units & structure, and ore target / subsidence zone / workings, and supported with descriptive drill hole core logging information (or descripton of grab samples), and; other pertinent information that may help to better understand samples and sample representation in relation to the results. Summary and detailed analysis of results, and statistical analysis on data robustness, would form a part of this report; as would figures presenting analytical findings and trends in data. All Contaminants of Potential Concern should be highlighted with respect to discussion and analysis.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-004	21-Jun-2016	Eric Soprovich (ECCC)	Geology	Typically a discussion on geology and geochemical characterization would include submission of reports detailings results of mineralogic/petrographic studies in support of the described lithologies (and which can aid in interpreting results of static/kinetic testing). These types of reports are not provided in this application. ECCC requests relevant mineralogic/petrographic study reports to aid in understanding and interpreting results from geochemical characterization. This could be included in a separate geochemistry characterization report.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-004.1	7-Oct-2016	Eric Soprovich (ECCC)	Geology	A precursory review of Appendix 5 indicates that mineralogy/petrographic information presented therein is summary information, and that the report further refers the reviewer to Appendices 5J and 5K for the original reports and detail (e.g., Harris Exploration, Grabben Petrographics). ECCC requests an accessible source for these original reports.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016

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ECCC-005	21-Jun-2016	Eric Soprovich (ECCC)	Geology	Spatial and representative distributions are important attributes to consider for sample selection in geochemical characterization programs. The present documentation identifies drillhole number and interval related to sample in tabular form but little additional information is provided to understand the distribution of samples relative to geology, structure, and development features. The very limited cross sections and plan map(s) which present drillhole information is of limited use (too coarse and insufficient coverage -- s.a. no cross sections provided of intercepts in orebody/subsidence zone) in order to appreciate sample distribution. Furthermore, no visual reference is provided for a majority of the samples used by the proponent to draw conclusions (it is not possible to orient individual samples or sample programs with important project features). ECCC requests adequate plan maps and cross sections detailing drillhole orientation, sample number and interval, geology (unit, lithology, alteration, structure), and development (ore target outline, subsidence zone, declines/gallery) and other identifying information to relate individual samples to project geology and component.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-006	21-Jun-2016	Eric Soprovich (ECCC)	Geology	Figure 2-1 provides a plan map overview of "local geology" but the area represented is constrained to the decline and and underground mine workings area only. While it is recognized that this Appendix focusses upon the underground and direct underground access, ECCC requests an additional map that presents outcrop/subcrop geology for the entire project site and features. At a minimum, ECCC requests a similar plan map at least at the scale of Figure 2-1 showing the access road tunnel, which is a component of access via tunnel excavation between the mill site and underground.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-007	21-Jun-2016	Eric Soprovich (ECCC)	Geology	ECCC requests information, supported by geochemical testing, respecting the influence of alteration type on geochemistry for each of the geologic units present and expected to be influenced by mining development. How sensitive are ML and/or ARD results to alteration type -- are there noticeable difference in production of acidity or release of metals (or time to initiation of reactions), for instance, between alteration types within the same geologic unit? Is each geologic unit and alteraton phase reflected within the three drillholes taken for geochemical characterization/confirmation purposes?	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-007.1	7-Oct-2016	Eric Soprovich (ECCC)	Geology	The response indicates there is little influence of alteration upon ARD potential (for the major lithologies). ECCC requests clarification regarding whether the observation of alteration type is similar with respect to release of metal leachate (i.e., release of potentials and parameters of concern).	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-008	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	In summary Table 2-2, the proponent should provide a reference (at the bottom of the table) to the location within project document(s) where the raw data can be found. This will allow for easier cross-reference.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-008.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	The data in this summary table is mostly derived from previous drill holes and samples obtained for permitting of the Kemess North project, previously presented as a part of Northgate (2005). ECCC notes that the notation regarding significance of shaded cells has been dropped from the updated Table 2.2.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-008.2	29-Nov-2016	Eric Soprovich (ECCC)	Geochemistry	In our most recent comment, ECCC did not mean to infer the importance of the previous analysis but rather to observe a change in highlighed information in the updated version. No further request/comment.	Proponent thanks the reviewer for the comment.	21-Dec-2016
ECCC-009	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Samples taken from what appear to be generally along the lineament of the decline were grouped and thus considered differently than those from similar geologic units in the underground gallery footprint. For instance, Asitka group rocks are included in the grouped decline analysis (s. 2.3.1.6). Table 2-3 groups results from all the geologic/lithologic units as representing one combined "unit" -- which is a different approach. Solid metals content only is presented apparently to represent static testing for ML potential, yet results from shake flask testing would provide better insight to metal mobility. As such a summary of SFE (or similar static or kinetic) testing of units would be preferable to understand ML release from decline materials (as opposed to presentation of solids content only). The presentation as a summary, only, is also too granular to determine whether specific geologic units may be better addressed (effects mitigated) individually with respect to mitigation (waste rock or exposed surfaces underground). ECCC requests SFE or similar static and/or kinetic information. In addition, It would be helpful if the proponent were to provide references to the location of raw (tabulated) data as a notation to the table.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-010	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	In their discussion regarding sample selection, the proponent highlights that kinetic test results conducted as part of a previous submission for a different project (i.e. Northgate 2005) were used to "expand" the testwork database. Where indicated (e.g., in tables), results from selected samples and tests are provided mainly or exclusively in summary form. This highlights the importance of providing the raw data (tabulated data detailing samples and results) for those samples/results that were utilized for the KUG project. Additionally, the Northgate (2005) document should be provided for additional insightabout geology and geochemistry beyond the currently-defined footprint (e.g., regional understanding of geochemical potentials). Any data (from previous characterization programs) used for summary, comparative and analytical purposes in this project document should be provided for review, and documented appropriately.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-010.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	ECCC notes that the newly-provided data tables come from Appendix 5M of the Appendix 5 report (Northgate, 2005). The copy of Northgate (2005) provided for our original request does not contain Appendices 5J through 5P. ECCC requests an accessible source for these appendices, which appear to have been truncated from the original. As per original (IR1) comment, any data from previous characterization programs used for summary, comparative and analytical purposes in this project document should be provided for review, and documented appropriately.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-011	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	The proponent cites sampling difficulties via drilling methods from previous characterization campaigns as a reason to pit sample via mechanical hoe to a maximum depth of between 2 - 3 meters at only three locations for the characterization of gossan for the KUG project (confirmation). Full sample information (e.g. spatial orientation) is not provided, however there is an trade-off apparent between the sample collection campaigns: one comprised of several drill hole locations and orientations to the full tens of meters depth of the gossan (earlier sample retrieval) to provide many discrete data points and a large composite sample if needed; and other incorporating shallow samples from three (poorly detailed) sample locations to provide a bulk sample from which a composite is derived. The results from the new (2011) composited sample may reflect gossan unit characteristics at surface (at three discrete locations) but doesn't provide insight to potential changes (even slight changes) in geochemical characteristics for gossan material at depth through the many tens of meters thickness gossan profile. Comparison between datasets/campaigns is limited to static ABA constituents with marginal or no real probing into ML release characteristics. Please elaborate upon degree of certainty, How certain is the proponent that their near-surface sampling at three locations is representative of potential gossan material variation laterally and through the depth profile? Is it possible that there could be enrichment/depletion of important geochemical constituents/characteristics with changing depth in the gossan zone? How similar/different are results from the 2011 campaign to similar near surface samples pulled from the earlier sampling/characterization effort(s)?	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-011.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	Original text in section 3.1.1.1 states that the gossan zone samples were recovered using a backhoe to extract samples at 2 to 3 meter depth from "...test pits..." at three discrete locations, as indicated on the photograph provided as Figure 3-1 (and not from a trenching program as indicated in the current response). ECCC recognizes that sample recovery is a common consideration with collection and characterization of geological materials. Fortunately some limitations imposed by loosely consolidated or broken rock have been overcome, and there are established methods and equipment that can provide a large volume, reasonably representative sample from a full drill hole length, recognizing that sample needs define the chosen method and equipment. The key consideration in this case is how relatively-shallow surface samples (2 - 3 meters from surface) may represent rock at depth (10`s of meters). Sampling programs for analytical purposes typically target specific rock samples while excluding others. Not probing to the unit profile depth effectively excludes all potential samples (and potential results) from that interval. Both drilling (depending upon method employed) and bulk sampling can be complimentary activities, with information from the one program informing or supporting the other. Figure 3-1 is a photograph presenting locations of test pits relative to an outline of the predicted subsidence area. Outcrop mapping produced elsewhere indicates the gossan zone bridges both Takla and Toodoggone litho groups. ECCC requests confirmation from the proponent that both major lithologic groups were included in the bulk sampling, as well as a map providing more detail (i.e., regarding sample characteristics/conditions).	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-012	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	In order to support discussion on sample selection: Figure 3-2 should indicate the footprint of the underground and subduction zone in relation to the drill hole sample locations. As requested elsewhere: plan maps should be supported with cross sections (showing drillhole alignment/orientation and sample identification/interval in relation to geology, structure, mine features, etcetera)	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-012.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	Please refer to ECCC's comments above relevant to the new figures.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-013	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Text in sections 3.1.1.2 and 3.1.1.3 incorrectly refer to Figure 3-11 for drill hole location information.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-014	21-Jun-2016	Eric Soprovich (ECCC)	Geology	The linkage between sample, sample features, and geochemical characteristics is not well ~~linked~~ articulated in these documents. In order to better understand sample selection in relation to geologic and mineralogic features, and thus resulting geochemical analyses, ECCC requests drill hole logs / core logs (e.g., visual/descriptive detailing: geologic unit, lithology, alteration, structural information, fabric, presence and form of sulphides) for those drill holes pertinent to the geochemical characterization.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
ECCC-014.1	7-Oct-2016	Eric Soprovich (ECCC)	Geology	As noted previously, some supporting appendices to the Appendix 5 document were not included with the proponent's submission; ECCC requests that these supporting appendices be provided. Detailed geologic information, such as that gained from reviewing geological core description logs, can provide added insight into geologic features (e.g., presence, form and distribution of minerals) and subsequent geochemical understanding (e.g., similarities/dissimilarities within and among lithologic units). While the newly submitted Appendix 5 contains test pit logs in appendices associated with that document, ECCC has not been able to find drill hole logs for pertinent drill holes intended for geochemical characterization. ECCC requests that drill hole logs be provided for pertinent drill holes, as referenced above.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-014.1	29-Nov-2016	Eric Soprovich (ECCC)	Geology	Thank you. Please confirm the location of ECCC-014_1_DDH_Logs_Lith_Alt_Group.xlsx.	The table (File Name **20161130 ECCC-014_1_DDH_Logs_Lith_Alt_Group**) was provided by email to EAO on November 30, 2016.	30-Nov-2016
ECCC-015	21-Jun-2016	Eric Soprovich (ECCC)	Geology	The proponent indicates that Toodoggone Formation material was not included in the trickle leach / sequential trickle leach program due to limited exposures at the project, yet limited cross section depictions (e.g., Fig. 3-6) indicate that Toodoggone will make up what could be a 'not insignificant' proportion of underground development (northern portion) including within the subsidence zone. ECCC requests clarification as to why Toodoggone was excluded from the kinetic testing, and support this with information respecting percent of area of expected subduction zone under Toodogone footprint vs. other units, and respective volumes of each lithology as broken / affected rock at closure.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-016	21-Jun-2016	Eric Soprovich (ECCC)	Geology	A cross section depiction representing vertical orientation of 2011 drill program sampled drill hole lineaments is provided in Figure 3-6 with an indication that the cross section represents trace O-O'. Is this essentially the same trace referenced as A-A' in Figure 3-2? In general, consistency in cross-referencing / positional referencing between included cross sections and plan maps would be helpful.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-017	21-Jun-2016	Eric Soprovich (ECCC)	Geology	Table 3-2 presents a summary of ABA-relevant constituents and only Cu (assumed from SFE analysis) for those samples selected for SFE sample set as a comparison to summary information for "Bulk Decline" samples. ECCC requests SFE data for all contaminants of particular concern (COPC's) be included in the presentation and discussion -- there should be a full discussion of SFE results by geologic unit / lithology / alteration (where noticed). Raw / tabulated individual sample information and related results from SFE testing could not be located in the appendices and as such should be provided as part of the geochemical database.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-018	21-Jun-2016	Eric Soprovich (ECCC)	Geology	Please clarify whether the "Cu" values represented in Table 3-2 are from kinetic SFE testing or instead represent Cu content from bulk rock (solid rock) chemistry.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-019	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	The text suggests that "...detailed geochemistry..." for BLI is provided in Section 3.1.1.1, yet there is no geochemistry detail in that section. Please account for this inconsistency.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-020	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Reliance upon a subset of BLI hypogene results from Northgate 2005, as indicated in the text and summarized in Table 3-3, highlights the need, and ECCC requests, to provide all pertinent data for review (and where provided to reference data source) to support the conclusions (s.a. comparative analysis in this section).	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-021	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Does the copper (Cu) values provided in Table 3-3 indicated mobile Cu from SFE (or kinetic) testing or are these Cu values a representation of whole rock analysis?	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-022	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	In addition to Cu, are there other COPC's of interest that warrant presentation and discussion? As indicated elsewhere, ECCC requests references to the location where the raw data (tabulated results of individual samples) can be found within the project document(s).	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-023	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	The proponent provides selective data in comparing some 2012 results with the 2014 bulk sample (limited static tests/results). Discussion presented on p.3-19 appears to suggest that the 2014 composite is reasonably representative of 2012 subset results, at least with respect to Cu content and depth. Depth may not be the only factor driving the observation (e.g., Cu variability) and particularly for what is observed of the select 2012 data. Are there other factors to consider? What do the two data sets show with respect to database robustness and the value of selecting a large number of small samples from many points (in three dimensions) versus a larger bulk sample from very few discrete locations?	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-023.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	Note, the intent of ECCC's original comment was to explore what other factors or lines of evidence indicate that the bulk sample from the three test pits reasonably represent the fully affected gossan unit (e.g. laterally where major lithologies may shift. other changes noted). ECCC has no further comment or request.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-024	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	In Table 3-5: what are the comparisons between the datasets when considering ML capacity via shake flask extractions (or similar static testing that measures metal mobility under test conditions)? ECCC requests results from the relevant static ML testing, along with the comparative analysis.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-024	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	ECCC notes that the proponent is correct that data from SFE's is not suited for acid potential / neutralization potential. SFE can have value, however, as a quick screening tool to provide insight respecting metal release potential and characteristics. Thank you for providing results for the more-recent SFE testing; ECCC has no further comment or request.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-025	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Table 3-5 indicates that there is a substantial range in contained solid Cu within the 2012 Gossan samples and that the 2014 composited sample is lower in Cu content than all 28 samples of those selected from the 2012 dataset (a factor of 10 lower than 2012 P50). What evidence is there (e.g., from sample logging/descriptions) to suggest that differences in lithology and/or alteration, and/or mineralogy and presence/absence of mineral salts / precipitated metals play a role in the observations?	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-025.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	ECCC notes that the intent of the information request was to explore the differences between the 2014 and 2012 results as presented in Table 3-5, where it is noted that the 2014 sample appears to be at the low end (or nearing depletion) in total S and sulphide sulphur relative to 2012, and how that may or may not be important to the analyses. It was not possible to compare the concentrations provided in the response to loading rates suggested in the Northgate (2005) document. ECCC requests added context or reference (relevant sections/tables) such that this comparison may be made.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-026	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	It is not clear why Toodoggone is not included in fracture zone source term contributions; based upon limited cross section representations provided, it appears that Toodoggone should contribute (if to a lesser amount than other geologic units).	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-026.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	ECCC requests section/table references to support this analysis	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-027	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Estimated NP depletion rates are summarized in Table 4-7 and text indicates the rates are derived from a combination of a KS analogue plus data contained in Northgate (2005). The summary table is not supported by data (data location) nor trend analysis. The suitability of using the KS analogue to represent KUG hypogene is not supported with reference to data location and trend analysis for that data. ECCC requests that the proponent buttress their argument by presenting the data and speaking to variability in measured release rates for each unit. For instance, the Northgate (2005) data should be presented along with any trend analysis that supports conclusions in this section.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-028	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Figure 4-11 depicts pre- and post-mining groundwater levels in cross section (the actual section G-G' location is unspecified). Diagram (b) suggests groundwater tables distant from the subduction zone will be affected by the operation, which should expose additional gossan and near surface materials that would otherwise reside below the groundwater table interface to a more oxygenated environment. How much additional gossan material will be exposed this way, and how has the proponent incorporated potential for additional metal leaching for these newly-exposed materials in source term development?	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-029	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Text accompanying Table 4-8 suggests that despite test conditions (controls/dependent variables) "...the concentrations from various scale tests demonstrate similar loads." It isn't clear how the proponent can make this claim when only concentrations are provided. It appears that the proponent is interchangeably using "concentration" and "load" as the same thing. Only summary concentration data is provided in Table 4-8. Please provide clarity to this apparent inconsistency.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-030	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Building upon the discussion on p.4-37 and information presented in Table 4-8: what types and masses of rock is represented by drainage reporting to KN-12? Are there other factors (e.g. potential attenuation along flowpaths) that could conceivably influence water quality at KN-12?	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016

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ECCC-030.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	Thank you for providing Figure EC-030-1. ECCC requests clarification in relation to Figure 4-11(b) in that original section: should the Takla unit indicated to the left (southwest) of the cross section, effected by a depressed groundwater table, be labelled to indicate that unit to be (Takla parent-source) gossan? What role, if any, does original parent-source (Takla, Toodoggone) have in metal release characteristics from gossan? Furthermore, please indicate whether other factors (such as metals attenuation) may also help explain water quality in the downstream direction to KN-12.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-031	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Data tables in Appendix A appear to include ABA and whole rock analysis results only. The text indicates that shake flask extractions (and maybe other static tests for ML) were performed but data for these additional tests could not be located. ECCC requests that the data tables be updated to include all data -- such as that from SFE testing -- that was used in developing opinions on geochemistry.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-032	21-Jun-2016	Eric Soprovich (ECCC)	Geology	It is unclear how samples are distributed in space relative to each other and to the project as a whole since either positional data is not present and/or due to a scarcity of plan maps and geo cross sections to present this information. As indicated elsewhere: ECCC requests that data provided in Appendix A and Appendix B be accompanied by plan maps and cross sections identifying individual samples with sample location (spatially in relation to geology, development, etcetera).	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-032.1	7-Oct-2016	Eric Soprovich (ECCC)	Geology	See earlier response.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-033	21-Jun-2016	Eric Soprovich (ECCC)	Geology	A table describing samples (retrieval locations, physical observations) used for the waste rock composites would be useful as an inclusion with the information provided in Appendix C - Kinetic Test Sample.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-034	21-Jun-2016	Eric Soprovich (ECCC)	Geology	Table 2-2 indicates that it is a summary of static geochemical characteristics for access tunnel material, yet the table only provides insight to ABA characteristics. Since these materials are not otherwise tested elsewhere (distant from the orebody and respecting inclusion of Asitka unit): ECCC requests that the results of SFE (or similar static) testing should be provided for insight on metal release from these units.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-034.1	7-Oct-2016	Eric Soprovich (ECCC)	Geology	Thank you for providing the SFE results. ECCC requests confirmation that sample VA15105486 does not have results from SFE testing.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-035	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Previous text (in project summary / overview) indicates some process changes to the mill to better accommodate ore from KUG. Do the bench test conditions utilized to obtain results for the Northgate (2005) characterization work and thus Kemess North (KN) project emulate (incorporate) planned changes to milling KUG ore? What features of KUG ore are different than either Kemess South (KS) or KN ore that necessitates a modification in milling, and what effect could those changes have upon tailings and thus metal release / release kinetics?	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-035.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	ECCC requests clarification regarding which features of KUG ore necessitate a modification in milling (optimization), what are the modifications, and what effect could these changes have upon tailings and metal release / release kinetics? ECCC also requests information regarding when results from the new bench scale testing with synthesized KUG tailings will be made available.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-036	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	For reference (and potential comparative purposes): what is the historical water chemistry for KS tailings? ECCC requests summary pore water and lixiviant (pond) water quality data for the existing KS tailings.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-036.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	ECCC notes that the proponent has indicated in their response that Appendix 11-A provides chemistry from the seepage pond only. Appendix 11-A is not specific on location, but does indicate that the pond itself was sampled (if TSFP is consistent with "Kemess South Tailings Storage Facility Pond" as per Abbreviations section. ECCC requests clarity regarding whether station WQ-TSFP as listed in Appendix 11-A is seepage pond water quality (as suggested in the recent response), and not water quality of standing water in the tailings pond itself. Although not considered in Appendix 7-F, ECCC recommends consideration of whether historical pore water and/or pond water quality data could provide some insight into predicted geochemical outcomes for Kemess Underground project tailings.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-037	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	The proponent indicates that exposed pit wall source terms for the KUG tailings impoundment are derived from work presented in Northgate (2010) for closure purposes. Very little information has been provided concerning the actual samples making up the bulk composites used in the testing, and little regarding test criteria and methodology. Since the KS information is relied-upon for developing source terms for the KUG project (at least in this instance), ECCC requests that the Northgate (2010) report be provided for referral/review.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-037.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	Despite several attempts and using multiple platforms the indicated report could not be downloaded and subsequently unpacked ("unzipped") from the source(s). ECCC requests an accessible version of the relevant report.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-038	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Please provide any additional water quality data from wall rock monitoring (wall washing, seep monitoring) and/or from monitoring water quality in the flooding pit, that may provide further context for discussion in this section.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-039	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	Graphs showing trends in release concentration for each of the COPC's would aid in understanding metal release characteristics for the geologic materials represented in the data tables.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-040	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	The proponent plans to use construction aggregate and rock from Borrow 10 expansion plus a proposed East Pit Quarry and the KS NAG dump, as discussed in Section 5 and indicated on Figure 5.1-1 (and Figure 6.3-1 for instance). Geochemical characterization of these materials including data results of ML and ARD testing could not be found elsewhere in the document (e.g. in geochemical appendices). ECCC requests data (or the location thereof) for geochemical testing of these materials characterizing both ARD potential and potential to generate metal leachate (e.g. SFE test results).	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-040.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	As indicated above, ECCC was not able to access the .zip file. ECCC does not have details on discussion nor conditions attached to the KS permit. ECCC notes that geochemical characterization of the proposed East Pit Quarry and KS NAG dump were not addressed in the response to IR1.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-040.2	29-Nov-2016	Eric Soprovich (ECCC)	Geochemistry	Thank you. Please confirm the location of the Eat Pit Quarry ML/ARD dataset.	The requested data was provided directly to the reviewer on November 10, 2016 by email.	21-Dec-2016
ECCC-041	21-Jun-2016	Eric Soprovich (ECCC)	Water (Quality & Treatment)	In Section 5.1.2.4 the proponent indicates that the underground workings are predicted to flood to a stable water table elevation discharging to East Cirque Creek 36 years after operations cease. The proponent further states that monitoring for water quality would continue in East Cirque Creek and Central Cirque Creek "...for up to five years...." ECCC requests clarification as to whether the proposed period is following surface discharge. What is the predicted transit time for groundwater from the underground workings to reach receiving surface water stations, will the intended monitoring stations track these groundwater inputs, and how does the planned five-year period incorporate expected lag in groundwater reporting from underground to surface discharge zones?	Particle tracks illustrating groundwater pathways from the subsidence zone to East Cirque creek are shown in Figure 9.6-8 and discussed on page 9-84. Most contact water (over 95%) is anticipated to report to East Cirque Creek within a couple hundred meters of the edge of the subsidence zone. This seepage is expected to follow shallow groundwater flowpaths associated with rapid travel times (less than two months).The remaining contact water follows deeper groundwater pathways and is expected to daylight in East Cirque creek within a couple kilometres of the development between 10 and 40 years after water levels have recovered in the development. Water quality monitoring after the underground workings are predicted to re-flood will continue until water quality within the receiving environment is confirmed to be stable at acceptable levels.	5-Aug-2016
ECCC-042	21-Jun-2016	Eric Soprovich (ECCC)	Water (Quality & Treatment)	The proponent indicating they will monitor East Cirque and Central Cirque creeks "..for **up to** [bold ours] five years..." suggests subjectivity in the commitment and could include instead three years or zero years.	The duration of monitoring after the underground workings are predicted to re-flood will not necessarily be limited to 5 years. Water quality monitoring will continue until water quality within the receiving environment is confirmed to be stable at acceptable levels.	5-Aug-2016
ECCC-043	21-Jun-2016	Eric Soprovich (ECCC)	Geology	Figure 5.4-1a provides a good graphical presentation of the regional geology. The proponent indicates the general location of the Kemess underground deposit area as a circle overlay. It would be instructive to expand this theme by including a local geology map (outcrop/subcrop) at suitable scale with an overlay incorporating the entire project development features.	The response is provided in memo **20160714_KUG Comment ECCC-043_Local Geology Map_Memo**	6-Jul-2016
ECCC-044	21-Jun-2016	Eric Soprovich (ECCC)	Water (Quality & Treatment)	The proponent suggests that diversion ditches will route intercepted water to a sedimentation pond. Accompanying Figures 5.7-1 and 5.7-2 are not of sufficient quality and detail to allow the reviewer to confirm surface drainage patterns. Similarly, figures that provide contour information at a reasonable scale (such as Fig.5.9-2) do not illustrate all the pertinent features related to water management, nor do they present the full complement of diversion and other water management structures related to the project. While it is recognized that accompanying figures are not final design, review of Figure 5.9-7 suggests that drainage from the decline portal could be as likely to bypass the sedimentation pond as it is likely to report to that pond for settling/clarification. Figures 1.3-1 through 1.3-6 in Appendix 11-D do not appear to incorporate a majority of the water diversion flow in the conceptual water management model provided. ECCC requests clearer water management information (textual and visual detail), linking capture area to water quality management features and subsequently receiving water bodies; this includes information for diversions related to the decline portal, north and south access portals, and open pit highwall diversion.	The response is provided in memo **20160805_KUG Comment ECCC-044_WQG_Memo**.	5-Aug-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
ECCC-045	21-Jun-2016	Eric Soprovich (ECCC)	Air Quality	After being crushed underground, ore is transferred to surface where it rehandled and transported via conveyor (5km) before temporary storage near the mill. ECCC requests information on dust management requirements and plans for mitigating air entrainment of ore particles during transport.	Dust suppression underground consists of wetting the rock before it is first excavated in the drawpoint or development heading to prevent dust liberation in the workings. If required, water sprays are also installed at tips (where rock enters ore/waste passes and or crushers). In addition, water sprays are installed as needed at transfer points between conveyors. As such, underground ore or waste rock generally has moisture content of 7-10%. This is sufficient to prevent dust liberation during transport from underground to the process plant. The air quality management plan in the Application (Section 24.3.4.2) also includes the following two commitments regarding fugitive dust mitigation along the conveyor: • limiting discharge heights from the conveyors onto stockpiles; and • using enclosed, negative-pressure housings with fabric bag collector system at conveyor transfer points.	5-Aug-2016
ECCC-046	21-Jun-2016	Eric Soprovich (ECCC)	Geology	The proponent states in their summary of the milling process that the mill has been modified following the KS project in order to "...suit the type...of anticipated ore." How is the KUG ore different from previous KS ore (and how is it similar)? What are the metallurgical constraints that precipitated a change to the process? Are there differences (e.g., in sulphide form/distribution, fabric, structure), that suggest KUG ore and tailings may behave differently geochemically than KS ore and tailings?	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-047	21-Jun-2016	Eric Soprovich (ECCC)	Geochemistry	The proponent indicates that the KUG ore will be subject to a finer target grind. Particle size has a bearing upon geochemical release rates, as does intimate contact and interaction between sulphide particles. What is the expected particle size for tailings (i.e. d50 of tailings) and how does that compare to that achieved for KS? What tailings grind did the lock cycle testing utilized for geochemical characterization produce?	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-047.1	7-Oct-2016	Eric Soprovich (ECCC)	Geochemistry	Northgate (2005) indicates a target grind K80 of 145 microns for primary grinding circuit, suggesting that finer grinds increased recoveries but could also lead to changed geochemical characteristics. Additional search of the document failed to retrieve particle size information for the tailings samples characterization (only notations that testing should occur at the "received particle size"). The proponent has indicated that modifications are being made to the mill circuit to improve recoveries, but has not indicated what those changes are. ECCC requests clarification regarding the target grind for KUG tailings and the particle size distribution (d50 / K80) of synthesized tailings used for geochemical testing, as well as how considerations related to grain size were incorporated into determining the KUG tailings source term.	The response is provided in memo **20161110_KUG Comments_ECCC_Geochemistry_Lorax Memo**	10-Nov-2016
ECCC-048	21-Jun-2016	Eric Soprovich (ECCC)	Water (Quality & Treatment)	It is not clear how the KUG project will be integrated with KS at closure, particularly in regard to expected/potential contaminant loads from KUG and from KS components reporting cummulatively to receiving water bodies. ECCC requests more detail on present and predicted loads from KS project features; alteration of KS project loads due to influence of KUG; and resulting predicted loads for KS components and KUG components at closure with an eye to cumulative loads and cumulative effects.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-048.1	7-Oct-2016	Eric Soprovich (ECCC)	Water (Quality & Treatment)	Text in Appendix 11-D (s.3.2.1.2) indicates two conditions, with both past predictive modelling and current monthly monitoring data being "incorporated as source terms in predictive modelling..." or "...incorporated in predictive modelling...." Assumptions can be made regarding actual source term selection via section 3.3, however ECCC could not find a comparison of the original predicted source terms for KS versus what is being determined via water quality monitoring for the KS sites of interest. While the proponent suggests that conservatism is achieved by assuming that "...potential geochemical loadings from the former KS mine...[will]...not further improve...," it isn't clear what the actual potential loadings are, nor what the assumed and upper cases may have been from the earlier predictive work. As this could have a bearing on the potential range of outcomes and adequacy of sensitivity analysis, ECCC requests further information in regard to actual potential loadings and assumed/upper cases from earlier predictive work.	The water quality assessment for the Kemess Underground Project is described in Chapter 11 and Appendix 11-D of the EAC Application. The assessment of water quality explicitly included consideration of the existing Kemess South (KS) site and facilities. For example, the description of water quality assessment boundaries in Section 11.3.2 of the EA Report states that: "The surface hydrology, and hydrogeology domains, and, by extension, surface water quality, are inclusive of: the proposed declines; underground mine; and areas of existing disturbance from the former KS mine, some of which will be used for the Project." Additionally, the description of the project area for the assessment of water quality in Section 11.3.2.1 of the EAC Application states that "geochemical loadings from existing facilities from the past-producing KS Mine are incorporated into predictive modelling for the Project (see Section 11.6) and cumulative effects are discussed in Section 11.7." The following KS facilities, depicted in Figure 1.1-1 of Appendix 11-D, were included in predictive modelling according to their proposed use, or due to an existing potential to interact with local surface water quality: Kemess South Tailings Storage Facility (KS TSF); Kemess South Non-Acid Generating Waste Rock Dump (KS NAG WRD); Western Diversion Ditch (WDD) and High Wall Diversion Ditch (HWDD); Western Collection System Pond (WCSP), South Collection System Pond (SCSP), and Selenium Collection Pond (SeCP) in the KS NAG WRD area; the processing facility; and the existing KS open pit. Therefore, the water quality predictions and effects that are addressed in the EA for the Kemess Underground Project, for all Project phases, are inclusive of contributions from the existing Kemess South site and facilities. A tabulated summary of input values for loadings from existing KS facilities are presented in Appendix 2 of Appendix 11-D. The predictive modelling employs a number of conservative assumptions with respect to existing conditions and potential loadings associated with former KS Project, as described in Chapter 11 (Section 11.6.1.1) of the Application, and in Appendix 11-D (Section 3.3). For example, a key conservative assumption is that the clay cover on the leach cap waste rock is 100% ineffective at reducing loadings from the KS waste rock pile to Waste Rock Creek. If the leach cap clay cover is effective at removing even 10% of the selenium loading from the KS waste rock pile, the KUG water quality model will over predict the selenium concentrations in Waste Rock Creek in Closure and Post-Closure. Similarly, to support predictive modelling, water quality data incorporated as source terms to represent existing conditions were restricted to data collected since KS mine entered post-Closure (April 2011 to December 2014) for stations within Kemess Creek, Waste Rock Creek, and Attichika Creek. Input values to the model represented monthly median values (base case) or 95th percentile values (sensitivity case 6, see section 3.4 of Appendix 11-D of the Application). Base case and sensitivity case 6 served to bracket currently existing conditions to support the effects assessment. Monitoring at these locations is currently ongoing; the existing conditions represented in the water quality model will be reviewed and updated to incorporate additional baseline data beyond that used to inform the EA water quality model and effects assessment to support the permitting stage of the Project.	10-Nov-2016
ECCC-049	21-Jun-2016	Eric Soprovich (ECCC)	Water (Quality & Treatment)	The proponent refers the reader to the "...Kemess South (KS) Reclamation and Closure Plan (Northgate 2010). The KUG project is not completely isolated from KS, therefore in order to understand the broader context of impact due to the combined effects of mining/milling KS and KUG orebodies, ECCC requests a copy of the Northgate (2010) document for review. In addition, ECCC requests the proponent provide an understanding of how project components from the two Kemess development phases interreact individually and additively to result in potential impact to recieiving water bodies (water quality), as cursory review of KS closure state and condition, provided in Section 6.1.1, does not provide sufficient detail.	The Kemess South RCP will be provided to the reviewer for reference purposes **(See File Kemess South RCP_2010_in response to ECCC-049)**. ERM highlights that the Kemess South RCP was approved through the separate regulatory review processes for the Kemess South Project and, as such, is not part of the scope of the assessment for the Kemess Underground Project. The water quality assessment for the Kemess Underground Project is described in Chapter 11 and Appendix 11-D of the EAC Application. The assessment of water quality explicitly included consideration of the existing Kemess South site and facilities. For example, the description of water quality assessment boundaries in Section 11.3.2 of the EA Report states that: "The surface hydrology, and hydrogeology domains, and, by extension, surface water quality, are inclusive of: the proposed declines; underground mine; and areas of existing disturbance from the former KS mine, some of which will be used for the Project." Additionally, the description of the project area for the assessment of water quality in Section 11.3.2.1 of the EAC Application states that "geochemical loadings from existing facilities from the past-producing KS Mine are incorporated into predictive modelling for the Project (see Section 11.6) and cumulative effects are discussed in Section 11.7." The following Kemess South (KS) facilities, depicted in Figure 1.1-1 of Appendix 11-D, were included in predictive modelling according to their proposed use, or due to an existing potential to interact with local surface water quality: Kemess South Tailings Storage Facility (KS TSF); Kemess South Non-Acid Generating Waste Rock Dump (KS NAG WRD); Western Diversion Ditch (WDD) and High Wall Diversion Ditch (HWDD); Western Collection System Pond (WCSP), South Collection System Pond (SCSP), and Selenium Collection Pond (SeCP) in the KS NAG WRD area; the processing facility; and the existing KS open pit. Therefore, the water quality predictions and effects that are addressed in the EA for the Kemess Underground Project are inclusive of contributions from the existing Kemess South site and facilities.	6-Jul-2016
ECCC-050	21-Jun-2016	Eric Soprovich (ECCC)	Terrestrial Ecosystems	What does the proponent plan to measure and report upon to demonstrate revegetative success?	The revegetation success monitoring program is a comprehensive monitoring program used to track reclamation success over time, ensuring that revegetated areas are developing into self-sustaining communities compatible with specified end land use objectives (i.e. wildlife habitat). Vegetation monitoring in revegetated areas will include percent vegetation cover and species composition. Permanent photo plots will be established in revegetated areas. The monitoring data gathered will be used to evaluate the success of the vegetation prescriptions and restoration objectives with identification of additional mitigation actions if required. The results of the revegetation success monitoring program will be reported annually to the BC MEM as a component of the annual reclamation report.	5-Aug-2016
ECCC-050.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC requests further information regarding whether the proponent has considered quantitative benchmark values to demonstrate revegetation success (e.g., cover rate as n% of some specified leaf area index +/- productivity as m% of productivity in surrounding terrain +/- t years to self-sustaining = revegetation success rate per unit area).	If the recovery objective of a site is to achieve a self-sustaining community compatible with specified end land use objectives and reclamation undertaken, then benchmarks will be established in order to measure reclamation success. Specifics on the metrics measured intended to assess the success of reclamation objectives will be further detailed in the Project permitting phase. It is recognized that reclamation benchmarks are dynamic in nature and that reclamation sites exist along a gradient of alteration, where reclamation end points exist along a similar gradient and are rooted in both ecological and socioeconomic factors. Reclamation efforts will not solely be placed on returning sites fully to a reference state, but also strategies undertaken for reinstating lost ecological processes and enhancing ecosystem services in transformed landscapes where it is likely to experience departures from the historic range of variabliity in surrounding systems.	4-Nov-2016
ECCC-051	21-Jun-2016	Eric Soprovich (ECCC)	Water (Quality & Treatment)	The short summary of Kemess South reclamation/closure suggests that the existing KS plan "...will complement the reclamation and closure for the KUG project." In what way is the KS closure complementary to KUG closure with consideration to water quality?	The approved RCP for the Kemess South site and facilities is helpful to planning for reclamation and closure of the Kemess Underground Project in several ways. The Kemess South RCP provides a site-specific basis that the final RCP for the Kemess Underground Project will draws upon. Additionally, because some Kemess South facilities and areas have undergone physical reclamation according to the approved plan (work that has received a number of reclamation awards and citations), some reclamation methods and techniques have been field-proven at this site, which reduces uncertainty for reclamation of the Kemess Underground Project. Ultimately, water quality in the receiving environment downstream of the combined Kemess South and Kemess Underground sites will be protected during construction, operations and closure through site-specific effluent quality criteria, which AuRico anticipates will be established for the Kemess Underground Project by MOE during future regulatory permitting.	6-Jul-2016
ECCC-052	21-Jun-2016	Eric Soprovich (ECCC)	Water (Quality & Treatment)	The proponent suggests that water treatment will continue into closure until such time as "...water quality meets discharge criteria..." but that criteria is not explored here. Is the discharge criteria indicated concentrations/criteria set for operations, or is the criteria to be set in consideration of receiving environment needs? What criteria is being suggested and where is it to be met?	At post closure, water treatment will be required until such time as the proponent can demonstrate the discharges meet permitted discharge limits. The discharge criteria and receiving environment criteria will be determined at the permitting stage.	5-Aug-2016
ECCC-053	21-Jun-2016	Eric Soprovich (ECCC)	Water (Quality & Treatment)	There is uncertainty respecting the final fate of water treatment sludge, yet this is a component of mitigation. The geochemical stability of this waste product is not provided here, but it is clear there may be a trade-off between "...environmental and cost considerations...." There is added sensitivity to this uncertain mitigation path respecting long-term stability of this waste and under what conditions the sludge(s) is/are most stable. Are there alternative options for the selenium (Se) sludge (i.e., with respect to producing a product suitable for sale, and thereby divert this material out of the waste stream)?	A key aspect of the Selen-IX pilot campaign conducted for the KUG project involved characterization of the residue material generated by Selen-IX. Through these this characterization, the stability of the residue was proven via TCLP (Toxicity Characteristic Leaching Protocol) testing. The Selen-IX residue is entirely inorganic and so there is no risk of bio-transformation as in the case of biosolids produced by biological selenium treatment. As the material is non-acid generating and has been shown to be stable under TCLP conditions, testing to date indicates that the material is suitable for disposal via co-mingling with tailings. TCLP testing of the residue indicates that it is appropriate for disposal in a non-hazardous landfill and so this option can be explored as well. The Selen-IX residue is majority iron oxide, containing approximately 45-50% iron as iron hydroxide, goethite and magnetite. BioteQ has discussed offtake of this material with steel producers and representatives of the steel industry have confirmed that the Selen-IX residue material could be appropriate feed in the steelmaking process. However, shipping of material from Kemess the Project to steel mills is expensive and the management of this supply chain is complex, making this option less practical.	6-Jul-2016

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ECCC-053.1	7-Oct-2016	Eric Soprovich (ECCC)	Water (Quality & Treatment)	The proponent indicates that TCLP testing helped form their opinion that the Selen-IX pilot residue is suitable for comingling with tailings. However, TCLP testing was developed to assess the potential for mobility of specific organic and inorganic contaminants from subject materials considered for potential codisposal in a municipal landfill. The SPLP (EPA 1312) test, or similar, using inorganic acids in the extractant fluid (such as weak acid extraction described by Price (2009)) instead of the organic acid used in TCLP testing, would likely provide a better indication for codisposal under conditions at the KUG mine site. ECCC notes that it should not be assumed that because a material passes the TCLP, indicating that it is suitable for disposal in a municipal (or "non-hazardous") landfill, that it is suitable for disposal at all other sites (where site environment may be very different). ECCC requests that the proponent consider alternate tests that reasonably replicate expected/potential acids/conditions of the proposed disposal sites.	In addition to TCLP testing of the Selen-IX pilot residue, this material was subjected to long duration tests designed to assess the long term leachability of tailings material and tailings material mixed with water treatment residue. A total of 4 saturated columns were initiated in April 2016. Two columns were setup with tailings alone with ratios of BLI to Takla ore of 50 BLI:50 Takla and 25 BLI: 75 Takla. A second set of saturated columns were setup with ratios of BLI to Takla ore of 50 BLI:50 Takla and 25 BLI: 75 Takla, however this set contained approximately 0.010 kg of Selen-IX for every 1.0 kg of sample. Each column contains approximately 5.0 kg of tailings. The Selen-IX mass added to two of the saturated columns was based on the proposed mass produced during life of mine relative to the mass of tailings produced. However, to provide a factor of safety in WQ estimates associated with the tailings/Se-IX mixture a much greater Se-IX to tailings ratio was considered. This would allow for potential variability in the water treatment plant solids to tailings solids ratio should management strategies vary. Additionally, it would provide a level of conservatism in porewater interactions within the KUG TSF. Preliminary results from the first 6 months of this program show no appreciable difference between the metal release from columns with and columns without water treatment residue. This program and the results therein will be discussed in more detail in future submissions after the program is completed.	4-Nov-2016
ECCC-054	21-Jun-2016	Eric Soprovich (ECCC)	Water (Quality & Treatment)	Water quality monitoring is suggested for the closure and post-closure phase but little detail is provided. The proponent should provide a conceptual water quality monitoring program in schedule form that includes monitoring stations, media, parameters, frequency/periods, duration, etcetera and is supported by maps indicating monitoring points. The present conceptual 'plan' does not provide enough information to determine whether the project effects and mitigation will be effectively monitored.	Water quality monitoring is described in the Fish and Aquatic Effects Monitoring Plan (Section 24.7), which will be developed in full during the Project permitting process to meet the requirements set out by provincial permits and federal regulations.	5-Aug-2016
ECCC-055	21-Jun-2016	Eric Soprovich (ECCC)	Geology	In accounting of geotechnical domains (and in reference to / building upon previous reports detailing previous rock mass domains) additional geologic units, and alteration types associated with underground development do not appear to be incorporated in the geochemical characterization program for the underground deposit (and elsewhere for the access tunnel geology). ECCC requests clarification of this apparent discrepancy between observed/expected geology between geotechnical investigations and analysis and that for geochemical characterization.	The response is provided in the memo **20160809_KUG Comment ECCC-002-055_Geochemistry_memo**	9-Aug-2016
ECCC-056	21-Jun-2016	Eric Soprovich (ECCC)	Geology	A listing of drawings and appendices is indicated in the Table of Contents, however these materials are not included with the report and could not be found elsewhere in the application. ECCC requests these attachments (especially drawings VM00575.6.600-018/019/020; and appendices B, F, and H) be provided for review for their potential value in understanding geological observations and rock characteristics as related to geochemistry and infrastructure.	The response is provided in the memo **20160812_B.1 KUG Comment ECCC-056_Infrastructure_Memo**	12-Aug-2016
ECCC-056.1	7-Oct-2016	Eric Soprovich (ECCC)	Geology	ECCC notes that the indicated memo could not be found/downloaded. ECCC requests an accessible version of this memo.	The memo **20160812_B.1 KUG Comment ECCC-056_Infrastructure_Memo** was submitted to EAO on August 12, 2016 and made available to the Working Group	10-Nov-2016
ECCC-057	21-Jun-2016	Christie Spry and Grazyna Chrobok (ECCC)	Water (Quality & Treatment)	ECCC requests further information on the treatment capacity of the selenium water treatment plant (Se WTP): 1. The designed capacity of 50 L/s (0.8 Mm3/yr) is less than the 120 L/s (1.9 Mm3/yr) capacity of the metals water treatment plant, leaving 70 L/s of discharge from the KUG TSF untreated during operations. Can the capacity of the Se WTP be increased to 120 L/s so that all of the discharge receives treatment for both metals and selenium? 2. Is the 50 L/s Se WTP capacity sufficient to treat all of the water leaving the selenium collection pond during construction?	1. The Selen-IX capacity (50 L/s) was established to fully treat the estimated discharge from the selenium collection pond during the Construction phase of the project. Based on water quality modelling completed to support the environmental assessment, treatment of this portion of the KUG TSF discharge during the Operations Phase is expected to allow the project to meet receiving environment objectives. The Selen-IX system capacity can be increased by adding treatment modules and would be considered as a potential adaptive management measure, if needed, to be able to meet MMER and effluent discharge permit requirements. 2. Yes, the Selen-IX capacity will be sufficient to treat all of the water leaving the selenium collection pond during Construction. An increase in treatment capacity from 50 L/s to 120 L/s could be achieved by adding treatment modules. BioteQ designed the system based on the flow rate specification given to us by ERM , the party responsible for developing the water balance for the Project.	6-Jul-2016
ECCC-057.1	7-Oct-2016	Christie Spry and Grazyna Chrobok (ECCC)	Water (Quality & Treatment)	Based on the EIS, ECCC understands that during operations, the WTP capacity of 120 L/s will be paired with a 50L/s selenium treatment capacity. The proponent proposes a potential adaptive management approach to increasing the capacity of the selenium treatment plant during operations by adding treatment modules in the later stage of the project if needed. ECCC remains concerned that adaptive management options and specifications are not considered in more detail at this stage to ensure the adequate treatment for discharges from the KUG TSF is feasible and available when required. The proponent is reminded that the Metal Mining Effluent Regulations (MMER), if applicable, apply at the final discharge point(s). To provide expert information on the characterization of potential effects from the project and mitigation measures, ECCC requests the following: • The required capacity of both the selenium and metal treatment plant should be determined during the EA stage of the project for the Agency to assess the impact of discharge from the KS open pit/KUG TSF on the water quality in Attichika Creek. • The proponent should specify how the adaptive management approach is to be implemented and how it will meet water quality requirements. • The proponent should provide a monitoring plan to assess the effectiveness of the selenium treatment plant and specify threshold levels at which additional modules would need to be added.	To support the Kemess Underground Project predictive water quality modelling was used to evaluate the effectiveness of various water management and mitigation strategies, including the potential location, treatment capacity requirements, and the timing of directed discharges from the KS open pit/KUG TSF to Attichika Creek (Appendix 4-D, Appendix 11-D). Planned water treatment for the Project is summarized in Section 1.3.4 and Section 3.2.4 as well as Figure 1.3-1 through Figure 1.3-6 of Appendix 11-D (Water Balance and Water Quality Modelling Report); details on proposed water treatment process are provided in Appendix 5-C. It is noted that final discharge limits for selenium (Se) are not currently regulated by the federal Metal Mining Effluent Regulations (MMER). Predicted discharge quality from the KS open pit/KUG TSF relative to maximum authorized concentrations per the MMER is provided in Table 3.5-1 of Appendix 11-D and Table 11.6-3 of Chapter 11 (Surface Water Quality Effects Assessment). Conceptual management and monitoring plans for the project are provided in Chapter 24 (Environmental Management Plans) of the Application. The Fish and Aquatic Effects Monitoring Plan (Chapter 24.7), Surface Water Management Plan (Chapter 24.16), and Water Treatment Plan (Chapter 24.18) are all relevant to managing and mitigating water quality impacts on the receiving environment. Monitoring associated with these plans would be used to inform adaptive management decisions to enable AuRico to remain in regulatory compliance. Specific triggers for adaptive management and adaptive management protocols have not yet been defined; these will be developed to support provincial Mines Act and Environmental Management Act permit applications and implemented prior to the initiation of the Construction phase. Specific discussion regarding the flexibility of treatment to changing conditions (i.e., flexibility of response to variation in flow rate for treatment, water composition, and climate) is discussed in Appendix 5-C of the Application, including increasing Selen-IX system capacity through addition of treatment modules and would be considered as a potential adaptive management measure. Recent results of the pilot plant study further demonstrate that Selen-IX™ capability to adapt to variable mass loads of selenium while maintaining effluent < 1 µg/L (BioteQ, 2016) Reference: BioteQ, 2016. Pilot Demonstration of Selenium Removal from AuRico Kemess Pit Water Using Selen-IX. Prepared by BioteQ Environmental Technologies, January 29, 2016.	28-Oct-2016
ECCC-057.2	29-Nov-2016	Christie Spry and Grazyna Chrobok (ECCC)	Water (Quality & Treatment)	ECCC appreciates the clarification provided by the proponent, but remains concerned about the limited treatment capacities, specifically those for selenium. The proponent is proposing to discharge 23 Mm3 of contact water from the former KS pit to Attichika Creek without treatment during project construction and discharge an additional 4.1 Mm3 of untreated contact water in the 1st year of project operation (Table 1.3-2, Appendix 11-D). ECCC recognizes that the predicted water quality for these discharges does not exceed the maximum authorized concentrations as per the MMER (Table 3.5-1, Appendix 11D), but notes that for those parameters not captured under the MMER the general prohibitions of the Fisheries Act, Section 36(3) apply. The predicted and measured water quality concentrations (Table 3.5.-1 and Table A2-1,Appendix 11D) for selenium exceed the CCME Water Quality Guidelines for the protection of aquatic life, the BC Ambient Water Quality Guidelines, and the BC Contaminated Sites Regulation Water Standards. ECCC understands that the proponent is planning to establish final discharge limits during the permitting stage. ECCC recognizes that the selenium treatment plant is capable of removing selenium to below guideline levels but remains concerned that only a portion of the discharge water will be treated: • Absence of any treatment for contact water discharged from dewatering of the former KS Pit/proposed TSF during the project construction phase (Year -3 to Year -1). 23 Mm3 of untreated contact water is proposed to be discharged directly to Attichiki Creek (Table 1.3-2, Appendix 11-D). • During the first of operation (Year 1), due to capacity limitation of both selenium and metal treatment plants, out of a total 6 Mm3 discharge from the existing KS Pit 4.1 Mm3 will be discharged to the Attichika Creek without any treatment. • During operation and closure (Year 2- 19), the metal removal treatment capacity is sufficient to treat the entire annual discharge volume (1.5-1.9 Mm3), but the proposed selenium treatment capacity is limited to 0.8 Mm3 per year. ECCC understands the capacity for selenium treatment can be increased, by adding additional modules to the Selen-IXTM system as part of an adaptive management plan. The proponent is planning to establish specific thresholds/indicators that will trigger the adaptive management plan during the permitting stage. ECCC recommends that the proponent clearly specify the trigger for increasing the selenium treatment capacity and how this will be monitored. The general references to the environmental management and monitoring plans provided in the proponents response to our comments (057.1) do not provide sufficient detail to understand how the need for additional selenium treatment will be assessed. Monitoring of the conditions that will trigger the need for additional selenium treatment is particularly important during the early stage of the project when discharge volumes to Attichika Creek from dewatering of the KS pit/KUG TSF are at the highest rate. ECCC recommends considering the comments provided here (053.1) together with related comments provided in response to comment 073.1.	Comment noted. Additional details on TUG TSF and receiving environemnt water quality monitoring will be incorporated into management plans developed to support the AuRico's Mines Act and Environmental Management Act permitting which will be implemented during construction and operations phases of the project.	21-Dec-2016
ECCC-058	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	Sampling frequency at most of the surface water sampling stations (particularly those which correspond to water quality prediction nodes) appears to be monthly. ECCC requests clarification as to whether the monthly frequency also includes additional weekly sampling during periods of maximum hydrograph fluctuations (e.g., freshet or fall rains), as per the BC MOE's Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators.	The number of samples collected per month per year is presented in Appendix 11-A, with additional data collected in Thutade Lake in 2015 provided in Appendix 11-C. The Application presents all baseline water quality data used in to inform existing conditions of the receiving environment, summarized in Table 11.4-3 in Chapter 11. The water quality data used in water quality predictive modelling is described in Section 3.2.1 of Appendix 11D. Weekly sampling was conducted in the spring and/or fall at most WQ nodes for at least one year; these include monitoring stations on: East and Central Cirque Creeks (stations KN-12, KN-09), Attycelley Creek (KN-11, KN-07, KN-06), Finaly River (KN-15), Thutade Lake (KN-TL), Waste Rock Creek (WQ-14F) and Attichika Creek (WQ-17, WQ-13). The weekly sampling data was incorporated into the monthly frequencies. The BC MOE Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (available on the BC MOE website at: http://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/water_air_baseline_monitoring.pdf) indicates that one full year of monthly sampling is required to establish baseline data, although generally current practice is that two years of data is recommended. There is adequate baseline data available to use in water quality modelling and for evaluation of potential effects (Appendix 11-D).	5-Aug-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
ECCC-059	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	The EIS states that over 19 years, the water quality sampling program has varied in terms of priorities, evolution of industry standards and laboratory analytical methods. ECCC requests commentary from the proponent as to the compatibility of water quality data from the pre-disturbance, KS Mine Construction and Operations, and KS Post-Closure (i.e., KUG baseline) time periods.	Surface water quality data have been collected since 1996 in the mine site area associated with planning and permitting of the KS Mine, and since 2002 in the underground mine area associated with planning of the previously proposed Kemess North project. The number of samples collected per month per year is presented in Appendix 11-A, with additional data collected in Thutade Lake in 2015 provided in Appendix 11-C. The Application presents all baseline water quality data used in to inform existing conditions of the receiving environment, summarized in Table 11.4-3 in Chapter 11. The water quality data used in water quality predictive modelling is described in Section 3.2.1 of Appendix 11D. To support predictive modelling, results of water quality monitoring and baseline studies for stations within and downstream of the footprint of the former KS mine incorporated as source terms for predictive modelling are restricted to water quality data collected since KS mine entered post-Closure (April 2011 to December 2014) —these results represent the existing water quality condition and would be subject to similar, modern industry standards and laboratory analytical methods. Similarly, data used to inform predictions outside the footprint of the former KS mine have been collected since 2007. This method provides a more accurate representation of background conditions and avoids any potential for artificially elevating the concentration of background water quality parameters in the predictive model and the effects assessment. The BC MOE Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (available on the BC MOE website at: http://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/water_air_baseline_monitoring.pdf) indicates that one full year of monthly sampling is required to establish baseline data, although generally current practice is that two years of data is recommended. There is adequate baseline data available to use in water quality modelling and for evaluation of potential effects (Appendix 11-D).	5-Aug-2016
ECCC-060	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	Effects on alkalinity, acidity, pH, turbidity, TSS and temperature were qualitatively assessed in the EIS. ECCC requests that the proponent provide rationale for selecting a qualitative approach to water quality predictions for these parameters (instead of a robust and quantitative predictive water quality model approach). In particular, ECCC requests additional justification for qualitative TSS predictions, as baseline data indicates a strong correlation between TSS levels and concentrations of COPCs during Q2.	Water quality indicators are assessed quantitatively in predictive modelling, semi-quantitatively using best available data, or qualitatively using professional judgement and experience (Sections 11.5 and 11.6). Modelled water quality parameters assessed in the Application are listed in Table 3.1-3 and correspond to water quality indicators that are relevant, measureable, responsive, and predictable. Alkalinity, acidity, pH and temperature are not included in the GoldSim model as the concentrations of these parameter will be a result of in situ reactivity and cannot be quantitatively modelled using a mass-balance model approach (e.g., biodegradation and assimilation reactions). Total suspended solids (TSS) and turbidity were not included in the predicative water quality model. As described in Appendix 11-D, these water quality indicators cannot be predicted with certainty as TSS loading from overland and stockpile runoff cannot be predicted with accuracy. Changes in turbidity, TSS, are qualitatively assessed using best available data, professional judgement, proposed discharge management and mitigation strategies for the Project, and expected conditions in the KUG TSF. The proponent acknowledges that concentrations of many water quality parameters in the receiving environment will vary seasonally. For example, divalent cations that have a strong affinity for particulates at circumneutral pH will often co-vary with seasonal changes in TSS (e.g., higher concentrations in freshet or Q2). This is considered in the water quality model as monthly values representing existing conditions are used as inputs of the model (i.e., monthly variation is accounted for in water quality model predictions; Appendix 11-D)	5-Aug-2016
ECCC-061	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	During construction, water from the KUG TSF will be discharged into Attichika Creek from May to October staged to the hydrograph, at a maximum rate of 1,091 L/s. ECCC requests further information as to how the variable discharge approach was incorporated into the water quality model: 1. During anomalously dry or wet (or hot or cold) years, the timing of the discharge release may need to be shifted in order to maintain staging. What are the implications for the receiving environment? Were sensitivity analyses conducted in order to quantitatively assess potential effects?	The proposed discharge location as well as the variable discharge approach was selected following a discharge alternatives assessment and extensive iterative predictive modelling exercise (Appendix 4-D of the Application). Base case model predictions for the Water Quality Model were based on the variable annual precipitation, base case groundwater inflows, and expected base case geochemical source terms. Further, the assessment of effects from KUG TSF discharge considered multiple sensitivity cases with respect to surface water hydrology, which are summarized in Table 3.4-1 of Appendix 11-D. That is, beyond base case (variable precipitation and runoff-off), sensitivity cases included average precipitation and runoff, 100-Year Wet precipitation and runoff, 100-Year Dry precipitation and runoff and high groundwater inflows which sufficiently cover climate variability during the life of mine and is consistent with other recent EA applications in BC. The timing and volume of variable discharge are not expected to change under most conditions change during the wet and dry years. Consistent timing and volumes (i.e., independence from climate conditions) makes the water management plan more reliable and less dependent on judgement and forecast. As discussed in Appendix 11-D, the water quality model used consistent staged discharge from May to October (i.e. no adjustment was made to the timing or rate of discharge from year to year). Sensitivity cases considered up to 1 in 100 dry years indicate show the water quality effects on the receiving environment are not significant. In anomalously dry weather there may be a need to curtail discharge in order to remain within receiving environment objectives, this action would be triggered based on monitoring as described in the Fish and Aquatic Effects Monitoring Plan (Section 24.7 of the EAC Application).	5-Aug-2016
ECCC-062	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	ECCC requests clarification as to whether the following statement is valid for the post-closure phase of the project: "Direct discharge from the KUG TSF will be regularly tested and managed to ensure compliance with all provincial and federal regulations and guidelines" (p.11-123). Water quality predictions for Waste Rock Creek during Post-Closure phase identify several COPCs (including nitrate, total Al, total Cu, total Mo, and total Se), meaning that the identified parameters exceed baseline + 10% as well as relevant water quality guidelines. The COPCs suggest that discharge from the KUG TSF does not actually comply with all provincial and federal guidelines.	The Post-Closure phase for the Project corresponds to the cessation of active water treatment and directed discharges from the KUG TSF; during this phase the KUG TSF is allowed to fill from recharge from overland runoff and precipitation; predicted water quality of the KUG TSF significantly improves over this period. A summary of Predicted KUG TSF Water quality in the Post-Closure Phase of the Project is provided in Table 3.5-2 of Appendix 11-D and indicates that predicted water quality is of suitable quality for discharge Waste Rock Creek in Post-Closure. Water quality monitoring of the KUG TSF and the receiving environment will be ongoing in Construction, Operations, and Closure and will service to validate water quality predictions. If monitoring indicates that KUG TSF is not of suitable quality, contingency measures can be initiated; for example, extension of active water treatment. The proponent is committed to ensuring that effluent is not acutely lethal at end of pipe and that chronic toxicity does not occur at the end of the IDZ, consistent with BC MOE policy and practices for permitting of effluent discharges under the Environmental Management Act. Note, Waste Rock Creek receives inputs from the WCSP, SCSP, and SeCP as well as the KUG TSF (seepage and overflow via the spillway) in the Post-Closure Phase; COPCs identified in Closure (including nitrate, total Mo, and total Se) largely correspond to inputs from the SeCP. It is important to note that a significant conservatism incorporated into predictive modelling is that all potential geochemical loadings from the former KS Mine do not further improve over the life of the Project. That is, it is assumed that mitigation achieved by the currently in-place KS leach cap is 100% ineffective at reducing loadings from the KS waste rock pile to Waste Rock Creek and the other retention ponds, and that all retention ponds, including the SeCP will interact with Waste Rock Creek under currently existing water conditions (Appendix 11-D). This is a significant source of conservatism, given that the geotechnical expectation is that the leach cap will be 100% effective at reducing loadings over time. Residual effects to surface water quality for Waste Rock Creek were assessed In Section 11.6.2.3; residual effects were assessed as not significant.	5-Aug-2016
ECCC-063	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	The EIS states that during post-closure, controlled discharge via a closure spillway from the KUG TSF will only occur once water quality meets receiving environment criteria. ECCC requests clarification as to which specific criteria will be used (e.g., water quality guidelines, site-specific water quality objectives?).	At post closure, water treatment will be required until such time as the proponent can demonstrate the discharges meet permitted discharge limits. The discharge criteria and receiving environment criteria will be determined at the permitting stage.	5-Aug-2016
ECCC-064	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	The closure phase of the project is predicted to take 6 years (i.e., the time predicted by the water quality model for KUG TSF water quality to meet receiving environment criteria). ECCC requests clarification as to the contingency plan should water quality not meet receiving environment criteria by the end of the proposed 6 years- would treatment via the WTPs continue? Would water be stored in the TSF and if so, what is the capacity for the TSF to store this water?	The contingency plan should water quality not meet receiving environment criteria by the end of the proposed 6 years is to continue water treatment until such time as the proponent can demonstrate the discharge meets permitted discharge limits. The temporal boundary delineating the Closure and Post-Closure phases of the Project was determined by predictive water quality modelling. Water quality monitoring during the Closure phase will be used to validate water quality predictions and the timing of the cessation of water treatment.	5-Aug-2016
ECCC-065	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	To minimize potential effects on water quality in Amazay Lake, seepage from the subsidence zone will be directed to East Cirque Creek in Closure and Post-Closure using decline bulkheads. ECCC requests further information on the following: 1. The long-term feasibility of the bulkheads as a mitigation option, including evidence from other mine sites. 2. Contingency plans for managing water quality should the decline bulkheads prove to not be an effective mitigation strategy. 3. Implications for water quality in Amazay Lake should the decline bulkheads prove to not be an effective mitigation strategy.	The response is provided in memo **20160805_KUG Comment ECCC-065 and 069_WQTreatment_memo**	5-Aug-2016
ECCC-066	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	ECCC seeks clarification as to some discrepancies noted between Table 11.6-1 and Table 11.6-3. For example, some of the parameters listed as components of the effluent in Table 11.6-1 are not included as components of the predicted discharge water quality in Table 11.6-3 (e.g., calcium). Also, ECCC requests rationale for why the maximum predicted concentrations for several parameters during the operations phase in Table 11.6-3 exceed the values determined for effluent quality. For example, Zn effluent quality (Table 11.6-1) will be 0.005 mg/L, and Zn predicted KUG discharge water quality (Table 11.6-3) is predicted to be 0.005 mg/L for operations (min and median) and closure (min, median and max) but is predicted to be 0.08194 mg/L for operations (max).	Table 11.6-1 presents the results of bench-scale water treatment testing that were incorporated as source terms to represent water treatment for the Se-IX™ and metals removal (MR) treatment plants in the predictive model; please refer to Section 3.2.4 of Appendix 11-D, Water Balance and Water Quality Model Report, for additional details. In contrast, statistical summaries of predicted discharge water quality from the KUG TSF are presented in Table 11.6-3 (Construction through Closure) as well as in Table 11.6-4 (Post-Closure). Parameters presented in these summary tables correspond to modelled water quality parameters, which are listed in Table 3.1-3 and correspond to parameters with working and approved BC water quality guidelines (BC WQG) and are inclusive of guidelines for the protection of aquatic life, drinking water and wildlife water supply. Water quality predictions presented in Table 11.6-3 are inclusive of the proposed water management plan as well as proposed Se-IX™ and MR water treatment of KUG TSF discharges. That is, predicted quality of KUG TSF discharges across the life of the Project will reflect periods of water treatment, periods when there is no proposed water treatment, as well as periods of partial by-pass of water treatment (see Section 3.2.4 and Figure 1.3-1 through Figure 1.3-6 in Appendix 11-D).	5-Aug-2016
ECCC-067	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	ECCC is seeking to understand how well the water quality modelling nodes capture project-related effects: 1. ECCC requests clarification as to the proximity of water quality node WQ-14F to the spillway entrance on Waste Rock Creek, and to the location on Waste Rock Creek where seepage from the KUG TSF will be daylighting. 2. ECCC requests clarification as to the proximity of water quality node WQ-01 to the location on Kemess Creek where seepage from the KUG TSF will be daylighting. 3. ECCC requests clarification as to the proximity of water quality nodes KN-12 and KN-09 to the locations on East Cirque Creek and Central Cirque Creek where seepage from the underground mine will daylight during closure and post-closure.	Response is provided in the memo **20160805 KUG Comment ECCC-067_Water Balance_memo**.	5-Aug-2016
ECCC-068	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	In the Surface Water Quality Effects Assessment, seepage from the TSF is described as reporting to Kemess Creek (p.11-148) and Waste Rock Creek (p.11-172) during all project phases. However, some of the conceptual models for Water Management in Appendix 11-D (Figures 1.3-1 to 1.3-3) do not include these seepage pathways. 1. ECCC requests clarification on the seepage pathways from the TSF during construction Year -4, Construction Years -3 to -1, and Operations Year 1. 2. ECCC requests clarification as to whether or not seepage pathways from the KUG TSF have been incorporated into the water quality model for the project phases identified in Figures 1.3-1 to 1.3-3.	According to the groundwater modelling results, seepage from the KUG TSF commences in 2022 (Project Year 2), before which the KUG TSF acts as a sink to local groundwater flows (Section 2.2-3 in Appendix 11-D). The seepage from the KUG TSF to Waste Rock Creek and Kemess Creek has been accounted for the water quality model.	5-Aug-2016

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ECCC-068.1	7-Oct-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	ECCC appreciates the clarification. It is noted that according to Appendix 9-C, seepage from the former KS pit (proposed KUG TSF) which commences in 2022 (Year 2) includes: • Seepage from the East Dam of the proposed KUG TSF which is predicted to daylight in Kemess Creek with an estimated travel time of approx. 0.6 years and a flow rate of about 1 L/s. • Seepage through the south pit wall which is predicted to discharge to Kemess Creek (70%) and to Waste Rock Creek (30%) with an estimated seepage travel of approx. 5.5 years and a net flow rate of approx. 1.2 L/s. For added consideration, ECCC provides the following comments: • Seepage from a mine site is considered a part of the flow rate which triggers the MMER (50 m3/day) and subsequently any water from the mine operations area can only be discharged through final discharge points under MMER. • It is the proponent's responsibility to monitor the seepage from the KUG TSF to Kemess Creek and Waste Rock Creek and ensure that seepage is directed through final discharge points if MMER applies.	AuRico acknowledges the comment and will consider it during the permitting stage.	28-Oct-2016
ECCC-069	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	The water quality model relies on synthetic precipitation and hydrological records as input data for the KUG site. 1. ECCC requests clarification as to whether meteorological and hydrological monitoring was conducted for KS mine. If so, please provide rationale as to why synthetic data sets were employed for the water quality model instead of historical data collected from the KS mine site. 2. ECCC requests clarification as to whether the synthetically generated precipitation and hydrological data were ground-truthed by establishing monitoring stations at the proposed KUG mine site.	The response is provided in memo **20160805_KUG Comment ECCC-065 and 069_WQTreatment_memo**	5-Aug-2016
ECCC-070	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	Water quality predictions are presented without providing confidence intervals. ECCC requests that confidence intervals be provided quantitatively in the tables of monthly model predictions (Appendix 11-D), as well as presented graphically with model predictions (Section 11.6).	Water quality predictions were completed deterministically, therefore confidence intervals cannot be calculated from a single model run. Uncertainty in water quality predictions was implicitly assessed through the use of sensitivity analyses which are extensively documented in Appendix 11-D and Section 11.6. This approach to assessing uncertainty in water quality predictions is standard practice for Environmental Impact Statements in British Columbia and Canada.	5-Aug-2016
ECCC-071	21-Jun-2016	Christie Spry (ECCC)	Water (Quality & Treatment)	The cumulative effects assessment for water quality only considers project-related COPCs, which allows for an increase of 10% above baseline conditions (based on the COPC screening methodology). If each incoming project allows for a 10% increase in contaminant loading, then it is feasible for a cumulative impact to occur that is not captured by the cumulative effects assessment for water quality. Since Pre-disturbance data is available for the mine site (pre-July 1997 data), ECCC suggests conducting a quantitative cumulative effects that compares pre-disturbance data to KUG model predictions in order to quantitatively assess the cumulative water quality effects of the KS and KUG mines.	The only past, present, or reasonably foreseeable project that is expected to interact with Project residual effects in the LSA is the former Kemess South (KS) Mine which is currently in a care and maintenance phase as described in detail in Section 1.4.2.1. Historical mining and mineral exploration activities associated with the former KS mine have had the potential to affect surface water quality of streams at some model nodes. To support predictive modelling, results of water quality monitoring and baseline studies for stations within and downstream of the footprint of the former KS mine incorporated as source terms for predictive modelling are restricted to water quality data collected since KS mine entered Post-closure (April 2011 to December 2014) —these results represent the existing water quality conditions. This method provides a more accurate representation of background conditions to assess Kemess Underground effects, and will be inclusive of potential cumulative residual effects of KS mining operations. Thus, recent past, current, and expected future effects to water quality related to KS have been fully integrated into the baseline water quality characterization, predictive water quality modelling, and residual effects assessment completed for the Project. As such, the residual effects assessment described in Sections 11.5 and 11.6 are considered to be cumulative in nature related to KS and further consideration of potential cumulative effects between Kemess Underground and KS are not required. Consistent with other recent EA applications in BC, the methodology to support the effects assessment used a two-step screening process to identify contaminates of potential concern (COPCs), as outlined in Figure 11.6-1 in Section 11.6 of the Application. This COPC screening process identifies parameters that increase in concentration beyond 10% and are greater than a relevant water quality guideline. The threshold of 10% was selected in order to be able to identify increases in the concentration of water quality parameters that would be measurable and quantifiable based on limitations in analytical precision. The methodology does not suggest that any future Project could increase water quality parameter concentrations by 10% without causing an effect.	5-Aug-2016
ECCC-072	21-Jun-2016	Grazyna Chrobok (ECCC)	Tailings and Waste Rock Management	A Conceptual Water Management Model for the site wide flow pathways during different phases of the proposed KUG project is presented in Figures 1.3-1 to 1.3 -6. The proponent is requested to include flow and discharge volumes in terms of m3/year and L/s for each of the pathways presented in Figures 1.3-1 to 1.3 -6.	A response will be provided in **20160805_KUG Comment ECCC-072_Water Balance_Memo**	5-Aug-2016
ECCC-073	21-Jun-2016	Grazyna Chrobok (ECCC)	Water (Quality & Treatment)	ECCC is concerned about the selenium and metal loading in the KS open pit (i.e., KUG TSF) effluent which is proposed to be discharged to Attichika Creek during construction and operations. Due to capacity limitations of the WTPs, untreated water will be released from the KS open pit/KUG TSF into Attichika Creek. For example: - 23 Mm3 of water from the KS pit dewatering will be discharged to Attichika Creek without selenium or metal treatment during the project construction; - 4.1 Mm3 of water from the KS pit dewatering will be discharged to Attichika Creek without selenium or metal treatment during the 1st year of operations; - and 1.1 Mm3 of water from the KS pit dewatering will be discharge to Attichika Creek without selenium treatment during production (Year2 to Year 13). The proponent is requested to provide water quality monitoring results for the KS pit water and evaluate effluent depositions from the existing KS tailings disposal facility into the KS open pit which was used a part of Selenium Management Plan for the former KS operation.	The water quality assessment for the Kemess Underground Project is described in Chapter 11 and Appendix 11-D of the EAC Application and explicitly includes consideration of the existing KS site and facilities. Existing water quality within the KS open pit (proposed KUG TSF) are provided in Table A2-1 in Appendix 2 of Appendix 11-D of the EAC Application. Existing water quality within the KS open pit was incorporated into the water quality model as the initial, pre-construction, pit water quality condition (Appendix 11-D). As part of the Selenium Management Plan for the Kemess South (KS) mine, seepage collected at the downstream side of the NAG WRD have been collected and pumped to the open pit since 2008 . AuRico currently holds an effluent discharge permit, since 2013, that allows discharge from the KS TSF to report to Kemess Creek (i.e. will not discharge to the open pit). This too has been considered in the water quality model used to support the Kemess Underground EA. To support the Kemess Underground Project predictive water quality modelling was used to evaluate the effectiveness of various water management and mitigation strategies, including the potential location, treatment requirements, and the timing of directed discharges from the KUG TSF to Attichika Creek (Appendix 4-D, Appendix 11-D). Planned water treatment for the Project is detailed in Section 1.3.4 and Section 3.2.4 as well as Figure 1.3-1 through Figure 1.3-6 of Appendix 11-D (Water Balance and Water Quality Modelling Report). Water quality predictions and associated effects assessment for the Project are inclusive of the water treatment (Appendix 11-D). Contrary to the statements in #ECCC-073, with development of the KUG Project, partial treated discharges from the KUG TSF will begin during the Construction phase. A selenium treatment plant (Se-IXTM) of 50 L/s capacity located in will be commissioned in Year -4. Water from the existing NAG WRD SeCP will be sent to the KUG TSF via the Se-IXTM plant during Years -4 to -1. Similarly, a dissolved metals removal (MR) treatment plant of an expected 120 L/s (1.9 Mm^3/yr) capacity will be commissioned in the first year of the Operations phase, in addition to ongoing Se treatment. Please see Section 1.3.4 and Section 3.2.4 for additional details regarding planned water treatment.	5-Aug-2016
ECCC-073.1	7-Oct-2016	Grazyna Chrobok (ECCC)	Water (Quality & Treatment)	The proponent provided water quality monitoring results for the KS pit as requested and also clarified that water from the existing KS tailings facility (not part of KUG) is being discharged to Kemess Creek (AuRico permit) and not to the former KS Pit (proposed KUG TSF). ECCC remains concerned with the proposed discharge volumes from the KS pit/KUG TSF into Attichika Creek during the project construction and operation phases. Dewatering of the former KS open pit/KUG TSF is required to create capacity for disposing tailings from the proposed KUG project. Therefore, large volumes of pit water are proposed to be discharged to Attichika Creek during the construction and operation phases of the project. The KS pit dewatering is planned to start during the project construction phase and the pit contact water will be discharged directly to Attichika Creek for six months of the year at a rate of 7.7 Mm3/yr for three years (Year -3 to Year -1). It is noted that a selenium treatment plant (STP) with capacity of up to 50L/s is planned to be commissioned in Year -4 and the treated effluent from the exiting selenium collection pond (SeCP) will be transferred to the KS Pit /KUG TSF. Nonetheless, the pit contact water is proposed to be discharged directly to the Attichika Creek without any treatment during the construction phase of the project. It is also noted that a metal removal (MR) plant with capacity of 120 L/s is proposed to be commissioned in Year 1 of the operation. During the 1st year of the operations, a total 6.0 Mm3/yr is proposed to be discharged from the KUG TSF to Attichika Creek for six months of the year. Yet only up to 1.9 Mm3/yr of the total discharge will be treated for metal removal and up to 0.8 Mm3/yr of the MR treatment effluent will pass through the STP before being discharged into Attichika Creek. For 11 years of the project operations (Year 2 to Year 13), a total of 1. 9 Mm3/yr is proposed to be discharged from the KUG TSF to Attichika for six months of the year. The entire 1.9 Mm3/yr KUG TSF discharge will receive MR treatment. However, only up to 0.8 Mm3/yr of the MR treatment effluent will pass through the STP before being discharged into Attichika Creek. To provide expert information on the characterization of potential effects from the project and mitigation measures, ECCC requests the following:	As discussed in Appendix 4-D (Discharges Alternatives Assessment), Appendix 11-D (Water Balance and Water Quality Modeling Report) and Chapter 11 (Surface Water Quality Effects Assessment), extensive predictive water quantity and quality modelling was conducted to define and optimize the water management strategy and water treatment plan for the Project (see summary in Section 11.5.3.1) as well as to support the effects assessment as presented in the Application. The goal of predictive modeling was to remove as much subjectivity as possible from the assessment and to increase certainty in the predictions of alteration of surface water quality, residual effects, and the determination of significance to ensure a robust, transparent, and defensible approach to the effects assessment. Water quality and quantity predictions that informed the effects assessment are inclusive of the proposed water treatment plan and discharge volumes from the KS pit/KUG TSF into Attichika Creek during the Construction, Operations and Closure Project Phases; no significant residual effects were identified (Section 11.6). Further, sensitivity analyses for the water quality model predictions were also provided in Section 11.6 and Appendix 11-D, which increase the confidence and conclusion of the effects assessment. Water quality data presented in Table A2-1 corresponds to existing water quality of the KS Open Pit, not predicted discharge quality to Attichika Creek during Construction. Predicted discharge quality (total and dissolved metals, nutrients and anions) from the KS open pit (proposed KUG TSF) during Construction, Operations and Closure relative to maximum authorized concentrations as per schedule 4 of the MMER is provided in Table 3.5-1 of Appendix 11-D and Table 11.6-3 of Chapter 11 (Surface Water Quality Effects Assessment). Predicted KUG TSF discharge water quality meets expected relevant federal (MMER) discharge criteria. Note, final discharge limits for selenium (Se) are not governed by the federal MMER and, further, BC water quality guidelines for the protection of aquatic life for Se (or any other receiving environment guidelines) do not apply at end of pipe. Specific discharge targets will be developed during permitting process and implemented prior to the initiation of the Construction phase, as required by the federal MMER and the Environmental Effects Monitoring program associated with the provincial Environmental Management Act for effluent discharge. This will include verification that water quality within the KS Pit is suitable for discharge during KS pit dewatering during the Construction Phase of the Project.	28-Oct-2016

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ECCC-073.2	29-Nov-2016	Grazyna Chrobok (ECCC)	Water (Quality & Treatment)	ECCC remains concerned about the project effects on water quality in Attichika Creek resulting from direct discharges of large volumes of untreated mine contact water from dewatering of the former KS Pit/proposed TSF. ECCC appreciates that predicted water quality (Table 3.5.-1) does meet MMER criteria, but reminds the proponent that for those for those parameters not captured under the MMER the general prohibition of the Fisheries Act 36(3) applies (see also ECCC's response to comment 57.1). Predicted water quality for discharges to Attichika Creek is presented in Table 3.5.-1 and current water quality in the KS Pit is presented inTable A2-1 (Appendix 11D). ECCC understands that the observed water quality differs from the predicted water quality during construction because additional changes to the existing water quality are anticipated (see EIS Section 11.6.2). We also note that predictions are provided as total metals, whereas existing water quality data is only available for dissolved metals. However, ECCC notes that both data sets (predicted and measured) exceed the CCME Water Quality Guidelines for the protection of aquatic life, the BC Ambient Water Quality Guidelines, and the BC Contaminated Sites Regulation Schedule 6 Water Standards for selected parameters; selenium being of particular concern. ECCC is aware that the BC ambient Water Quality Guidelines do not apply at the point of discharge, but in the receiving environment outside of the initial dilution zone. ECCC understands the proponent is planning develop specific discharge limits during the permitting stage that will apply at the point of discharge. ECCC acknowledges that the proponent is planning to verify that the water quality meets the permitted discharge limits prior to discharging the KS Pit contact water to Attichika Creek. ECCC recommends that non-compliant water be retained in the KS Pit until adaptive management strategies (e.g. additional water treatment) can be implemented. Additionally, comparing actual discharge water quality to model predictions would facilitate ground-truthing of the model results for future project stages. As per our original comment (073.1) the proponent is reminded that the MMER apply when effluent discharge (individual or combined, including seepage) from the mine operations area reaches 50 m3/day on any given day. This means that: • effluent from the KS Pit can only be discharged to the environment via (a) final discharge point(s) in accordance with the MMER; and • Environmental Effects Monitoring may need to be conducted in accordance with MMER requirements.	Comment noted. AuRico does anticipate that an EEM program that meets the MMER will be required and that this program will be designed and implemented in order to comply with the MMER.	21-Dec-2016
ECCC-074	21-Jun-2016	Grazyna Chrobok (ECCC)	Tailings and Waste Rock Management	ECCC requests that the proponent clarify the following discrepancy: Figure 5.11.2 indicates that the KS pit (KUG TSF) is to be dewatered down to elevation of approximately 1210 m during the project Construction phase and 23 Mm3 of the pit water is to be discharged to Attichika Creek . However, Figure 6.4 (Appendix-6A) indicates that it will be necessary to discharge approximately 39 Mm3 of water from the KS pit prior to the Mill start-up by dewatering the pit down to the elevation 1180 m.	Figure 6.4 in Appendix 6-A represents the 2012 Feasibility Study. Additional water management planning has occurred since that period with one update being a reduce volume of pit dewatering prior to operations.	5-Aug-2016
ECCC-075	21-Jun-2016	Grazyna Chrobok (ECCC)	Geotechnical	ECCC notes that a number of geological structures including two major faults Kemess North Fault (KNF) and East Bounding Fault (EBF) exists in the area of the proposed KUG caving operation. ECCC is concerned that these faults could act as preferential groundwater seepage pathways for mine water to reach the Attycelly Creek watershed, thereby affecting flowsand water quality in both East Cirque Creek and Central Cirque Creek by introducing contaminated groundwater seepage from the underground mine operations. Please provide rationale as to why these major geological structures were not incorporated into the KUG groundwater seepage predictions provided in Appendix 5-F.	Appendix 5-F contains underground seepage predictions based on analytical solutions. This report was issued in 2012 in support of the Feasibility Study. For the purpose of informing the Water Balance and Water Quality model, groundwater fluxes (dewatering rates and fluxes to/from creeks) from the 3-D KUG groundwater flow model were used (Chapter 9, Appendix 9-B). The groundwater model incorporates all mapped faults in the Project area, with distribution of these features shown in Figure 9.6-2 and properties included in Table 9.6-1.	5-Aug-2016
ECCC-076	21-Jun-2016	Grazyna Chrobok (ECCC)	Water (Ground)	Contact water from the underground mine (shallow groundwater) is predicted to discharge to East Cirque Creek during Closure and Post-Closure. ECCC requests that the proponent provide rationale as to why the deeper groundwater isn't also anticipated to daylight the East Cirque Creek.	Deeper groundwater is expected to daylight in East Cirque Creek along longer pathlines, as indicated in Figure 9.6-8 discussed on page 9-84. Most contact water (over 95%) is anticipated to report to East Cirque Creek within a couple hundred meters of the edge of the subsidence zone. This seepage is expected to follow shallow groundwater flowpaths associated with rapid travel times (less than two months).The remaining contact water follows deeper groundwater pathways and is expected to daylight in East Cirque creek within a couple kilometres of the development between 10 and 40 years after water levels have recovered in the development.	5-Aug-2016
ECCC-076.1	7-Oct-2016	Grazyna Chrobok (ECCC)	Water (Ground)	The proponent clarified the difference between shallow and deep groundwater flow. ECCC requests that the proponent clarify how they intend to monitor and manage seepage of underground contact water in the area of subsidence zone which is predicted to report to East Cirque Creek including: • the 95% of seepage that is expected to follow shallow groundwater pathways, and • the remaining seepage that is anticipated to follow deeper groundwater pathways and expected to daylight in the creek after water levels have recovered.	The detailed groundwater monitoring plan outlined in Appendix 9-D (sub-Appendix B) makes provisions for the installation of three nested monitoring wells within the subsidence zone as wells as an additional, deeper monitoring well in the vicinity of the well pair DH-03-14A/B (a few hundred meters downgradient of the subsidence zone). The new well installed near DH-03-14A/B will aid in the characterization of deeper groundwater pathways issuing from the development. The proposed wells will allow monitoring of reflooding rates as well as groundwater quality; which will aid in forecasting impacts to East Cirque Creek. If water quality conditions in the subsidence zone indicate acidic conditions and/or water quality disparate to predicted concentrations, mitigative measures can be implemented to address these concerns. Potential strategies include the installation of injection wells at varying depths within the subsidence zone designed to transfer lime neutralization slurry into the groundwater to precipitate metals in situ. While further investigations and engineering design would need to be fully assessed, the fractured nature of the subsidence zone is clearly beneficial to this potential strategy.	10-Nov-2016
ECCC-077	21-Jun-2016	Grazyna Chrobok (ECCC)	Water (Ground)	The proponent is reminded that seepage from the mine site (including from the KUG TSF and the underground mine) is considered to be effluent under the *Metal Mining Effluent Regulations (MMER)* . ECCC requests that the proponent clarify how they intend to monitor and manage their groundwater seepage in accordance with the *MMER.*	A detailed groundwater monitoring plan is outlined in Appendix 9-D. Included in the proposed plan is monitoring of underground inflows, groundwater wells and key surface water stations. The rationale behind this plan is to collect sufficient information so that the groundwater models (and hence, GoldSim model) can be validated and provide early detection of mine contact water in groundwater prior to groundwater discharging to surface water receptors. Should mine contact water be detected in groundwater in concentrations or locations that are deemed unacceptable as defined during permitting, additional studies will be undertaken to identify mechanisms of transport and corrective action, if required.	5-Aug-2016
ECCC-078	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Terrestrial Ecosystems	Chapter 15, Section 15.5.3.1, "Mitigation for Habitat Loss and Alteration" states that "potential effects of subsidence will be monitored as per the Subsidence Effects and Terrain Monitoring Plan (Chapter 24, Section 24.14)." In Chapter 24, Section 24.14, no information is provided regarding how subsidence effects on wildlife would be monitored. ECCC requests that plans for subsidence effects monitoring related to wildlife include all wildlife VCs and COSEWIC-assessed and SARA-listed species found or with suitable habitat (moderate or high quality) in the predicted subsidence area and surrounding 250m buffer.	Although high quality habitat within the subsidence area and 250 m buffer has been modelled for caribou, moose, mountain goat, grizzly bear, and hoary marmot, it is only hoary marmot that has been observed during multiple years within this area. As such, AuRico has committed to conducting pre-construction surveys for active hoary marmot dens within subsidence zone and within 250 m buffer area and monitoring of active hoary marmot dens within the subsidence area (Section 24.19). Subsidence is anticipated to be an alteration to the topography in the area which is within alpine tundra habitat but devoid of vegetation. With the exception of hoary marmot, the other VCs for which suitable habitat was modelled in the subsidence area, are anticipated to have the capability to continue to move through the area without hindrance. Both the Subsidence Effects and Terrain Monitoring Plan and Wildlife Management and Monitoring Plan will be developed in further detail to support the subsequent permitting process and will include cross referencing to wildlife monitoring commitments relevant to both plans.	6-Jul-2016
ECCC-078.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	During the Working Group Meeting in Prince George (27 June 2016), the Proponent presented models that predicted 80-90m total vertical subsidence in the modeled subsidence zone. This subsidence may create changes in hydrology, vegetation, or overall landscape and ecosystem changes; it is unclear from the application what form these changes may take. ECCC requests that the proponent provide rationale for how species for which suitable habitat was modeled in the subsidence zone are anticipated to have the capability to continue to move through the area without hindrance, with reference to potential changes in hydrology, vegetation, or overall ecosystem changes.	Talus, tundra and heath ecosystem types are found in the proposed subsidence area (Section 2.5 of Appendix 13-A). The subsidence area is within alpine tundra (BAFAun) and spruce willow birch (SWBmks) subzones (Section 2.4.2.3 in Appendix 13-A and Figure 13.5-2). Ecosystems in the subsidence zone are primarily dry, rocky types with limited vegetation. The majority of the ecosystems are talus with altai fescue - Arctic willow tundra and mountain heather in the alpine tundra. Talus, sub-alpine fire - mountain heather and sub-alpine fir - feathermoss krummholz forest types are common in the spruce willow birch subzone. The post-subsidence landscape is expected to be a conical depression and resemble that of a post-disturbance landslide in that there will be both zones of depletion and accumulation (Cruden and Varnes 1996; Section 13.5.3.1). In zones of depletion, the exposed parent material will revert to the intial stages of soil development and ecological succession. In zones of accumulation, the resultant vegetation communities will vary depending on the end surface expression of the land and the existing soil characteristics. Research conducted by Tripathi, Singh and Singh (2008) examined the physio-chemical characteristics of vegetation following subsidence, repoted both positive and adverse impacts of subsidence on soil moisture, bulk density, water holding capacity, organic carbon content, and total nitrogen and phosphorus. An increase in all these parameters was found in depression areas, while on slopes the values were lower. The overlying vegetation in the subsidence zone experienced a reduction in growth due to the decrease of water availability in some areas (Sengupta 1993) or the saturation of soils in newly formed depressions. The severity of subsidence, the tolerance of ecosystems to disturbance, the end surface expression, soil characteristics, and environment conditions will determine the trajectory of succession at the local scale (Walker and Moral 2003). The proposed panel caving operations are expected to alter natural drainage pathways by changing ground water flow patterns, which may lead to creation of new seepage areas, slumps, or gullies several years after the end of mining activity (Section 13.5.3.3). The majority of the effects related to subsidence will affect talus and scree slopes which are resilient and adpated to reoccuring disturbances (Section 13.6.2.1). Certain ecosystems such as the tussock forming Altai fescue - Arctic willow tundra and mountain heather heath have a low resiliency to disturbance and are not likely to adapt to the degree of subsidence over the medium term, but new alpine vegetation communities are likely to establish over the long-term. The subsidence zone was assessed as altered in the wildlife and terrestrial ecology chapters of the Application. This is because the habitat will not be replaced by any kind of infrastructure. In additional to the changes described above the alteration that will occur is in the topography of the area. The slopes of the subsidence area are assumed to fill with the surrounding talus material to the angle of repose found on nearby slopes. This will occur within an area of alpine ridges between East Cirque Creek and and Amazay Lake that is already topographically steep. As such, navigating through this area should be similar to what wildlife already experience. Substantive avoidance of this area is not anticipated as there will be little to no human activity at the ground surface associated with it. Sensory disturbance that could occur would be related to people and vehicles accessing the area on an infrequent (less than once per week) basis. Cruden and Varnes. 1996. Landslide Types and Processes - Special Report. National Research Council, Transportation Research Board. (1996. 247:76): Quoted in M. Geertsema and J. J. Pojar, Tripathi, N., R. S. Singh, and J. S. Singh. 2008. Impact of post-mining subsidence on nitrogen transformation in southern tropical dry deciduous forest, India. Environ Res, 109. Sengupta, M. 1993. Environmental impacts of mining: monitoring, restoration, and control. Boca Raton, FL: Lewis Publishers. Walker, Lawrence R. and R. d. Moral. 2003. In Primary Sucession and Ecosystem Rehabilitation.Cambridge, UK: Cambridge University Press.	4-Nov-2016
ECCC-078.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	In the Proponent's response, ECCC notes that subsidence will result in loss of altai fescue-Arctic willow tundra, which is considered to be the best early winter caribou feeding habitat in the alpine and subalpine (Section 11.8.1 of Application Appendix 15-A) areas of the LSA. ECCC will engage in upcoming meetings with the Proponent and members of the caribou sub-working group to further address implications of this for potential impacts to caribou in the area. ECCC acknowledges that the Proponent provides rationale for their assumptions around wildlife movement through the subsidence zone. ECCC finds a high level of uncertainty in these assessments and requests that particular attention be paid to wildlife movement in the area in mitigation and management plans related to subsidence if the Project should be granted its Environmental Assessment Certificate.	There will only be 7 ha of Altai fescue - Arctic willow Tundra altered in the subsidence area (Table 13.5-2 of EAC Application) out of a total of 586.3 ha available in the LSA (Table 13.4-4 of EAC Application). The 7 ha represents 1.2% of what is available in the LSA. This habitat type is not limited to the subsidence area and is not limiting in terms of availability within the LSA.	21-Dec-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
ECCC-079	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	In the approved AIR, Section 6-7.2.1, the Proponent lists indicators for the wildlife VCs including "...changes in: habitat (loss or alteration)..." ECCC requests clarification on why "habitat (loss or alteration)" was not included in the potential effects from use of the ORAR on wildlife and wildlife habitat.	The Omineca Resource Access Road (ORAR) is an existing road currently supporting industrial traffic and as such no habitat loss or alteration will occur. The impact to wildlife due to use of the ORAR is assessed in Appendix 15-C of the Application.	6-Jul-2016
ECCC-080	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	In many cases, disturbing wildlife and/or wildlife habitat is prohibited by regulatory frameworks and legislative requirements (e.g. SARA, MBCA, etc.); thus "where practical" should not generally be included as wording for management and monitoring plans. ECCC recommends that the phrase "where practical" be removed from "minimize the extent of disturbance to wildlife and wildlife habitat resulting from Project activities, where practical."	Additional regulations such as those supported by Worksafe BC also direct activities. For subsequent versions of the management plan to support the permitting process, the phrase will be reworded to reflect ECCCs comments as well as ensure commitments to other regulations will be followed.	6-Jul-2016
ECCC-081	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Subsection 79(2) of the SARA states that a person conducting an environmental assessment: "must identify 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. The measures must be taken in a way that is consistent with any applicable recovery strategy and action plans." To assist the federal Responsible Authority (the Canadian Environmental Assessment Agency) meet its obligations under SARA s. 79, ECCC recommends that the Proponent identify adverse effects of the project on listed wildlife species and its critical habitat; and that measures be developed within the context of the EA so that actions are taken to avoid or lessen adverse effects to listed wildlife species and monitor those effects, consistent with any applicable recovery strategy and action plan.	Baseline inventory was conducted to identify listed wildlife species and critical habitat (baseline wildlife and habitat reports), and an assessment was conducted to identify adverse effects on them from the project (Chapter 15 of the Application), and mitigation and monitoring was proposed to reduce effects (Chapter 24, section 19 of the Application) . To date the only species identified in the RSA that has an applicable final recovery strategy and action plan is southern mountain caribou (Environment Canada 2014). Critical habitat identified in this recovery strategy is only found outside the LSA and was included in Appendix 15-C. The Appendix 15-C it was identified as ungulate winter range (UWR). In absence of publically available critical habitat mapping in the LSA, habitat suitability modelling was conducted independently that identified high elevation winter range, low elevation winger range, and high elevation summer range. These areas are consistent with the attributes listed in Environment Canada (2014). The assessment (section 15.6.2.1) indicates no significant residual effect on caribou resulting from loss or alteration of habitat, and mitigation to reduce impacts from other effects (mortality, disturbance, disruption to movement , and chemical hazards) is identified in Chapter 24.19.1 of the Application. The assessment concluded that there would be no significant residual effects on caribou from the development. Other species at risk on Schedule 1 of SARA or identified by COSEWIC including western toad, little brown myotis, olive-sided flycatcher, short-eared owl, northern goshawk, rusty blackbird, common nighthawk, barn swallow, wolverine and grizzly bear were given similar consideration in Chapter 15. In addition, Appendix 25-B summarizes relevant information in the Application to address federal requirements, including SARA 79(2) specifically.	6-Jul-2016
ECCC-081.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC notes that the following species identified in the RSA have applicable final recovery strategies or management plans (to date): 1. Little Brown and Northern Myotis 2. Olive-sided Flycatcher 3. Common Nighthawk 4. Rusty Blackbird ECCC suggests that without additional analyses requested, it is not possible to conclude that there would be no significant residual effects on caribou from the development.	Aurico acknowledges that recovery strategies and management plans are available for the five aformentioned species. Aurico will be revising the Wildlife Management and Monitoring Plan to support the subsequent permitting process, and will consider these recovery and management plans and the guidance provided within them in revised management plans. Furthermore, if critical habitat is developed for these species during a time that will overlap with Project development and operation, AuRico will consider potential implications to any critical habitat in the Project area when it becomes available (e.g., responses to comments ECCC-107 and ECCC-107.1). Hence, consideration of these available management and recovery strategies in the revised Wildlife Management and Monitoring Plan, as well as consideration of potential future critical habitat for little brown myotis, northern myotis, olive-sided flycatcher, common nighthawk, and rusty blackbird, will ensure that the Project is developed in a way that is consistent with federal requirements, including SARA 79(2) specifically. Specific to caribou, Aurico has conducted additional analyses on the existing level of disturbance and additive disturbance from the Project on draft critical habitat provided by ECCC. The results of these analyses and conclusions for the Project are presented in Memo **20161028_KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo.**	28-Oct-2016
ECCC-081.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Response re: myotis, olive-sided flycatcher, common nighthawk, and rusty blackbird are satisfactory. To further address content in Memo KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo, ECCC will engage in upcoming meetings with the Proponent and members of the caribou sub-working group.	The caribou sub-working group met on November 25, 2016 and minutes from the meeting will be made available from the BC EAO.	21-Dec-2016
ECCC-082	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Little Brown Myotis and Northern Myotis were both detected during acoustic monitoring surveys in a single year of survey efforts (2014). Though during those surveys Northern Myotis was only detected once at Saddle Pond (p 70 of .pdf), acoustic survey efforts in this case may not detect inter-annual variation or provide sound baseline data to draw the conclusion that the Northern Myotis "...may be present in low densities in the area or was migrating through the area." ECCC recommends that bat surveys be conducted for more than one year to account for inter-annual variation, as well as survey and potential weather limitations. Survey stations should include the same locations as previous years as well as additional stations to account for un-surveyed features (i.e. those identified as quality hibernacula (Figure 15.4-15) and roosting (Figure 15.4-16) habitat in suitability modeling and any inactive mine features that could support roosts or hibernacula (see Loeb et al. 2015, Holroyd and Craig 2016)). Field surveys employing methodologies such as radio telemetry, visual surveys, and acoustic monitoring should be evaluated for use in acquiring baseline information, including locations of hibernacula and maternity roosting sites. ECCC suggests referring to provincial inventory standards, published methodologies, and provincial best management practices for guidance on surveying methodologies. ECCC advises that acoustic bat surveys alone are insufficient in determining the presence and location of hibernacula and roosting sites for bats. In addition to habitat suitability modeling, an inventory of wildlife trees, buildings, mines and cliff/cave features in the Project area, as appropriate for the potentially impacted species, should be conducted to identify potential maternity roosts and hibernacula and inform where survey stations should be located. References: Loeb, S.C., Rodhouse, T.J., Ellison, L.E., Lausen, C.L., Reichard, J.D., Irvine, K.M., Ingersoll, T.E., Coleman, J.T., Thogmartin, W.E., Sauer, J.R. and Francis, C.M., 2015. A plan for the North American bat monitoring program (NABat). Holroyd, S.L., and V.J. Craig. 2016. Best Management Practices for Bats in British Columbia, Chapter 2: Mine Developments and Inactive Mine Habitats. B.C. Ministry of Environment, Victoria, BC. 60pp.	Bats, including species at risk, have been identified as present in the LSA, and the assessment assumed their presence in suitable habitat. Additional information on the bat population or bat community would not have influenced the conclusions of the assessment. The Project is in a cold northern climate, and as such only deep caves or fissures (generally associated with karst geology and enhanced by geothermal activity (e.g. Bilecki, L.C. 2003) will have internal environments that can maintain the constant temperatures and humidity required to support wintering bats. Karst geology with the potential to support hibernacula only exist on the edge of the LSA away from the infrastructure (Figure 15.4-15), and as such hibernacula are unlikely to be affected by the Project if they occur in that area. The underground mine may function as bat habitat in future. The biogeoclimatic (BEC) zones of spruce willow birch (SWB) and alpine tundra (BAFA) associated with the Project LSA are cold and relatively unproductive for forests and do not support trees large enough to provide significant day or maternal roosts for bats (e.g. that may be occupied by large numbers of bats). Areas with larger trees were classified at most as moderate suitability for their potential in the LSA to support roosts for individuals, or small numbers of bats. The trees capable of providing the best day and maternal roosting habitat would be associated with more nutrient rich sites at lower elevation BEC , such as the boreal white and black spruce (BWBS) in the region. Pre-clearing surveys are proposed (Chapter 24 section 19) and these should be sufficient to detect any significant roosts in the low probability that they occur. As such, additional baseline data collection is not anticipated to change the outcome of the assessment or proposed mitigation. Bilecki, L.C. 2003. Bat hibernacula in a karst landscape of central Manitoba; Protecting critical wildlife habitat while managing for resource development. M.Sc. thesis, U of Manitoba, Winnipeg Man.	6-Jul-2016
ECCC-082.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC notes that in the absence of adequate baseline studies for roost sites and hibernacula for Little Brown Myotis and Northern Myotis conducting only pre-clearing surveys and habitat suitability modeling is not sufficient to provide a complete understanding of where roost sites and hibernacula are located and might result in destruction of features that are required for recovery of these species. Considering that all roost sites and hibernacula might not be identified during pre-disturbance surveys, ECCC continues to recommend that the proponent apply the precautionary principle and commit to additional baseline surveys and accepted mitigation measures, to avoid or lessen potential loss of roost sites and hibernacula. This information is needed to assist the RA in meeting its duty under ss. 79(2) of the SARA to identify potential adverse effects on bats and would be important for verifying the potential significance of impacts.	Aurico has committed to both temporally and spatially avoid potential bat roosting habitat and hibernacula during Project development. As noted in the response to ECCC-083.1, the Project footprint will remove 0.6% of the available Moderate rated roosting habitat identified within the LSA and none of the very limited High rated roosting habitat. The remaining 4% of the expected habitat loss and alteration predicted in the Application/EIS is of Moderate rated roosting habitat mapped within buffers surrounding existing and new infrastucture (see p. 15-23 for description of buffers); no High rated habitat occurs within buffers surrounding new or existing infrastucture (also see response to ECCC-083.1 for discussion on evaluation of bat roosting habitat) . It is unlikely that all habitat within these buffers will be developed and lost; hence, the actual amount of potential bat roosting habitat that will be removed by Project development will be minimal. Despite this expected minimal habitat loss bats, Aurico will consider placing bat roosting boxes within the LSA to offset the lost of potential roosting habitat from Project development, such as discussed in the newly developed Best Management Practices for Bats in British Columbia (BC MOE 2016). The number of boxes that may be installed will be determined following the construction phase and will relate the results of pre-construction surveys to determine the location of roost sites (if conducted) and the amount of potential roosting habitat that is lost. Aurico will be revising the existing Wildlife Management and Monitoring Plan to support future permitting processes. The next iteration of the this plan will consider the recovery strategy for little brown myotis and northern myotis and the guidance provided within it. In addition, guidance provided in BC MoE 2016 will also be considered in subsequent version of the plan to ensure Project development does not adversely affect bat habitat. BC MOE. 2016. Best Management Practices Guidelines for Bats in British Columbia: Chaper 2: Mine Development and Inactive Mine Habitats. British Columbia Ministry of Environment. Victoria, BC.	28-Oct-2016
ECCC-082.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC acknowledges the Proponent's response and commitment to avoiding potential bat roosting habitat and hibernacula. ECCC recommends that the Proponent closely follow the BMP Guidelines document (BC MOE 2016) when revising the existing Wildlife Management and Monitoring Plan. Due to uncertainty around box value and documented low occupancy rates, ECCC discourages the Proponent from relying solely on bat boxes to offset any potential loss. ECCC encourages consideration of other alternatives including artificial roost trees that simulate trees with loose bark (BC MOE 2016) and other appropriate accepted measures.	AuRico appreciates the suggestions regarding bat mitigation options and will take them into consideration when developing the next iteration of the Wildlife Management and Monitoring Plan.	21-Dec-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
ECCC-083	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Northern Myotis were potentially detected once at Saddle Pond (p 70 of .pdf) during a single year of acoustic surveys. These surveys may not detect inter-annual variation or provide sound baseline data to draw the conclusion that the northern myotis "...may be present in low densities in the area or was migrating through the area." ECCC recommends that habitat suitability modeling be conducted for Northern Myotis to assess foraging, maternal roosting, and hibernacula habitat potential in the LSA. ECCC suggests that this suitability modeling be used to guide additional survey locations for Northern Myotis in the LSA. Habitat requirements and uses differ between bat species (Environment Canada 2015), meaning that species-specific survey locations may be required. Reference: Environment Canada. 2015. Recovery Strategy for Little Brown Myotis (Myotis lucifugus), Northern Myotis (Myotis septentrionalis), and Tri-colored Bat (Perimyotis subflavus) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Available at http://www.sararegistry.gc.ca/default.asp?lang=En&n=2A04680B-1	Additional inventory would not alter the approach taken for the assessment of effects on northern myotis or bats in general. Hibernacula could only exist within the cold climate of the area if features were deep enough to support a constant temperature and humidity required to sustain bats, and /or geothermal exists. Karst geology with the potential to support hibernacula only exist on the edge of the LSA away from the infrastructure (Figure 15.4-15), and as such hibernacula are unlikely to be affected by the Project if they occur in that area. Considering the biogeoclimatic (BEC) zones associated with the project LSA (spruce willow birch and alpine tundra) , trees will not be large enough to provide significant day or maternal roosts. Roosting habitat was modelled (Figure 15.4.16) and this habitat has sufficient similar attributes to support foraging of northern myotis as well. Wetland inventory is effective for identifying foraging habitat, and mitigation associated with other valued components (e.g. western toad, waterbirds, fish values) will also be effective to mitigate potential effects on bat foraging habitat.	6-Jul-2016
ECCC-083.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC notes that due to the inter-annual variation in the use of habitat features by bats, habitat suitability modeling alone is not likely sufficient for Northern Myotis effects assessments. ECCC further notes that 300 ha of high quality roosting habitat are predicted to be lost or altered due to the project (Chapter 15, Table 15.6-13). ECCC continues to recommend that habitat suitability modeling in combination with field surveys be conducted to evaluate Northern Myotis activity in relation to any suitable features in the Project area. ECCC requests the proponent provide a definition or quantify the phrase "significant day or maternal roosts" in order for ECCC to provide expert information on the effects and mitigation measures. In addition, trees in the LSA may be large enough to support roosts for Northern Myotis, particularly in the lower elevation areas of the LSA (e.g. pathway proposed for the discharge pipeline (Chapter 15, Figure 15.6-22)). ECCC notes that Northern Myotis have been shown to roost in trees with a large range of diameters (e.g. 25-44 cm from references in COSEWIC status report). ECCC requests additional rationale and data be provided to support the claim that "trees [in the project LSA] will not be large enough to provide significant day or maternal roosts."	Although Table 15.6-13 and Figure 15.6-22 refers to the bat roosting habitat that will potentially be lost or altered as "high quality", high quality habitat for bats was considered a combination of habitat rated as High and Moderate during habitat suitability modelling, and only habitats rated as Moderate occur within the Project footprint area and associated buffers, as as seen in Figure 15.4-16. The actual Project footprint area is estimated to remove 42.3 ha of moderate roosting habitat while 257.7 ha will potentially be altered. The altered area occurs within the buffers that were used for the assessment. No high rated habitat will be lost or altered by the Project. As stated in Section 15.4.3.7 under the sub-heading Roosting Habitat Identification "The highest rated habitat were those provided by vegetation that was likely to support roost trees (i.e. old and of largest diameter capable of providing cavities, thick bark, and area that bats may use for day or maternal roosts in single or small groups). Lower elevation and the most productive forested stands were assumed to have the highest potential to support roost trees, particularly stands with structural stage 7 old growth supporting large white spruce or riparian habitat with old structural stage 5 cottonwood. Forest of structural stage 6 or greater on the most productive sites of the SWBmk were believed capable of producing conifer stems that may have cavities and were given a maximum of Moderate suitability." The distribution of these habitats in the LSA is summarized in Table 15.4-25. Considering the above, habitats with the expected largest diameter trees (i.e., high rated habitats in old growth conifer forests and mature riparian habitats) are limited in the LSA and will not be lost or altered by Project development, while Moderate rated habitats are more extensive (covering over two-thirds of the LSA) and represent mature conifer forests with modest diameter trees, of which only 42.3 ha will be removed by the Project (0.6% of total Moderate rated habitat available) and 257.7 ha may potentially be altered (4% of total available). Hence, at a minimum, less than 1% of the available Moderate rated habitat will be lost during Project development, with an additional 4% that may be altered, which informed the assessment of no residual effects for bats resulting from habitat loss and alteration of roosting habitat. The largest diameter trees are expected to have the best capability of supporting habitat for a number of roosting individuals (i.e., a day roost or maternal colony), while trees with more modest diameters are more likely to support single individuals, or possibly small numbers of individuals. This information informed the statement that "trees will not be large enough to provide significant day or maternal roosts", that is to say, the majority of trees within the LSA likely are not suitable for supporting large numbers (colonies) of roosting bats. Specific to northern myotis, the provided literature which report on diameter of roost trees indicate that the majority of roost trees were of diameters of 30 cm or greater (Broders and Forbes 2004; Garroway and Broders 2008; Park and Broders 2012), with only one reported instance of roosting in smaller diameter trees (mean diameter of roost trees for non-lactating females was 22.7 +/- 2 Standard Error; Park and Broders 2012). This information, though specfic to eastern Canada, does provide support that selected roost habitat for northern myotis is likely in larger than average diameter trees, which is represented by high rated habitat within the LSA that will be unaffected by Project development. Broders, H., and G. Forbes. 2004. Interspecific and intersexual variation in roost-site selection of northern long-eared and little brown bats in the Greater Fundy National Park Ecosystem. Journal of Wildlife Management 68:602-610. Garroway, C., and H. Broders. 2008. Day roost characteristics of northern long-eared bats (Myotis septentrionalis) in relation to female reproductive status. Ecoscience 15:89-93. Park, A., and H. Broders. 2012. Distribution and roost selection of bats on Newfoundland. Northeastern Naturalist 19:165-176.	28-Oct-2016
ECCC-083.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Response satisfactory. Due to inter-annual variation in the use of habitat features by bats and initial detections of Northern Myotis in Project baseline surveys, ECCC recommends that additional pre-construction surveys for Northern Myotis (using currently accepted best management practices and survey methods) be conducted in the LSA as a condition of the Environmental Assessment Certificate.	AuRico has committed to pre-clearing surveys for bats to identify and avoid maternal roost sites if clearing occurs during May to September (Table 24.19-1).	21-Dec-2016
ECCC-084	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	The proposed "Recovery Strategy for Little Brown Myotis (Myotis lucifugus), Northern Myotis (Myotis septentrionalis), and Tri-colored Bat (Perimyotis subflavus) in Canada" states that "unlike Little Brown Myotis, which most often forage over water and are aerial hawkers, Northern Myotis forage more frequently along and within forests and although they feed on flying insects, they also glean prey." (Environment Canada 2015). In the application, Section 15.6.8 states that, "The assessment and mitigation is appropriate for all bat species including federally endangered little brown myotis and provincially red-listed, eastern red bat." (pg 212 of .pdf) Given differences in habitat requirements and behaviours, ECCC recommends that species-specific effects assessments be conducted for Little Brown Myotis and Northern Myotis, the two SARA-listed bat species detected in 2014 acoustic surveys.	Agreed subtle differences occur for habitat use between species, however forested habitats are important to both species and foraging habitats in the open have also been considered. Other effects such as disturbance , chemical effects, mortality etc. are suitably similar between the species that no separation is considered to be required. As such, AuRico does not feel that species specific assessments are necessary. Mitigation associated with other valued components (e.g. western toad, waterbirds, fish) will also mitigate potential effects to bat foraging habitat.	6-Jul-2016
ECCC-084.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC continues to recommend species-specific effects assessments be conducted for Little Brown Myotis and Northern Myotis, the two SARA-listed bat species detected in 2014 acoustic surveys.	Additional species-specific assessments for these two species are not expected to materially change the conclusions of the Application/EIS. Potential hibernacula for these two species was evaluated in the Application/EIS, and no suitable structures with appropriate thermal conditions were identified within the Project footprint and assocaiated buffers. Potential roosting habitat for little brown myotis and northern myotis has been identified in habitat suitability mapping, and it is acknowledged that this roosting habitat may also represent suitable foraging habitat for northern myotis. An evaluation of loss and disturbance to these habitats was conducted in the Application/EIS (and discussed in further detail in responses to ECCC-082.1 and ECCC-083.1). Loss and alteration of potential foraging sites in wetlands and waterbodies for both myotis species has been captured under the assessment of potential effects to VCs waterbirds (Section 15.6.10) and western toad (Section 15.6.12). These assessments concluded that there would be no residual effects as a result of habitat loss and alteration following mitigation, which includes avoidance of clearing during the breeding season for waterbirds (p. 15-276, which will be updated to April 1 to August 15 [see response to ECCC-101.1] which aligns with the period of time when bats would be active in the region, from May through September), final siting of Project infrastructure will prioritize wetland avoidance (p. 15-310), and riparian buffers of at least 30 m, and larger where possible, will be maintained around waterbodies (BC MOE 2014) (p 15-310). These mitigation actions would be applicable to reduce the potential effects to little brown myotis and northern myotis using wetlands and waterbodies for foraging purposes. As noted in previous repsonses, Aurico is committed to updating the Wildlife Management and Monitoring Plan, and consideration will be given to specific bat mitigation strategies and guidance for avoidance of impacts to bat and bat habitat provided in available recovery strategies for little brown myotis and northern myotis and best management practices for bats in British Columbia. In addition, Aurico will consider placing bat roost boxes in the LSA to mitigate and offset for potential roosting habitat lost due to Project development. The number of boxes that may be installed will be determined following the construction phase and will relate the results of pre-construction surveys to determine the location of roost sites (if conducted) and the amount of potential roosting habitat that is lost. BC MOE. 2014. Guidelines for Amphibian and Reptile Conservation during Urban and Rural Land Development in British Columbia (2014). British Columbia Ministry of Environment: Victoria, BC.	28-Oct-2016
ECCC-084.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Response satisfactory. ECCC recommends that the Proponent closely follow the BMP Guidelines document (BC MOE 2016) when revising the existing Wildlife Management and Monitoring Plan. Due to uncertainty around value and documented low occupancy rates, ECCC discourages the Proponent from relying solely on bat boxes to offset any potential loss. ECCC encourages consideration of other alternatives including artificial roost trees that simulate trees with loose bark (BC MOE 2016) and other appropriate measures in mitigation strategies. ECCC notes that the appropriate bat-specific plan is as follows: BC MOE. 2016. Best Management Practices Guidelines for Bats in British Columbia: Chaper 2: Mine Development and Inactive Mine Habitats. British Columbia Ministry of Environment. Victoria, BC. and not the BC MOE 2014 amphibian guidelines cited in the IR response.	AuRico appreciates the suggestions regarding bat mitigation options and will take them into consideration when developing the next iteration of the Wildlife Management and Monitoring Plan.	21-Dec-2016
ECCC-085	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	In "Roosting Habitat Identification" for Little Brown Myotis (pg. 73 of .pdf), the application states "In addition to vegetation, rock outcrops were identified and given a **Low** habitat suitability rating as they may support crevices used by roosting bats." ECCC requests clarification on why rock outcrops were given a **Low** habitat suitability rating if they may support crevices used by roosting bats.	The biogeoclimatic (BEC) zones associated with the LSA (spruce willow birch and alpine tundra) are high elevation and support less hospitable environmental conditions for roosting bats than nearby areas at lower BECs (e.g. boreal white and black spruce). As such these potential roost sights are rated low suitability relative to other areas available.	6-Jul-2016
ECCC-086	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	In Table 15.6-13, 300 ha of high quality roosting habitat are predicted to be lost and altered due to the project. In Table 15.6-14, 204.8 ha of roosting habitat are predicted to be lost due to noise. In Table 15.6-23 and text in sections 15.6.8.1-.3, mitigation measures are focused on vegetation clearing being planned preferentially outside of the roosting period (May to September) in areas likely to support roosts, or that preconstruction surveys will be conducted. Considering that all maternity roost sites and hibernacula might not be identified during pre-disturbance surveys, ECCC continues to recommend that the Proponent apply the precautionary principle and commit to more robust mitigation measures. In consultation with appropriate government authorities, ECCC recommends developing and implementing additional project-specific measures to avoid and lessen any adverse effects on bat species at risk individuals, residences, including hibernacula, and other important habitats associated with the carrying out of the Project. Where maternity sites or hibernacula have been identified, ECCC recommends identifying, implementing and monitoring appropriate buffers to protect bat species at risk maternity roosting sites and hibernacula throughout all phases of the Project, noting that the size of the buffer will depend on specific disturbance and site conditions.	In the assessment, there is no suitably geology (i.e. karst) in the LSA that may support hibernacula and be impacted by the development. High quality roosting habitat includes High and Moderate suitability ratings (Figure 15.4.16 and 15.6.22). Disturbance occurs in the LSA within mostly Moderate classified habitat, which is associated with high elevation biogeoclimatic (BEC) zones; spruce willow birch and alpine tundra are unlikely to support large roosts (e.g. those that would support large numbers of bats) as the sites are not productive and so large tree stems are not produced . Pre-clearing surveys will be sufficient to ensure that no significant roosts are disturbed in the low probability that they occur in these less productive BECs.	6-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
ECCC-086.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC notes that in the absence of adequate baseline studies for roost sites and hibernacula for Little Brown Myotis and Northern Myotis, conducting only pre-clearing surveys is not sufficient to provide a complete understanding of where roost sites and hibernacula are located and might result in destruction of features that are required for recovery of these species. Considering that all roost sites and hibernacula might not be identified during pre-disturbance surveys, ECCC continues to recommend that the proponent apply the precautionary principle and commit to additional survey methods and accepted mitigation measures, to avoid or lessen potential loss of roost sites and hibernacula.	As noted in previous responses, Aurico will update the Wildlife Management and Monitoring Plan to support future permitting processes and will consider available information with regards to mitigation strategies for bats provided in the recovery strategy for little brown myotis and northern myotis and in the Best Management Practices for Bats in British Columbia (BC MOE 2016). At a minimum AuRico commits to completing pre-clearing surveys to identify structural stage 6 or 7 trees that could be used as roosting habitat or hibernacula and offset the potential loss of observed roosting habitat by installation of bat boxes in a suitable location. BC MOE. 2016. Best Management Practices Guidelines for Bats in British Columbia: Chaper 2: Mine Development and Inactive Mine Habitats. British Columbia Ministry of Environment. Victoria, BC.	4-Nov-2016
ECCC-086.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Response satisfactory. Due to inter-annual variation in the use of habitat features by bats and initial detections of Little Brown and Northern Myotis in Project baseline surveys, ECCC recommends that additional pre-construction surveys for bats be conducted in the LSA using currently accepted best management practices and survey methods as a condition of the Environmental Assessment Certificate.	AuRico acknowledges this suggestion.	21-Dec-2016
ECCC-087	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	On page 220 of .pdf, under "Residual Effect of Direct Mortality for Bats," sensitive periods are stated as "breeding from April 1 to July 31." Other parts of the document reference sensitive periods from May to September. ECCC requests clarification on differences in sensitive periods referenced in application.	April 1 to July 31 is associated with the breeding period in BC, however in northern BC bats are not expected to migrate from hibernacula and arrive on site until May where they are expected to reside until September when they migrate back to winter habitat. Thus April 1 to July 31 is for breeding while May to September is associated with bat occupancy in northern BC .	6-Jul-2016
ECCC-088	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	The proposed recovery strategy for Little Brown and Northern Myotis includes a partial identification of critical habitat that currently only includes specific locations, as indicated in the document. This critical habitat is considered insufficient to meet the population and distribution objectives. As such, newly found hibernacula that meet the criteria specified in the recovery strategy may be identified in an amended recovery strategy or subsequent action plan as critical habitat. ECCC should be contacted for updated critical habitat information in subsequent phases of the assessment process. ECCC should also be contacted if the presence of a hibernaculum is confirmed for Little Brown or Northern Myotis in the project footprint. **A final recovery strategy may become available within a timeframe that overlaps with that of project activities.**	Comment acknowledged, no hibernacula were identified in association with this assessment and potential hibernacula areas are outside the infrastructure area (Figure 15.4-15).	6-Jul-2016
ECCC-089	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Page xiii of the Appendix states, "A caribou habitat capability model for the Terrestrial LSA was developed using the species account and ratings tables developed for KN and KS and the updated TEM for the Terrestrial LSA." ECCC requests clarification on why only the LSA and not also the RSA was assessed using the caribou habitat capability model, as the RSA includes the spatial scale being used to assess caribou. ECCC requests clarification on why a habitat suitability model or resource selection function was not completed.	Capability models were developed based on available TEM mapping to be used to direct mitigation and reclamation of the site. Habitat suitability models, including those for caribou, were developed (see Appendix 15-B, habitat suitability baseline report) for the LSA where terrestrial ecosystem mapping (TEM) data was available. The assessment of habitat loss and alteration is based on results of the habitat suitability mapping (Section 15.6.1.2 page 15-152).	6-Jul-2016
ECCC-089.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Response is satisfactory regarding clarification on why a habitat suitability model or resource selection function was not completed. ECCC continues to request clarification on why only the LSA and not the RSA was assessed for impacts to caribou and their habitat using the caribou habitat suitability model, as the RSA includes the spatial scale being used to assess effects to caribou. ECCC requests that habitat mapping from Sittler et al. (2015) be used to assess the effects of the proposed and existing Project infrastructure and the direct and indirect zones of impact from these latter features on caribou and their habitat within the RSA. ECCC also requests a comparison between the habitat mapping from Sittler et al. (2015) and the habitat suitability mapping completed in the LSA with regards to the effects of the proposed and existing Project infrastructure and the direct and indirect zones of impact from these latter features on caribou and their habitat. ECCC notes that habitat models for the Project were not field tested (Appendix 15-B), and thus may not accurately represent and reflect the conditions for local wildlife populations. ECCC requests that the habitat model for caribou be tested (e.g., field, using caribou telemetry and/or observations, etc.) to validate its robustness in predicting habitat suitable for caribou.	The LSA was used for determining impacts to caribou using the habitat suitability modelling as new habitat loss and sensory disturbance will only occur within the LSA. The only Kemess Underground activity that will occur in the RSA is use of the existing Omineca Resource Access Road (ORAR). Potential impacts to caribou at the RSA scale were considered for the cumulative effects assessment (Section 15.7) as well as the assessment of use of the ORAR (Appendix 15-C). Given that ECCC considers the draft critical habitat for the Chase herd as the best available information no additional analysis has been conducted using the candidate habitat polygon types identified by Sittler et. al. 2015. The impact of direct and indirect zones of impact are provided in the memo **KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo** in response to #ECCC-098.1. The same memo referenced above includes an assessment using the candidate critical habitat for the Chase herd and the proposed new LPU in response to #ECCC-097.1, #ECCC-098.1 and #ECCC-115. The results of a comparison of the habitat suitability modelling and caribou observations are found in the memo **20161020_KUG Comments_FLNRO 024.1_habitat suitability_Memo.**	28-Oct-2016
ECCC-089.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC questions the statement that "new…sensory disturbance will only occur within the LSA." Clearing of the ORAR in the winter months should be considered a new sensory disturbance to caribou and may result in avoidance or displacement (see impacts of roads in Johnson et al. 2015 for examples). In addition, clearing of the ORAR may increase ease of predator access by wolves. ECCC therefore finds uncertainty in the ORAR effects assessment in Appendix 15-C and is of the opinion that, without further information about predators and possible impacts of increased ORAR use and clearing, it is not possible to fully determine potential impacts of the Project on caribou. To address these issues, ECCC will engage in upcoming meetings with the Proponent and members of the caribou sub-working group. ECCC continues to request the analysis using the candidate habitat polygon types from Sittler et al. 2015 as this data provides important life stage habitat information for caribou in the LSA and RSA and is essential in understanding potential impacts of the Project.	The Omineca Resource Access Road (ORAR) is an existing road that was constructed beginning in the 1960's and ending in the 1980's (Appendix 15-C). It was cleared during the winter during Kemess South Operations which ended in 2011. Although the ORAR has not been cleared in the winter since then, clearing has occurred previously and was therefore not considered a novel source of disturbance compared to past conditions. Effects related to increased predator access was considered in Appendix 15-C of the Application. AuRico and ERM have repeatedly attempted to obtain the Sittler et al data since October 2015, but the information has not been made available. AuRico does not consider this assessment required to support a conclusion of no significant effects.	21-Dec-2016
ECCC-090	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Under Model Accuracy, the application states, "The caribou habitat capability model for Living during the early and late winter, spring, summer and fall seasons within the Terrestrial LSA carries a moderately high rating accuracy. Limited quantitative assessment of accuracy was completed using sign density information as outlined below in Section 11.8.2.1." (pg. 11-12) ECCC notes in Figure 11.8-1 that data presented on observed caribou and their sign does not align well with capability ratings used in habitat mapping. ECCC requests a statistical analysis of the overlap of this occurrence information and more importantly that of all past occurrence data (e.g., direct sightings of live or dead animals from ground and aerial surveys, GPS/telemetry, local and traditional knowledge) with habitat capability mapping to define its robustness. ECCC requests that the five candidate habitat polygon types identified by Sittler et al. (2015) for caribou and the new Thutade herd boundary be assessed in relation to the habitat capability mapping and project.	Habitat capability mapping was not used in the assessment. Habitat suitability mapping (Appendix 15-B) was used and determined to be more robust as it was based on a model used in the Kutcho Creek drainage (Rescan 2008). This model reflects attributes used for mapping habitat similar to the high elevation winter range, low elevation winter range and high elevation summer range defined as critical habitat in Environment Canada (2014) southern mountain caribou recovery plan. The high elevation winter range model was found to predict 95% of caribou inventory observations in High and Moderately High classified habitat. Caribou data presented in Sittler et al. (2015), which included GPS collar data, aerial survey data, and identification of candidate polygons for high and low elevation caribou winter range was requested from the province through both a sensitive data request in the Knowledge Management Branch and through contact with Dean Peard in October 2015. The GPS collar data was received in November 2015 but the aerial survey data and high and low elevation caribou range identified through habitat modelling using a Bayesian belief model, have not been received. Rescan. 2008. Kutcho Project Wildlife Habitat Suitability Baseline Report. Prepared for Kutcho Copper Corporation by Rescan Environmental Services Ltd. November 2008.	6-Jul-2016
ECCC-090.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC requests the proponent indicate where the range models for caribou are located in their documents, their predictive ability (e.g., 95% of caribou inventory observations in High and Moderately High classified habitat), and what this ability is based on (e.g., verified by caribou inventory observations – number, Proportion, season). ECCC also requests detailed information on the methods used in the Rescan 2008 Kutcho report and how they compare to attributes described in ECCC's 2014 SMC recovery plan. ECCC awaits an assessment of the outstanding aerial survey data and the five candidate habitat polygon types identified by Sittler et al. (2015) for caribou and the new Thutade herd boundary in comparison to the habitat suitability mapping completed and the proposed and existing Project infrastructure and the direct and indirect zones of impact from these latter features. Candidate Critical Habitat (CCH) data, updated LPU boundaries, and disturbance data for the Chase herd have been shared with the proponent under a restricted Data License Agreement (DLA). ECCC requests that the requested effects assessment include the LPU boundaries and CCH to provide information on potential impacts to caribou in the area.	Habitat suitability modelling for caribou is in Appendix 15-B. Model assumptions are located in Appendix 7 of this document. The results of a comparison of the habitat suitability modelling and caribou observations are found in the memo 20161020_KUG Comments_FLNRO 024.1_habitat suitability_Memo. The aerial survey data from Sittler et. at. 2015 was incorporated into the response for #ECCC-091.1 which is provided in the memo **KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo.** Given that ECCC considers the draft critical habitat for the Chase herd as the best available information no additional analysis has been conducted using the candidate habitat polygon types identified by Sittler et. al. 2015. For the same reason, the Rescan 2008 Kutcho caribou modelling assumptions have not been compared to the caribou biophysical attributes in Environment Canada (2014) southern mountain caribou recovery plan. The impact of direct and indirect zones of impact on the Thutade herd are provided in the memo referenced above in response to #ECCC-098.1. The same memo referenced above includes an assessment using the candidate critical habitat for the Chase herd and the proposed new LPU in response to memo **KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo**.	28-Oct-2016
ECCC-090.2	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC acknowledges the Proponent's response. ECCC will engage in upcoming meetings with the Proponent and members of the caribou sub-working group to provide further response to the Proponent's effects assessment. ECCC continues to request the analysis using the candidate habitat polygon types from Sittler et al. 2015 as this data provides important life stage habitat information for caribou in the LSA and RSA. ECCC considers this analysis essential in understanding potential impacts of the Project to caribou in the area.	The caribou sub-working group met on November 25, 2016 and minutes from the meeting will be available from the BC EAO. As indicated at the November 25, 2016 caribou sub-working group meeting, the candidate habitat polygons from Sitter et al. 2015 have not yet been made available to AuRico (as of December 2, 2016) by the province despite AuRico originally requesting them in October 2015 with subsequent follow up.	21-Dec-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
ECCC-091	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	In two sections of the application, the Proponent states that a number of studies have been undertaken for woodland caribou in the vicinity of the Project from 1978 to 2014, especially near the KS and KN properties. However, a comprehensive summary of data from these studies is not provided. (xiii, and pg. 11-4) ECCC requests the Proponent summarize and provide all caribou occurrence data (e.g., direct sightings of live or dead animals from ground and aerial surveys, GPS/telemetry, local and traditional knowledge) and null data (e.g., flight paths, transects) within the Thutade ZTO, and Spatsizi, Chase, and Wolverine herd boundaries. Please include references for data, data in digital (e.g., shape files) and written format, time of observation, and number and sex/age (e.g., bulls, cows, calves) of individuals observed where applicable.	GPS collar data presented in the Sittler et al. (2015) report and used in the assessment is available from http://www.env.gov.bc.ca/wildlife/wsi/siwe.htm under Project ID 5218 for the Omineca Region. Spatial data collected during baseline surveys for Kemess North, Kemess South, and Kemess Underground will be provided directly to ECCC as a digital data package. Caribou observational data used for the assessment were primarily within the northern mountain caribou zone of trace occurrence which is also the proposed Thutade herd area. Caribou observations and survey effort is presented in Figures in Chapter 15 and in Appendix 15-A.	6-Jul-2016
ECCC-091.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC awaits an assessment by the proponent of all caribou data, which includes the outstanding aerial survey data from Sittler et al. (2015), and shared CCH, in relation to the proposed and existing Project infrastructure and the direct and indirect zones of impact from these latter features. This assessment should include information on the number, distribution, sex, age, proportion, and season of interaction for caribou affected by the above.	Please refer to Memo **KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo**	28-Oct-2016
ECCC-091.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC will engage in upcoming meetings with the Proponent and members of the caribou sub-working group to further address the Proponent's response to this IR.	The caribou sub-working group met on November 25, 2016 and minutes from the meeting will be made available by the BC EAO.	21-Dec-2016
ECCC-091.3	23-Dec-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	See "CWS_KUG_Caribou_23Dec2016" memo	EAO did not require AuRico to respond to this memo. Recommendations from ECCC were considered in EAO's assessment report.	N/A
ECCC-092	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC requests the Proponent summarize, with references and maps, where digital data is available, all legal or proposed government caribou habitat (e.g., WHAs, UWRs, protected areas) and identified important habitat (e.g., models, resource selection functions) within the Thutade ZTO, Spatsizi, Chase, and Wolverine herd boundaries.	GPS collar data presented in the Sittler et al. (2015) report and used in the assessment is available from http://www.env.gov.bc.ca/wildlife/wsi/siwe.htm under Project ID 5218 for the Omineca Region. UWR and WHA information can be obtained from http://www.env.gov.bc.ca/wld/frpa/uwr/approved_uwr.html. Project specific maps with updated ungulate winter ranges have been provided in the memo **20160706 B.1 - KUG Comment FLNRO-016, FLNRO-017, FLNRO-018, FLNRO-127, FLNRO-128, FLNRO-134_UWR_Memo**. Parks within the general wildlife RSA are shown in Figure 4.2-1 of Appendix 17-A.	6-Jul-2016
ECCC-093	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Under Limitations and Assumptions, the application states, "Baseline surveys have been conducted over time for both KN and KS Project areas. The habitat has not significantly changed during the time from initial surveys within the LSA." (pg. 11-10) Given that loss and/or degradation to habitat at both local and landscape levels influence the survival and recovery of caribou, ECCC requests the Proponent undertake, as part of a cumulative effects assessment, further disturbance mapping in the LSA, RSA, and Thutade ZTO, and Spatsizi, Chase, and Wolverine herd boundaries that accounts for current and reasonably foreseeable future impacts to habitat. This assessment should map known disturbances (e.g., forestry, mining, recreation) over the life of the mine and analyze the effects of these disturbances (e.g., spatial arrangement, quantity/amount/extent, type, longevity/duration, magnitude/severity, context/relationships) on seasonal and life history habitats of caribou (e.g., migration, calving, and distribution). Limitations and assumptions should be stated and references and digital data provided to ECCC where available.	Habitat mapping was based on ecosystem mapping products which considered vegetation communities and their current condition. This accounts for impacts from other developments. The ORAR is evaluated separately (Appendix 15-C) and considers the effects from vehicle use including other industrial and recreational users. Habitat loss and alteration considered in the wildlife cumulative effects assessment for the general RSA is shown in Figure 13.7-1. Additional disturbances considered for the wildlife cumulative assessment are shown in Figures 8.7-1, 8.7-2, 8.7-3, 8.7-4, 8.7-5, 8.7-6, and 8.7-7. Habitat loss (Table 15.8-4), habitat alteration (Table 15.8-5), and indirect mortality (Appendix 15-C) has been assessed for caribou in the caribou RSA which includes the northern mountain caribou associated with the proposed Thutade herd and the Chase herd (Figure 3.1-1 in Appendix 15-C). Caribou associated with the Wolverine herd were also included in the assessment of indirect mortality due to use of the ORAR in Appendix 15-C.	6-Jul-2016
ECCC-093.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC requests that habitat loss and alteration data be shown together in a figure with a legend that differentiates these categories and key sources (e.g., mining, roads, forestry with date ranges), which includes the Project's existing and expected impacts to habitat and the LSA and RSA boundaries. ECCC requests that the following additional disturbance data be included in the above analysis, which includes present, approved, and proposed information (the latter two categories are called 'beyond' below and should be added to existing habitat loss or alteration data if not already included): forest harvesting/cutblock data from 2009 to present and beyond; linear features (utility and service lines such as seismic and pipelines, transmission lines, roads and railways) to present and beyond; open-pit coal mining present and beyond; oil and natural gas exploration and extraction facilities <30 years since development to present and beyond.	Please refer to Memo **KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo**	28-Oct-2016
ECCC-093.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC will engage in upcoming meetings with the Proponent and members of the caribou sub-working group to further address the Proponent's response to this IR.	The caribou sub-working group met on November 25, 2016 and minutes from the meeting will be made available by the BC EAO.	21-Dec-2016
ECCC-093.3	23-Dec-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	See "CWS_KUG_Caribou_23Dec2016" memo	EAO did not require AuRico to respond to this memo. Recommendations from ECCC were considered in EAO's assessment report.	N/A
ECCC-094	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC requests further information on the distribution and abundance/density status of alternate prey and of predators in the area and on their impacts (existing and/or potential) on the caribou herds associated with this Project. Please cite literature and note any limitations and assumptions. This information is important in determining the overall impact of the Project on caribou.	The current, available information on predators and alternate prey was used and presented in the application (Section 15.4.3.2 Moose, Section 15.4.3.5 Furbearers, Appendix 15-A: Section 10 Moose, Section 8 Marten, Fisher and Wolverine, and Section 24.19). Aerial surveys for moose occurred primarily during Kemess South operations and wolves were only observed incidentally. No in depth analysis of abundance levels of moose and wolves and how they relate to each other has occurred as baseline studies were not designed with this objective in mind.	6-Jul-2016
ECCC-095	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	The application states that, "Increased access off the ORAR during the winter could also lead to increases in recreational activities such as snowmobiling. Snowmobile trails can facilitate the movement of wolves and therefore lead to increased risk of predation (Environment Canada 2014; Roberts 2014). This effect is identified as a potential residual effect for woodland caribou, moose, and mountain goat (Table 4.1-1)." (pg. 4-4) ECCC did not locate any assessments of recreational access generally or snowmobile use (historic and current) specifically and how the activities which increase and maintain access routes may be influencing predators and/or caribou populations and distribution within the Thutade ZTO, and Spatsizi, Chase, and Wolverine herd boundaries. This information could include surveys, interviews, photos, video, etc. and could provide information on the number, timing, frequency, duration, location, density, and/or change over time of access. ECCC thus requests further information and/or data related to recreational access, including snowmobiling in order to better understand the context for cumulative effects on caribou.	It was agreed with FLNRO, EAO, and MMPO on Nov. 12, 2015, to conduct a qualitative assessment of increased use of ORAR which resulted in the assessment presented in Appendix 15-C. AuRico does not presently have data on recreational usage of the ORAR, and is not aware of any such data. AuRico has committed to implementing mitigation measures to reduce recreational access off of the ORAR during the winter and recording incidental observations of recreational usage once the project proceeds into construction (Section 4.2.4 of Appendix 15-C).	6-Jul-2016
ECCC-096	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Spatsizi and Chase herd range sizes (km^2) read: 15,2691 and 12,4651 respectively. To best assess potential effects of this project, ECCC requests clarification on herd size.	There was an error associated with these herd range sizes in Table 3.1-1 as the last digit (1) should have been a superscript. The sizes should have read 15,629 and 12,465 km^2 as presented in Table 11.3-1 of Appendix 15-A.	6-Jul-2016
ECCC-097	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	The Southern Mountain Caribou recovery strategy (Environment Canada 2014) states: "To meet the recovery goal, additional critical habitat will need to be identified for many LPUs because critical habitat is only partially identified in this recovery strategy". Recovery planning, including the development of recovery strategies and identification of critical habitat, is an adaptive process which responds to best available information as it emerges, often in working with others such as provincial officials, Indigenous governments, environmental consultants, and communities. Critical habitat can exist outside of a currently mapped and available critical habitat polygon. The Department expects to update the critical habitat identification for Southern Mountain Caribou on the SAR Public Registry in the foreseeable future, based on this response and consideration of new information. ECCC notes that through this process, updated information has become available on the location and extent of Southern Mountain Caribou critical habitat. Using the best available information (May 2016) and using draft critical habitat maps that have been updated by ECCC since the Recovery Strategy was posted as Final on the SAR Public Registry, ECCC has found substantial overlap of the Project LSA and RSA with draft SMC critical habitat extending northwards from the Chase herd. ECCC suggests that this information is important to accurately assess the effects of the project on SMC in the area and recommends that any effects assessments for caribou incorporate this updated information. While this spatial information is being reviewed and verified internally, ECCC may share this with the Proponent via a Data License Agreement (DLA). ECCC requests that the effects assessment incorporate information on revised draft critical habitat for Southern Mountain Caribou. ECCC requests that this include: a) a quantitative analysis of the area of critical habitat which may be impacted by the Project, including buffering human disturbance by 500 m, and b) a qualitative assessment of impacts to critical habitat from the Project, which considers literature and/or studies on impacts from mines caribou, including avoidance behavior and potential population level effects. Presently, the updated COSEWIC assessment of Woodland Caribou (2014) is awaiting response from the Minister of Environment and Climate Change. Until Ministerial direction is received regarding that assessment, the Southern Mountain Caribou Recovery Strategy remains the authoritative document informing the recovery needs of Southern Mountain Caribou. References: COSEWIC. 2014. COSEWIC assessment and status report on the Caribou Rangifer tarandus, Northern Mountain population, Central Mountain population and Southern Mountain population in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxii + 113 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm). Environment Canada. 2014. Recovery Strategy for the Woodland Caribou, Southern Mountain population (Rangifer tarandus caribou) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. viii + 103 pp.	Critical habitat for southern mountain caribou identified in the southern Mountain Caribou Recovery Strategy was included and considered in Appendix 15-C. It is represented by the ungulate winter range areas in Appendix 15-C. Further, the Project LSA is within an area not associated with a local population unit for any of the herds identified in the southern mountain recovery strategy. AuRico will contact ECCC to enter in a Data Licence Agreement to obtain and consider the draft critical habitat for southern mountain caribou. It will be considered in future management plans and mitigation actions at the time at which it is finalized and publically available. In absence of this information, habitat mapping was conducted by the proponent to identify habitat for caribou in the LSA. This included mapping habitat with similar vegetation and topographic attributes as identified in the caribou recovery strategy (Environment Canada 2014) for high elevation winter range, low elevation winter range and high elevation summer range. These maps informed the assessment and the results are detailed in Appendix 15-B.	6-Jul-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

For Working Group Use					For Proponent Use	
ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
ECCC-097.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Candidate Critical Habitat (CCH) data, updated LPU boundaries, and disturbance data for the Chase herd have been shared with the proponent under a restricted Data License Agreement (DLA). ECCC requests that the effects assessment incorporate information on revised draft critical habitat for Southern Mountain Caribou. ECCC requests that this include: a) a quantitative analysis of the area of critical habitat which may be impacted by the Project, including buffering human disturbance by 500 m, and b) a qualitative assessment of impacts to critical habitat from the Project, which considers literature and/or studies on impacts from mines caribou, including avoidance behavior and potential population level effects.	Please refer to Memo **KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo**	28-Oct-2016
ECCC-097.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC will engage in upcoming meetings with the Proponent and members of the caribou sub-working group to further address the Proponent's response to this IR.	The caribou sub-working group met on November 25, 2016 and minutes from the meeting will be made available by the BC EAO.	21-Dec-2016
ECCC-097.3	23-Dec-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	See "CWS_KUG_Caribou_23Dec2016" memo	EAO did not require AuRico to respond to this memo. Recommendations from ECCC were considered in EAO's assessment report.	N/A
ECCC-098	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	The delineation of caribou herds and assignment of individuals is a complex process, particularly in areas that are considered trace occurrence zones and near the border between Northern and Southern Mountain Ecological Areas. Chapter 24, Section 24.1.1 (pg 141 of .pdf) states, "The caribou occurring in the Project area belong to the northern ecotype, and are associated with the newly proposed Thutade herd (Sittler et al. 2015). Northern ecotype caribou within the Northern Mountain National Ecological Area (NMNEA) are listed as 'special concern' under Schedule 1 of the Species at Risk Act (SARA; COSEWIC 2014). South of the Project area, the Chase herd is federally protected as Threatened under SARA Schedule 1." ECCC requests that the Proponent conduct an assessment of the Project's potential impacts on each of the three groups overlapping the Project RSA and LSA: unassigned NMC individuals and proposed Thutade herd (northern mountain), and Chase herd including new CH information (northern ecotype, southern mountain). This effects assessment and any management plans or mitigation strategies should be framed in a context of best available information and objectives in management plans, recovery strategies, other literature, and consultation with federal caribou experts. The assessments should also include, but not be limited to, potential larger-scale consequences of caribou displacement from their current habitat, possible site avoidance behaviour by caribou, potential impacts of subsidence, and cumulative effects. ECCC notes it is accurate to indicate the Chase herd is federally listed as Threatened on SARA Schedule 1.	Effects to caribou occurring in the Project LSA which could be either unassigned northern mountain caribou individuals or individuals belonging to the proposed Thutade herd were assessed in Chapter 15. Effects to individuals belonging to the Chase herd were assessed in Appendix 15-C. This included critical habitat areas publically available and identified in the southern mountain caribou recovery strategy. These critical habitat areas are identified as the ungulate winter range areas in Appendix 15-C. The potential effects that were considered in Chapter 15 included habitat loss and alteration, sensory disturbance, mortality, disruption of movement, attractants and chemical hazards. Site avoidance due to noise was assessed as a residual effect in section 15.6.2.2, habitat alteration due to subsidence was assessed as a residual effect in section 15.6.2.1, and cumulative effects were assessed in section 15.7. AuRico will enter into a data sharing agreement with ECCC in order to consider draft caribou critical habitat during development of a more detailed wildlife management plan as part of the subsequent permitting process.	6-Jul-2016
ECCC-098.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC-CWS has shared candidate critical habitat mapping under a Data License Agreement (DLA) with the Proponent. ECCC requests that the Proponent conduct an assessment of the Project's potential impacts on each of the three groups overlapping the Project RSA and LSA: unassigned NMC individuals and proposed Thutade herd (northern mountain), and Chase herd including new CH information (northern ecotype, southern mountain). This effects assessment and any management plans or mitigation strategies should be framed in a context of best available information and objectives in management plans, recovery strategies, other literature, and consultation with federal caribou experts. The assessments should also include, but not be limited to, potential larger-scale consequences of caribou displacement from their current habitat, possible site avoidance behaviour by caribou, potential impacts of subsidence, and cumulative effects	Please refer to Memo **KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo**	28-Oct-2016
ECCC-098.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC will engage in upcoming meetings with the Proponent and members of the caribou sub-working group to further address the Proponent's response to this IR.	The caribou sub-working group met on November 25, 2016 and minutes from the meeting will be made available by the BC EAO.	21-Dec-2016
ECCC-098.3	23-Dec-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	See "CWS_KUG_Caribou_23Dec2016" memo	EAO did not require AuRico to respond to this memo. Recommendations from ECCC were considered in EAO's assessment report.	N/A
ECCC-099	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC suggests that valued component Grizzly Bear: "federally listed as a species of Special Concern" should read "COSEWIC assessed as a species of Special Concern (COSEWIC 2012)" References: COSEWIC. 2012. COSEWIC assessment and status report on the Grizzly Bear Ursus arctos in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiv + 84 pp.	Comment acknowledged, AuRico agrees that the suggested wording would be appropriate.	6-Jul-2016
ECCC-100	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Table 15-2.1 lists applicable regulatory and policy framework documents for wildlife. To most effectively assess potential project impacts on migratory birds, and to evaluate the effectiveness of any proposed mitigation strategies during the EA decision making process, ECCC recommends that proponents follow the scientifically-based framework presented in the following document and include this document in the framework documents in Table 15-2.1: Goudie, I., Lang, A., Gjerdrum, C., Cotter, R. and Donaldson, G., 2009. A framework for the scientific assessment of potential project impacts on birds. Canadian Wildlife Service, Atlantic Region.	The migratory birds guidance document that was included in the final Application Information Requirements and considered for the assessment was the Migratory Birds Environmental Assessment Guideline (Milko 1998). This is consistent with other recently certified mine projects in BC which used the Milko 1998 guidance, including the KSM Project and Brucejack Gold Mine Project. The Goudie et al (2009) guidance will be considered for future management plan development.	6-Jul-2016
ECCC-101	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Table 24.19-1 Wildlife VC Sensitive Periods states that nesting/fledging periods for migratory water- and landbirds are April 1 to July 31. ECCC recommends that the following online tool be used to determine sensitive periods for all migratory birds: https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1 Some species found in the project area may nest outside of the April 1 to July 31 window (e.g. Red Crossbills https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1#_01_4)	The reference provided will be consulted prior to pre-clearing surveys. However the reviewer is reminded that the project is in high elevation BEC at northern latitudes where survival would be low for young of any birds nesting past July 31.	5-Aug-2016
ECCC-101.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC requests that the Proponent provide rationale to support the assertion that survival would be low for young of any birds nesting past July 31.	The Wildlife Management and Monitoring Plan describes the mitigation strategies for the avoidance of sensitive wildlife features and sensitive periods for wildlife. These measures will take into account Environment Canada's Avoidance Guidelines for Migratory Birds (ECCC 2016) and will be in accordance with legislation in the Migratory Birds Convention Act (1994) and the Species at Risk Act (2002). The reference regarding timing of the nesting period provided in Comment ECCC-101 (https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1), will be consulted and taken into account when scheduling clearing and the potential need for pre-clearing surveys. As indicated in the above resource, the general nesting period of migratory birds within the Project falls within the zone A4 and A5. The document specifies a regional nesting period of mid-April to mid-August for A4 and A5. In response, AuRico will revise the general migratory bird sensitive time period when pre-clearing point count surveys would be needed to April 15 to August 15. AuRico's assertion about the project being in high elevation BEC at northern latitudes where survival would be low for young of any birds nesting past July 31 (response to comment ECCC-101), was a general reference to the nesting period for birds at high elevation sites being relatively shorter compared to conspecifics at lower elevation sites in the same region (Martin et al. 2009, Evans Ogden et al. 2012, Martin 2014), and later nesting, double brooding, individuals having lower nest success than earlier nesting birds (i.e. Perrins 1970, Hochachka 1990). This was the rationale used in the Effects Assessment for modifying the date range for pre-clearing point count surveys based on elevation and nesting phenology (Chapter 15, Section 15.6.11.1). Bears, H., K. Martin, and G. C. White. 2009. Breeding in high-elevation habitat results in shift to slower life-history strategy within a single species. Journal of Animal Ecology 78:365–375. Evans Ogden, L. J., M. Martin, and K. Martin. 2012. Mating and Breeding Success Decline with Elevation for the Pacific Wren (Troglodytes pacificus) in Coastal Mountain Forests. The Journal of Ornithology 124(2): 270-276. Martin, K. 2014. Ecology and conservation of birds in upland and alpine habitats. Proceedings of the BOU's 2014 Annual Conference. http://www.bou.org.uk/bouproc-net/uplands/martin.pdf Perrins, C.M. 1970. The timing of birds' breeding seasons. Ibis, 112: 242–255. Hochachka, W. 1990. Seasonal Decline in Reproductive Performance of Song Sparrows. Ecology 71(4), 1279-1288.	28-Oct-2016
ECCC-102	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Chapter 15 (pg 250 of .pdf) states that "Pre-clearing surveys within seven days prior to vegetation clearing will be conducted if clearing is to take place during the breeding season." Table 24.19-1 Wildlife VC Sensitive Periods states that pre-clearing surveys will be conducted to "…identify and avoid active nest sites if clearing occurs during April 1 to July 31." It is important that the Proponent carry out all phases of the project in a manner that protects and avoids harming, killing or disturbing migratory birds or destroying or taking their nests or eggs. In this regard, the Proponent shall take into account Environment Canada's Avoidance Guidelines for Migratory Birds. The Proponent's actions in applying the Avoidance Guidelines shall be in compliance with the Migratory Birds Convention Act, 1994 and with the Species at Risk Act. Migratory birds, the nests of migratory birds and/or their eggs can be inadvertently harmed or disturbed as a result of many activities–including, but not limited to, clearing trees and other vegetation, draining or flooding land, or using fishing gear. This inadvertent harming, killing, disturbance or destruction of migratory birds, nests and eggs is known as incidental take. Incidental take, in addition to harming individual birds, nests or eggs, can have long-term consequences for migratory bird populations in Canada, especially through the cumulative effects of many different incidents. ECCC cannot issue a permit to authorize the disturbance or destruction of a nest in circumstances of incidental take. For further details, please refer to ECCC's web page on Avoidance of Detrimental Effects to Migratory Birds at: http://ec.gc.ca/paom-itmb/default.asp?lang=En&n=C51C415F-1. ECCC does not recommend that clearing occur during sensitive periods, even with pre-clearing surveys. Nest search techniques are not recommended because, in most habitats, the ability to detect nests remains very low while the risk of disturbing active nests is high. Flushing nesting birds increases the risk of predation of the eggs or young, or may cause the adults to abandon the nest or the eggs. The Proponent should be aware of the risks and take appropriate action to ensure compliance with the MBCA.	The proponent will ensure that guidance provided on ECCC's website Avoidance of Detrimental Effects to Migratory Birds (Incidental Take) will be followed which includes a preference for point count surveys to determine bird presence, behaviour, and potential nestings if clearing occurs during the migratory bird reproductive period.	6-Jul-2016
ECCC-102.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC continues to recommend that clearing not occur during sensitive periods, even with pre-clearing surveys. Nest search techniques are not recommended because, in most habitats, the ability to detect nests remains very low while the risk of disturbing active nests is high. Flushing nesting birds increases the risk of predation of the eggs or young, or may cause the adults to abandon the nest or the eggs.	The following mitigation activities are planned for migratory birds: 1) Vegetation clearing will be scheduled outside of sensitive periods for migratory birds (April 15 to Aug 15), wherever possible (see comment response 101.1). 2) Point count surveys will be conducted if work proceeds during the sensitive period to determine bird presence, behaviour, and potential nestings, if clearing occurs during the migratory bird reproductive period. 3) Active nest sites will be protected by species specific buffers using guidance from Environment and Climate Change Canada (2016), with a minimum 30 m buffer if evidence of nesting behaviour is observed and commitment to avoid clearing during sensitive period is not possible. ECCC 2016. General Nesting Periods of Migratory Birds in Canada. http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1. Accessed 2016	28-Oct-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
ECCC-102.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC continues to recommend that clearing not occur during sensitive periods for migratory birds, whether with or without surveys to determine potentially active nest sites. In most habitats, the ability to detect nests remains very low while the risk of disturbing active nests is high. ECCC notes that point count surveys alone are not sufficient to confirm evidence of nesting, and thus additional survey methods should be integrated into mitigation and management strategies. Where it is deemed impossible to clear outside of sensitive periods, and in order to determine presence of breeding birds, ECCC recommends that the Proponent create a scientifically sound approach in the Wildlife Management and Monitoring Plan that follows existing RISC standards for inventory and survey methods of Forest and Grassland Birds (including recommendations for survey frequency and timing), as well as other currently accepted species-specific survey and inventory methods where applicable (especially for SARA-listed species that are often not detected using existing RISC guidelines (e.g. Common Nighthawk, Short-eared Owl, etc.)). In cases where it is deemed necessary to clear during the sensitive period, ECCC advises that an experienced observer conduct area searches for evidence of nesting (e.g. presence of birds in breeding habitat through observation of singing birds, alarm calls, distraction displays, etc.). ECCC acknowledges the commitment of the Proponent to avoid clearing during the sensitive period if possible, and receiving guidance around appropriate buffers and search techniques to avoid detrimental effects to migratory birds.	AuRico appreciates the recommendations regarding migratory bird mitigation and will take them into consideration when developing the next iteration of the Wildlife Management and Monitoring Plan.	21-Dec-2016
ECCC-103	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC requests clarification on species included in the statement "…based on species." under Environmental Protection Measures during Operations for Migatory Landbirds VC.	Landbirds have different nesting habitats and behavior dependent on species and as such these differences will be considered during monitoring (e.g. different techniques for monitoring nesting in grasslands versus forested habitats)	5-Aug-2016
ECCC-104	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Chapter 15 states "Barn swallows use infrastructure for nesting and may benefit from additional infrastructure in the area." No management suggestions for Barn Swallows are provided in Chapter 24. ECCC requests that measures be identified in order to avoid harm to Barn swallows (COSEWIC-assessed as Threatened) in particular during infrastructure construction and maintenance and ensure compliance with the MBCA. In general, attention should be paid to Barn Swallows potentially nesting on infrastructure and adaptive management should be included for this species in wildlife management plans.	Chapter 24 section 19 provides a framework for ensuring that all birds are protected from harm. These are generalized in 24.19.4 environmental protection measures which includes "monitoring and adaptively managing the use of Project structures by wildlife for security habitat (refugee, shelter), daily activities (roosting, perching), or nesting purposes". The Wildlife Management and Monitoring Plan will be further developed to support the subsequent permitting process.	6-Jul-2016
ECCC-104.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	During a site visit to the existing Project infrastructure, ECCC-CWS staff observed nesting Barn Swallows on site. While the species is currently not listed under SARA, COSEWIC has assessed the species as threatened and there is potential for the species to be listed as threatened on Schedule 1 of SARA (thereby requiring critical habitat identification to the extent possible) within a timeframe that overlaps with Project construction and operation. ECCC requests that Barn Swallows be explicitly included in the Wildlife Management and Monitoring plan, with a species-specific strategy for monitoring and avoiding or minimizing potential effects to swallows on site. Schedule 1 is updated from time to time; ECCC notes that it is important that future amendments to Schedule 1 of SARA be considered in Project planning.	The barn swallow (Hirundo rustica) was listed as Threatened by COSEWIC, and is provincially Blue-listed (BC CDC, 2013). Although the species was considered Threatened by COSEWIC since a 2011 COSEWIC assessment, it has yet to be added to SARA Schedule 1. In addition to adhering to legislative requirements indicated in the Wildlife Act and Migratory Bird Convention Act, AuRico commits to including in the Wildlife Management and Monitoring Plan, the following Barn Swallow species-specific mitigation: - Conducting pre-clearing point count surveys within seven days prior to vegetation clearing, if clearing is to take place during the breeding season (April 15 to August 15). - Monthly nest surveys of infrastructure potentially used by barn swallows for nesting, during the indicated breeding season. - A species-specific buffer will be employed around all probable or actual nest sites that are detected during pre-clearing point count surveys or on infrastructure. These nests will be monitored until the young have fledged or the nest is abandoned. The minimum buffer distance of 30 to 50 meters will be utilized wherever practicable assuming Project operability; the exact buffer distance employed for any nest sites recorded and the outcome of the nesting attempt will be reported in appropriate construction monitoring or annual reporting.	4-Nov-2016
ECCC-104.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC acknowledges the Proponent's commitment to species-specific Management and Monitoring for Barn Swallow. ECCC generally does not recommend nest searching for Migratory Birds, as bird nests are difficult to locate, even with highly trained observers. However, Barn Swallow nests are relatively easier to locate given that they are conspicuous, nest in colonies, and are typically found in anthropogenic structures. It is therefore possible to locate Barn Swallow nests and colonies within a Project area, allowing for the effects assessment and/or planning of mitigation measures to be based on the location, status, number, and other features of the nests or colonies, meaning that nest searching should be conducted in addition to proposed pre-clearing point count surveys. While conducting nest searches, it is important to avoid unintentional disturbance to nesting birds by: 1) always approaching nests with care and caution; and 2) minimize the amount of time spent at the nesting area. ECCC notes that the incubation and nestling period for Barn Swallows in BC may be as short as 29 days (Campbell et al. 1997), meaning that the proposed monthly nest surveys may not capture all active nests during the most sensitive periods. ECCC recommends that nest surveys of infrastructure be conducted bi-weekly (at minimum) to maximize opportunities for adaptive management if active nests are found and that this be included in the Wildlife Management and Monitoring Plan.	AuRico appreciates the recommendations regarding barn swallow mitigation and will take them into consideration when developing the next iteration of the Wildlife Management and Monitoring Plan.	21-Dec-2016
ECCC-105	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Establishing an accurate baseline that reflects natural inter-annual variation is important for assessing potential project impacts, focusing mitigation and monitoring, and addressing potential cumulative impacts. It is also important to note that a key purpose of collecting baseline data is to determine the presence of any biodiversity or distribution hotspots. For the scientific assessment of potential impacts on migratory birds, ECCC recommends that the Application should follow the guiding principles as presented in: Hanson et al. 2009, A framework for the scientific assessment of potential project impacts on birds - CWS Technical Report series No. 508. Available online at: http://publications.gc.ca/site/archivee-archived.html?url=http://publications.gc.ca/collections/collection_2010/ec/CW69-5-508-eng.pdf ECCC notes that baseline surveys for migratory landbirds were only conducted from 23-26 June 2006 and only in the northern part of the LSA (Appendix 15-A) at 38 point count stations (Chapter 15). Appendix 15-A states that "survey routes were selected to cover the main development areas (pit, dam, tailings pond), and to assess representative TEM habitat types", though this appears to only be in a portion of the northern section of the LSA (Appendix 15-A, Figure 4.6-1). ECCC notes that many sections of the LSA have not been surveyed, including the existing and proposed infrastructure throughout the southern portion and proposed subsidence area and underground tunnel/decline in the northern portion, though construction and operation activities are proposed in these areas. ~~ECCC suggests that~~ This sampling does not meet requirements necessary to establish an accurate or current baseline that allows for assessment of potential impacts of the Project on migratory birds. ECCC recommends that surveys be conducted within the past 5-10 years, and over multiple years, incorporating multiple visits per year at the same points to account for natural and contemporary inter-annual variation and maximize detectability within the LSA. ECCC recommends that additional breeding bird surveys for forest and grassland songbirds be conducted following guidelines in the ECCC technical report and appropriate RISC standards to cover the LSA, including proposed and existing infrastructure areas.	The assessment included groups of birds with similar habitat and behavior, and it used representative indicator species (e.g. olive-sided flycatcher) and groups with similar habitat requirements (e.g. cavity nesting waterfowl, wetland dependent birds, landbirds etc.) to inform the assessment. Habitat that was suitable for the indicator species or species groups was assumed to be occupied even if baseline surveys had not verified this assumption. Habitat included in the assessment for migratory waterbirds was habitat appropriate for wetland breeding birds (Figure 15.6-30), cavity nesting waterfowl (Figure 15.6-31) , and riverine birds (Figure 15.6-32). For migratory landbirds, all three biogeoclimatic subzones were included in the assessment as migratory bird nesting may occur in all three (Figure 15.6-36). Additional baseline surveys would not alter the conclusions of the assessment which was based on the assumption of suitable habitats being occupied. Additional baseline studies would similarly not result in alternate mitigation measures than those proposed which are considered to be effective at mitigating effects to migratory landbirds.	6-Jul-2016
ECCC-105.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC continues to suggest that this sampling does not meet requirements necessary to establish an accurate or current baseline that allows for assessment of potential impacts of the Project on migratory birds. ECCC considers it insufficient to simply "assume" that suitable habitat is occupied and a species is present and cautions that such a method of setting baseline does not allow for an accurate effects assessment, making it challenging to evaluate results of future monitoring and mitigation efforts for migratory bird species. ECCC continues to recommend that additional breeding bird surveys for forest and grassland songbirds be conducted following guidelines in the ECCC technical report and appropriate RISC standards to cover the LSA, including proposed and existing infrastructure areas.	The Response is provided in memo **20161110_KUG Comment_ECCC-105.1, 106.1 Bird density_Memo**.	10-Nov-2016
ECCC-105.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC acknowledges the additional work done by the Proponent to provide more information on potential impacts to migratory birds and avian species at risk. In section 4.1 of the memo, ECCC notes that point count surveys alone are not sufficient to confirm evidence of nesting, and thus additional survey methods should be integrated into mitigation and management strategies. Where it is deemed impossible to clear outside of sensitive periods, and in order to determine presence of breeding birds, ECCC recommends that the Proponent create a scientifically sound approach in the Wildlife Management and Monitoring Plan that follows existing RISC standards for inventory and survey methods of Forest and Grassland Birds (including recommendations for survey frequency and timing), as well as other currently accepted species-specific survey and inventory methods where applicable (especially for SARA-listed species that are often not detected using existing RISC guidelines (e.g. Common Nighthawk, Short-eared Owl, etc.)). In cases where it is deemed necessary to clear during the sensitive period, ECCC advises that an experienced observer conduct area searches for evidence of nesting (e.g. presence of birds in breeding habitat through observation of singing birds, alarm calls, distraction displays, etc.).	AuRico appreciates the recommendations regarding migratory bird mitigation and will take them into consideration when developing the next iteration of the Wildlife Management and Monitoring Plan.	21-Dec-2016
ECCC-106	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	~~ECCC suggests that~~ Existing baseline sampling for migratory birds does not meet requirements necessary to establish an accurate or current baseline that allows for assessment of potential impacts of the Project, including those on COSEWIC-assessed and SARA-listed avian species detected in the LSA and RSA. ECCC notes that Common Nighthawks (SARA: Threatened), Barn Swallows (COSEWIC: threatened), and Short-eared Owls (SARA: Special Concern) are not well represented by standard avian point counts and other standard survey techniques because of their unique behaviours. ECCC recommends additional baseline surveys using species-specific protocols throughout the LSA for Common Nighthawk, Barn Swallow, and Short-eared Owl. ECCC can provide guidance on these protocols and study design as required. If confirmed in the LSA after appropriate baseline has been collected, ECCC requests effects assessments be conducted for Common Nighthawks (SARA: Threatened), Barn Swallows (COSEWIC: Threatened), Short-eared Owls (SARA: Special Concern), and Rusty Blackbirds (SARA: Special Concern) to determine potential effects of the Project and guide any management and mitigation plans that should be produced to address these.	Habitat appropriate for common nighthawks, barn swallows, and rusty blackbirds was already captured and included in the assessments for migratory waterbirds and landbirds. Short-eared owl habitat (Figure 15.4-18) was also identified and included in the assessment. Further field studies to verify the presence of these species would not alter the conclusions of the assessment as these species were assumed to occupy suitable habitat. Additional baseline studies would similarly not result in alternate mitigation measures than those proposed which are considered to be effective at mitigating effects to migratory landbirds.	6-Jul-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
ECCC-106.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC continues to suggest that this sampling does not meet requirements necessary to establish an accurate or current baseline that allows for assessment of potential impacts of the Project on migratory birds. ECCC considers it insufficient to simply "assume" that suitable habitat is occupied and a species is present and cautions that such a method of setting baseline does not allow for an accurate effects assessment, making it challenging to evaluate results of future monitoring and mitigation efforts for migratory bird species. In addition, ECCC notes that adverse effects for species at risk can be based on whether the proposed project or physical work aligns with the known threats of recovery strategies, management plans, or other recovery documents. ECCC continues to request that the proponent conduct effects assessments for each species, using guidance from recovery documents and COSEWIC assessment reports. ECCC requests that the Proponent provide density and abundance estimates of migratory birds, particularly species at risk, throughout the LSA, as part of these effects assessments, in order to best assess potential effects and plan for future monitoring and mitigation efforts on site.	The Response is provided in memo **20161110_KUG Comment_ECCC-105.1, 106.1 Bird density_Memo**.	10-Nov-2016
ECCC-106.2	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC acknowledges the additional work done by the Proponent to provide more information on potential impacts to migratory birds and avian species at risk. In the absence of additional species-specific effects assessments, ECCC accepts the Proponent's density estimates and percentages of birds potentially affected in the LSA. ECCC requests that the Proponent commit to mitigation measures in the Wildlife Management and Monitoring plans to reduce potential effects of increased traffic on the ORAR and other roads associated with the project, especially for Common Nighthawk and Short-eared Owl (both of which have roads as identified threats to recovery/management). ECCC agrees with the Proponent's conclusions that "it is reasonable to conclude the no significant effects to migratory landbirds will occur" and "it is not anticipated that the Project will materially deter from achieving the federal management and population objectives for Olive-sided Flycatcher and Short-eared Owl." ECCC requests the Proponent to use adaptive management strategies if these conclusions are expected to change during the course of the Project.	AuRico acknowledges the comment and will include adaptive management in the next iteration of the Wildlife Management and Monitoring Plan.	21-Dec-2016
ECCC-107	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	The finalized recovery strategy for Olive-sided Flycatcher does not include a description of critical habitat because of a lack of adequate information. A schedule of studies is presently in place to identify critical habitat. As such, habitat that meets criteria specified in the recovery strategy may be identified in an amended recovery strategy or subsequent action plan as critical habitat. An amended recovery strategy may become available within a timeframe that overlaps with that of project activities. Presently, there is a lack of data related to Olive-sided Flycatcher presence and abundance in large portions of its range. Without this information any model used to predict critical habitat with current data may have a limited ability to do so in these areas (Environment Canada 2016). ECCC should be contacted for updated critical habitat information during the assessment process. ECCC suggests that Olive-sided Flycatcher habitat data collected by the proponent in the LSA and RSA be shared with ECCC, as this area is one with limited data. Reference: Environment Canada. 2016. Recovery Strategy for the Olive-sided Flycatcher (Contopus cooperi) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 52 pp.	AuRico will consider potential implications to any critical habitat in the project area when it becomes available.	6-Jul-2016
ECCC-107.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Response satisfactory. ECCC will contact the Proponent when CH becomes available for Olive-sided Flycatcher and Common Nighthawk.	AuRico acknowledges the comment; no further action required at this time.	28-Oct-2016
ECCC-108	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Though the ORAR is predicted to be a low traffic volume road, it is worth noting that traffic noise reduces breeding bird densities in habitats adjacent to roads and increased traffic can increase mortality risk for bird groups, particularly for roads through quality avian habitat (Bishop & Brogan 2013; Calvert et al. 2013). ECCC notes that the Seiler (2005) reference (Section 4.1.2, pg 4-3) is from a study involving only moose and does not include other wildlife groups. Given research into avian mortality and other disturbances related to roadways, ECCC suggests that an interaction for migratory birds is possible, specifically in relation to direct and indirect mortality, and disruption of movement. ECCC recommends that literature reviews of potential disturbances related to roadways include research on all groups of wildlife included as valued components. ECCC requests justification and additional support for interactions not being expected with migratory water- and land-birds from the use of the ORAR. References: Bishop, C. A., and J. M. Brogan. 2013. Estimates of avian mortality attributed to vehicle collisions in Canada. Avian Conservation and Ecology 8(2): 2. Calvert, A. M., C. A. Bishop, R. D. Elliot, E. A. Krebs, T. M. Kydd, C. S. Machtans, and G. J. Robertson. 2013. A synthesis of human-related avian mortality in Canada. Avian Conservation and Ecology 8(2): 11.	Low traffic volume on 2-lane roads considered in Bishop and Brogan (2013) had an average traffic volume of 6,500 vehicles/day. Average project related traffic along the ORAR due to the Project is expected to be 12 vehicles. Given the difference of two orders of magnitude, it is expected that the Project traffic will have negligible effects on migratory birds along the ORAR.	6-Jul-2016
ECCC-109	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Table 15-2.1 and Section 24.19.2 list applicable regulatory and policy framework documents for wildlife. ECCC recommends that recovery strategies, management plans, and best management practices be considered and incorporated into effects assessments and management plans for species at risk detected in the LSA and RSA. ECCC recommends adding the following documents: Western Toad: Provincial Western Toad Working Group. 2014. Management plan for the Western Toad (Anaxyrus boreas) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 29 pp.	The western toad management plan and the guidance provided within it will be considered in subsequent management plan developed to support the subsequent permitting process.	6-Jul-2016
ECCC-110	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Table 15-2.1 and Section 24.19.2 list applicable regulatory and policy framework documents for wildlife. ECCC advises that recovery strategies, management plans, and best management practices be considered and incorporated into effects assessments and management plans for species at risk detected in the LSA and RSA. ECCC recommends adding the following documents: Birds: COSEWIC. 2011. COSEWIC assessment and status report on the Barn Swallow Hirundo rustica in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 37 pp. Environment Canada. 2015. Management Plan for the Rusty Blackbird (Euphagus carolinus) in Canada. Species at Risk Act Management Plan Series. Environment Canada, Ottawa. iv + 26 pp. Environment Canada. 2016. Recovery Strategy for the Common Nighthawk (Chordeiles minor) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 49 pp. Environment Canada. 2016. Recovery Strategy for the Olive-sided Flycatcher (Contopus cooperi) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 52 pp. Environment Canada. 2016. Management Plan for the Short-eared Owl (Asio flammeus) in Canada [Proposed]. Species at Risk Act Management Plan Series. Environment Canada, Ottawa. v + 35 pp.	These management plans and the guidance provided within them will be considered in subsequent management plans developed to support the subsequent permitting process.	6-Jul-2016
ECCC-111	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	Table 15-2.1 and Section 24.19.2 list applicable regulatory and policy framework documents for wildlife. ECCC advises that recovery strategies, management plans, and best management practices be considered and incorporated into effects assessments and management plans for species at risk detected in the LSA and RSA. ECCC recommends adding the following documents and incorporating them as necessary for effects assessment: Caribou: Environment Canada. 2012 Management Plan for the Northern Mountain Population of Woodland Caribou (Rangifer tarandus caribou) in Canada. Species at Risk Act Management Plan Series. Environment Canada, Ottawa. vii + 79 pp. COSEWIC. 2014. COSEWIC assessment and status report on the Caribou Rangifer tarandus, Northern Mountain population, Central Mountain population and Southern Mountain population in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xxii + 113 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm). Environment Canada. 2014. Recovery Strategy for the Woodland Caribou, Southern Mountain population (Rangifer tarandus caribou) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. viii + 103 pp. Bats: Environment Canada. 2015. Recovery Strategy for Little Brown Myotis (Myotis lucifugus), Northern Myotis (Myotis septentrionalis), and Tri-colored Bat (Perimyotis subflavus) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Available at http://www.sararegistry.gc.ca/default.asp?lang=En&n=2A04680B-1 Holroyd, S.L., V.J. Craig, and P. Govindarajulu. 2016. Best Management Practices for Bats in British Columbia, Chapter 1: Introduction to the Bats of British Columbia. B.C. Ministry of Environment, Victoria, BC. 108 pp. Holroyd, S.L., and V.J. Craig. 2016. Best Management Practices for Bats in British Columbia, Chapter 2: Mine Developments and Inactive Mine Habitats. B.C. Ministry of Environment, Victoria, BC. 60pp.	These management plans and the guidance provided within them will be considered in subsequent management plans developed to support the subsequent permitting process.	6-Jul-2016

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ID #	Comment Date (i.e. 22-May-16)	Reviewer Name / Agency (i.e. Alex Kwang, MEM)	Subject (See "instructions" tab)	Comment (Include Memo reference as applicable)	Proponent Response (Include Memo reference as applicable)	Response Date
ECCC-112	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	In Figure 15.4-27, potential Western Toad habitat is mapped along the shores of Thutade Lake and in the northeastern portions of Kemess Creek between Kemess Lake and the existing tailings storage facility, yet there are very few or no survey locations in these areas. ECCC requests clarification on why these areas were not surveyed, despite being identified as potential Western Toad habitat. In the case of the Kemess Creek habitat area, ECCC suggests this is a particularly important area to survey given that a juvenile toad, which "may also indicate a breeding site or nearby breeding site" (pg 91 of .pdf), was found at the edge of the Kemess Creek identified habitat area. Without this information, it may not be possible to appropriately assess potential project effects on Western Toad. Please refer to Memo 0606_ECCC-CWS_WesternToadStandardGuidanceEnvironmentalAssessments ("Western Toad Standard Guidance") for details on ECCC suggested survey methodologies.	All habitat identified as potentially supporting breeding was assumed to have toads present, regardless of inventory results or absence of inventory effort. As such the additional survey requested would not alter the conclusions of the assessment or mitigation and monitoring proposed in Chapter 24 section 19.	6-Jul-2016
ECCC-112.1	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Terrestrial Ecosystems	ECCC considers it insufficient to simply "assume" that suitable habitat is occupied and a species is present and cautions that such a method of setting baseline does not allow for an accurate effects assessment, making it challenging to evaluate results of future monitoring and mitigation efforts for western toad. In the absence of additional baseline data for Western Toad, ECCC requests that the Proponent provide density and abundance estimates using existing baseline data throughout the LSA, in order to best assess potential effects and plan for future monitoring and mitigation efforts on site and assist the RA in identifying potential adverse effects under ss. 79(2) of the SARA.	The response is provided in memo **20161103_0.2 KUG Comment ECCC-112.1_Western Toad_memo**	10-Nov-2016
ECCC-113	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	On page 90, the application states that "maintaining breeding habitat and connectivity at a regional scale is a management priority for western toads because of their long distance dispersal." In Chapter 24, Table 24.19-2, there is no reference to how this connectivity may be maintained to avoid disturbance and disruption to migrating Western Toads during the year. Also, there is no habitat mapped for other life stages of Western Toad in the LSA or RSA. ECCC recommends that mitigation measures include, but not be limited to, protection of migration corridors and other important life stage habitats. Please refer to Memo 0606_ECCC-CWS_WesternToadStandardGuidanceEnvironmentalAssessments ("Western Toad Standard Guidance") for more details on ECCC recommended mitigation measures.	The assessment currently provides mitigation measures to protect habitat and ensure mortality from human interactions is limited (Chapter 24, section 19). Breeding for western toads was confirmed in the RSA but not in the LSA. Surveys prior to construction of the water discharge line through the potential suitable western toad habitat near Attichika Creek will occur to determine if breeding is occurring in this wetland. If it is confirmed, construction will occur when the toads are no longer in the area or alternate mitigation measures would be employed to avoid effects on breeding toad. Observations of western toads will also be a part of the wildlife monitoring program described in Section 24.19.5.	6-Jul-2016
ECCC-113.1	7-Oct-2016	Eric Soprovich (ECCC)	Terrestrial Ecosystems	ECCC requests more detail on alternate mitigation measures proposed to avoid effects and a review of the efficacy of these mitigation measures.	Aurico will implement no-disturbance buffers surrounding any identified breeding habitats for western toads found during pre-construction surveys using guidance provided in ECCC (2016). Buffers will include the maximum distance recommended in ECCC (2016) to ensure protection of habitat that encompasses a large amount of western toad movement in terrestrial habitats surrounding aquatic breeding areas. ECCC 2016. Environmental Assessment Standard Guidance for the Western Toad. Environment and Climate Change Canada/Canadian Wildlife Service	28-Oct-2016
ECCC-114	21-Jun-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC requests clarification of what is meant by "...avoid wetlands to the degree practical..." and what mitigation plans are in place if wetlands cannot be avoided.	Avoidance where practical would include selecting final siting options that completely avoid or minimize direct disturbance to wetlands when options are available, and to otherwise use additional caution to minimize disturbance when working in or around wetland areas. Other factors such as mitigation for other wildlife, safety (as directed by Worksafe BC) or logistics may influence the ability to avoid wetlands. Mitigation is identified in Table 24.19-1 for breeding ponds. Surveys prior to construction of the water discharge line through the potential suitable western toad habitat near Attichika Creek will occur to determine if breeding is occurring in this wetland. If it is confirmed, construction will occur when the toads are no longer in the area or alternate mitigation measures would be employed to avoid effects on breeding toad.	6-Jul-2016
ECCC-115	29-Sep-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC requests that an assessment of disturbance to Chase herd caribou candidate CH in the LSA and RSA be conducted according to the following disturbance assessment criteria: 1) any disturbance to high elevation summer (spring, calving, summer, fall/rut) and/or winter range range; and low elevation summer (spring, calving, summer, fall/rut) range; and 2) low elevation winter range and connectivity range using human-caused physical disturbance visible on Landsat at a scale of 1:50,000, including all habitat within a 500 m buffer; and/or fire disturbance in the last 40 years, as identified in data from each provincial jurisdiction, without a buffer.	Please refer to Memo **KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo**	28-Oct-2016
ECCC-115.1	29-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	ECCC will engage in upcoming meetings with the Proponent and members of the caribou sub-working group to further address the Proponent's response to this IR.	The caribou sub-working group met on November 25, 2016 and minutes from the meeting with be made available by the BC EAO.	21-Dec-2016
ECCC-115.3	23-Dec-2016	Kimberly Dohms (ECCC-CWS)	Wildlife and Habitat	See "CWS_KUG_Caribou_23Dec2016" memo	EAO did not require AuRico to respond to this memo. Recommendations from ECCC were considered in EAO's assessment report.	N/A
ECCC-116	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wetlands	ECCC recommends that for Black Spruce-Horsetail-Sphagnum (peat moss) wetlands in the LSA, the proponent: • Conduct an assessment of wetland function and of the effects of the project on wetland function, which includes (but is not limited to) a description of the natural processes of wetlands (physical, chemical, and biological) potentially directly and indirectly adversely impacted; • Identify any potential impacts to migratory birds or species at risk that may result from impacts to wetlands or loss of wetland function; • Identify any potential federal authorizations, permits or licenses that may be required for the Project, including their likely geographical scopes; and, • Explain how effects on wetlands will be mitigated and, where effects remain following avoidance and minimization and where the goal of no net loss of the Federal Policy on Wetland Conservation should be considered, include wetland compensation in any mitigation plans. ECCC notes that this may fall within the scope of a federal authorization (MMER; see ECCC-057, -073), Effluent is proposed to be discharged is proposed to be discharged to the Attichika Creek without treatment during the construction phase of the project (see ECCC-073). This may impact migratory birds and species at risk that use this wetland complex as habitat.. ECCC is requesting information: • In order for ECCC to provide advice to assist federal departments with federal regulatory role in the project (e.g. DFO, TC, NRCan, ECCC) in meeting their obligations under the Federal Policy on Wetland Conservation, to achieve a goal of no-net-loss of wetland function. Should there be impacts to wetlands that are directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the designated project, they would be considered an environmental effect pursuant to CEAA 2012; • In order for ECCC to provide advice to assist CEAA in assessing potential adverse effects to migratory birds and species at risk resulting from potential impacts to wetland function. Impacts to migratory birds are to be taken into account under CEAA 2012 and all adverse effects to species at risk must be identified under ss. 79(2) of SARA; and, • Because ECCC is aware that Indigenous communities have expressed interest in relation to traditional use and wildlife for wetlands that may be affected by this project. Should there be environmental effects related to the traditional use of wetlands by Aboriginal peoples, they would be considered an environmental effect pursuant to CEAA 2012. The memo "Federal Policy on Wetland Conservation - Guidance for Application and Implementation in Environmental Assessment" provided earlier indicates further information on on the Federal Policy on Wetland Conservation. ECCC can also be contacted for further information on how the Policy should be considered during this project EA and guidance on effects and function assessments.	Since June 2015 (precise date unknown), the wetland ecosystem in question (Black Spruce-Horsetail-Sphagnum (peat moss)) has been downgraded within BC from blue-listed to yellow-listed (BC Conservation Data Centre, 2016). Currently, there are no blue or red-listed wetlands within the Kemess Underground local study area. As the federal policy applies to blue- and red-listed wetlands only (Federal Policy on Wetland Conservation Guidance for Application and Implementation in Environmental Assessment; ECCC-CWS 2014), the requested information in no longer required. This has been confirmed by CWS via email correspondence.	4-Nov-2016
ECCC-116.1	4-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wetlands	Thank you for bringing this status change to our attention. As has been pointed out, the no-net-loss clause in the FPWC no longer applies for this request, meaning that the effects assessment is no longer required and this IR can be wrapped up quite quickly. Please note that ECCC-CWS still has concerns about existing baseline data and characterization of potential impacts from the Project to the wetland complex as this area may serve as important habitat for Species at Risk and migratory birds. However, no further action on this IR is required.	Comment acknowledged.	4-Nov-2016
ECCC-117	7-Oct-2016	Kimberly Dohms (ECCC-CWS)	Wetlands	Section 13.3.3 states that "Table 13.4-5 identifies the wetlands that occur in the LSA. There is one provincially (blue) listed wetland type (Sb-Horsetail-Sphagnum [Wb09]) that occurs in the LSA. However, no project-related impacts are anticipated for the Wb09 wetlands in the LSA." ECCC notes that this blue-listed wetland does not appear in Table 13.5-2 "Loss and Alteration of Terrestrial Ecology Valued Components." ECCC requests more information on how this wetland type may be lost or altered. ECCC also requests more information on the location of this wetland in the Attichika wetland complex. As noted above, such wetlands information is of importance in helping assess project impacts and significance of environmental effects of the project.	See response to ECCC-116.	4-Nov-2016
ECCC-117.1	4-Nov-2016	Kimberly Dohms (ECCC-CWS)	Wetlands	See response ECCC-116.1	Comment acknowledged.	4-Nov-2016
MEM-004b.2	30-Oct-2016	Hugh McCreadie, MEM	Water (Ground)	The figures provided were very clear and clarified the modeling approach.	AuRico thanks the reviewer for the comment.	21-Dec-2016
MEM-073	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	The vast majority of transient piezometric response corresponded to snow melt, which suggests that most recharge is from snow melt. Please comment on if and how this behaviour may affect the establishment of a groundwater divide between East Cirque Creek and Upper El Condor Creek after closure.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

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ID #	Comment Date (i.e. 22-May-16)	Reviewer Name / Agency (i.e. Alex Kwang, MEM)	Subject (See "instructions" tab)	Comment (Include Memo reference as applicable)	Proponent Response (Include Memo reference as applicable)	Response Date
MEM-073.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	The response did not really address the comment. Considering that the water table can be expected to be drawn down significantly during operations, the recharge rate can be expected to decrease due to the increased thickness of the unsaturated zone. This effect may be exaggerated considering that most recharge occurs during snowmelt, which is a relatively concentrated period. Therefore, the establishment of a groundwater divide post-closure and/or the rate at which this groundwater divide would be established may be affected. If this phenomenon was not considered when estimating the rate at which the groundwater divide would be established, please justify its exclusion.	The response is provided in the memo **20161102_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater2**	4-Nov-2016
MEM-074	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Isotopes were wisely used to estimate the groundwater age. The Application suggests that all or most groundwater samples include a component of modern recharge and ancient recharge. The age of the ancient recharge was in the range of thousands of years. Considering that groundwater flow is laminar, please describe the mechanism that would result in this mixing of modern and ancient recharge.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-074.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	At permiting a more thorough description of how the isotope data have shaped the hydrogeological interpretation will be required.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-075	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Please discuss how the groundwater age derived from carbon dating is consistent (or not) with travel times simulated by the groundwater model and recharge rates assigned to the groundwater model.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-076	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	The calculated hydraulic conductivity values from several packer tests were 10 to 1000 times greater than the hydraulic conductivity assigned to the model in the depth range of 200 to 500m. The report indicated that this difference was assessed in the sensitivity analysis. However, the six sensitivity cases listed in Section 4.4 included only a 10% increase in hydraulic conductivity relative to the baseline model. Please elaborate on how the sensitivity analysis addressed the high hydraulic conductivity values that were measured in the field but not incorporated into the model.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-076.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	The baseline groundwater model in the Application is one of several credible possible models of this flow system. However, the model presented in the Application is not unique considering the understandable uncertainty in hydrogeological input parameters and the relatively sparse set of low-flow measurements and groundwater-elevation measurements. This non-uniqueness is understandable and typical of projects at this stage of development. As documented in Table 76-1, the hydraulic conductivity in model layers 5 through 7 is consistent with the geometric mean of the hydraulic conductivity test results at corresponding depths. However, the large-scale hydraulic conductivity of bedrock is often underestimated by the results of this type of test and is often better represented by values toward the upper end of the measured distribution of hydraulic conductivity. Considering that the baseflow targets used for calibrating the model may be too low considering that they are based on winter low flows rather than an estimate of average annual baseflow, please justify why the hydraulic conductivities in the model were limited to values approximately equivalent to the geometric mean. Some selected documentation of a sensitivity analysis were provided in Table 76-2 of the response, which clarified the comment in the Application. However, this sensitivity analysis changed the hydraulic conductivity only in layers 5 through 7, which can be expected to result in degraded calibration statistics without compensating adjustments to recharge and/or hydraulic conductivity in other layers. Please justify this choice of parameter adjustment.	The reponse is provided in the memo **20161107_KUG_Comments_MEM_Hydrogeo_Lorax Memo3_Groundwater3.**	9-Nov-2016
MEM-076.2	30-Oct-2016	Hugh McCreadie, MEM	Water (Ground)	The response is accepted for the purpose of the EA. Further work will be required during operations to improve the understanding of baseflow.	AuRico acknowledges the comment.	21-Dec-2016
MEM-077	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Central Cirque Creek was one of the key groundwater flowpaths that was considered in this Environmental Assessment but a conceptual hydrogeological cross section was not provided. Please develop a conceptual cross section from Amazay Lake, along Central Cirque Creek, through the proposed subsidence zone, and terminating somewhere in the vicinity of KN-11-06 (similar to Figure 9.4-8)	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-078	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Some packer tests had water takes that were too high to calculate a K value, which will inform the conceptual model. The Application implies that all of these tests were in the broken zone but it's not quite clear. Please provide a table that lists the location and test interval of each of these tests, and distinguish these test intervals on the relevant hydrogeological sections. Please describe how these tests were used to inform the interpretation of hydraulic conductivity values that were assigned to the groundwater model.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-079	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Bedrock formations are often anisotropic but the bedrock within the study areas was assumed to be isotropic without a supporting discussion. Anisotropy can influence recharge characteristics and groundwater flowpaths, which can influence the rate or potential for establishing groundwater divides after closure. Please justify the assumption of isotropy.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-080	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Some of the formations within the study areas include basalt flows, which tend to be relatively permeable. Please confirm that the packer test intervals included all relevant occurrences of basalt that were encountered in the bore holes. Please also confirm whether the geological model has been developed to a level where the occurrence of basalt can be anticipated.	The response is provided in memo **20160819_KUG_Comments_MEM_Hydrogeo_Clarification_Permitting_Lorax_Memo**	19-Aug-2016
MEM-080.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	Satisfactory response for EA. Considering the data scatter and decreasing frequency of tests with depth, the decrease in hydraulic conductivity is not compelling. However, it is accepted for the EA as one reasonable interpretation. Continued development of the interpretation of the occurrence and permeability of the basalt during will likely be required during operations.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-081	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	The conceptual cross sections do not include faults. However, faults have been mapped in the area, such as the KN fault, and the compartmentalization of groundwater by faults and preferential groundwater flow along faults is a ubiquitous phenomenon in bedrock flow systems. Please describe the reasoning for excluding faults from the conceptual model.	The response is provided in memo **20160819_KUG_Comments_MEM_Hydrogeo_Clarification_Permitting_Lorax_Memo**	19-Aug-2016
MEM-081.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	Satisfactory response. Ongoing interpretation of piezometric levels to augment the interpretation of faults, and updates to the structural geology model may be required during operations.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-082	27-Jun-2016	Hugh McCreadie, MEM	Closure and Reclamation	The Application states that the steady state baseline model was calibrated to "... May 2013 water levels which represent annual minima after a period of winter draindown. These low water levels were achieved using a low winter recharge rate in the steady-state calibration." Using a steady state model as part of the analysis is completely appropriate but should use average annual water levels and average annual recharge. Please describe the reasoning for using a steady state model for simulating annual minima, especially considering that the gradient has a strong seasonal variation. Similarly, the recharge illustrated in Figure 9.6-1 does not seem to represent a low winter recharge rate, which seems contradictory. Please clarify.	The two sentences in Section 4.5.1 "Recall that the model..... were achieved using a low winter recharge rate in the steady state calibration." should be deleted. The baseline model was calibrated to a recharge distribution of 3 % of mean annual net precipitation in the valley bottoms and 15 % in alpine areas.	19-Aug-2016
MEM-082.1	22-Sep-2016	Hugh McCreadie, MEM	Closure and Reclamation	A response was provided for the part of the comment about recharge. Please also clarify how the groundwater elevation targets were developed for the steady state model (requested but not answered). For example, are the groundwater elevation targets an average of all water levels? If so, how were differing periods of record and measurement frequencies handled when calculating the average?	The response is provided in the memo **20161102_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater2**	4-Nov-2016
MEM-082.2	30-Oct-2016	Hugh McCreadie, MEM	Closure and Reclamation	The qualitative points made in the Round 2 response are acknowledged. However, the use of seasonal low water levels in a steady state model reperesenting average annual recharge is not really appropriate. Please recalculate the head calibration statistics with the observed water levels based on average annual values, and summarize these statistics in a format similar to Appendix 9-B of the Application, as follows: - Tables 4.1-1 and 4.1-2; - Figure 4.1-1, modified to plot head residual on the y-axis rather than modelled head; - Figures 4.1-2 to 4.1-4, inclusive; - Figure 4.4-1. Please also provide a small table that summarizes the basis of the annual average (for example, daily measurements with data logger, monthly manual measurements, etc.) and whether the seasonal maximum and minimum were captured in the average.	Following discussions with the BC EAO, AuRico understands that information provided to date is sufficient to inform EAO's assessment report, thus no furhter response has been prepared.	21-Dec-2016
MEM-083	27-Jun-2016	Hugh McCreadie, MEM	Closure and Reclamation	Only specific storage was included in the sensitivity analysis of the transient model. Specific yield would also be a relevant sensitivity parameter unless the model was run in confined mode. Please clarify whether the model was run in confined mode or unconfined mode. If the model was run in confined mode, please justify how this mode is appropriate for this groundwater system.	To ensure the groundwater model is appropriate for the project groundwater system, the FEFLOW model was run in an unconfined-confined mode that automatically determines whether a model layer is confined or unconfined. The top layer is always unconfined while for the lower layers if the predicted head is above elevation of element, then FEFLOW assigns as confined. In the FEFLOW model, the specific yield (Sy) was assigned as effective porosity. Noting almost all monitoring wells especially for those wells close to the region of interest (e.g., KN-11-08, KN-11-09, KN-11-12, KN-11-19) are screened in deep layers that are typically expressed as "confined layers" in the model, a direct relation between model specific yield and water table fluctuations would not be better achieved through the model sensitivity on specific yield as compared to the specific storage sensitivity. As such, a sensitivity on Sy was not performed and presented.	19-Aug-2016
MEM-083.1	22-Sep-2016	Hugh McCreadie, MEM	Closure and Reclamation	Even though the piezometers are screened at depths corresponding to deeper model layers, varying the specific yield will affect the water table elevation, which will affect the head calculated at depth. Please complete a sensitivity analysis of specific yield.	The response is provided in the memo **20161102_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater2**	4-Nov-2016

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MEM-084	27-Jun-2016	Hugh McCreadie, MEM	Closure and Reclamation	These figures illustrate hydraulic head contours. Please clarify whether these contours represent the water table or hydraulic head contours at some depth.	The contours in these figures represent the water table.	19-Aug-2016
MEM-085	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	The bulk hydraulic conductivity of a rock mass is typically considerably higher than indicated by the results of packer tests. Please justify applying the calculated K's from packer testing results directly rather adjusting for scale dependence.	The response is provided in memo **20160819_KUG_Comments_MEM_Hydrogeo_Clarification_Permitting_Lorax_Memo**	19-Aug-2016
MEM-085.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	Some larger scale field testing and groundwater model updates that include calibration to inflows to the decline and to the subsidence zone will likely be required during operations.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-086	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	In addition to packer testing, the behaviour of drilling circulation is a useful qualitative indicator of permeable zones that are sometimes not captured by the packer testing. Please summarize the information that was collected on drilling circulation continuity and/or losses in diamond drill holes, especially in the holes in proximity to the decline.	The response is provided in memo **20160819_KUG_Comments_MEM_Hydrogeo_Clarification_Permitting_Lorax_Memo**	19-Aug-2016
MEM-086.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	Satisfactory response. Monitoring and documentation of drilling circulation and the associated interpretation of the results should be incorporated into future drilling programs.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-087	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	The Application stated that " ... the baseline model predictions are visually consistent with the observed groundwater hydrographs." However, the character of the field response was actually quite different from the character of the modelled response. Whereas the field data were generally characterized by a sharp increase and decrease in the spring, followed by a slow asymptotic decline and occasional response to rainfall, the model response was characterized by much more gradual changes. The sensitivity analysis with respect to specific storage demonstrated that the difference in character was not due to that parameter. The difference in character could be due to the way that recharge was distributed throughout the year. Please update the groundwater model so that it more closely emulates the character of the transient response of observed groundwater levels.	The comment is acknowledged. The proponent will comply with necessary requirements at time of permitting.	19-Aug-2016
MEM-088	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Vertical gradients typically indicate key features of a groundwater flow system and a mis-match between modelled and observed vertical gradients can indicate that these features are not well represented in a numerical model. The large downward gradient that was observed at KN11-12/19 and DH03-14A/14B are in key locations of the study area. The numerical model successfully simulated a downward gradient at both locations but the magnitude was too small by a factor of 3 to 4. At permitting, MEM will expect a new version of the model that more closely emulates the observed downward gradients, and evaluate the effect, if any, of these new model versions on predicted post-closure flowpaths.	The response is provided in memo **20160819_KUG_Comments_MEM_Hydrogeo_Clarification_Permitting_Lorax_Memo**	19-Aug-2016
MEM-088.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	Hydraulic gradients will reflect hydrogeological conditions considerably beyond the well head, which is one reason they are very useful for enhancing the understanding of larger-scale hydrogeological features and associated groundwater flowpaths.Sensitivity analysis is needed for the reason stipulated in the response: the groundwater model computes water levels based on an interpolation from surrounding nodes. The downward gradients measured at DH03-14 are unusually large for the base of a valley, and warrant further consideration by developing a sensitivity case that more closely emulates those gradients. The purpose of this sensitivity case is to consider the hydrogeological conditions that could cause this unusually strong downward gradient in a valley bottom and the potential implications for the effects assessment, if any.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-089	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	The influence of sulphide weathering in the samples from KN11-19 seems to be attributed to the gossan on the north side of the ridge. If a groundwater divide separates the north side of the ridge from the south side, please describe how water from the gossan would reach KN11-19.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-089.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	Agreed that the presence of sulphate in KN11-19 does not necessarily preclude the presence of a groundwater divide between East Cirque Creek and Upper El Condor Creek catchments considering that sulphide mineralization has been observed throughout the Takla Formation. However, KN11-19 appears to be located outside the mapped gossan area. Please provide any independent evidence that might be available for sulphide weathering in this area of the south side of the ridge. For example, is extensive iron staining evident in proximity to KN11-19?	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-090	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	The Application describes the groundwater samples from KN11-19 as representing reducing conditions "despite being screened ... in what is interpreted to be a groundwater recharge area." The interpretation of this area as a recharge area is a key component of the conceptual model that confines the groundwater flowpaths to East Cirque Creek. Please clarify whether the Application is saying that these reducing conditions contradict this area being interpreted as a recharge area.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-091	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	A review of the surface-water chemistry at selected stations (concentrations and composition) in conjunction with groundwater would inform the understanding of groundwater-surface-water interaction, which is germane to assessing the potential project effects via groundwater pathways. Please assess the surface water quality data, particularly the data collected during low flow, from the viewpoint of enhancing the understanding of baseline groundwater quality and groundwater-surface-water interaction.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-091.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	Since the surface water samples are from low-flow periods, the water quality of these samples should represent an aggregate of all groundwater discharging to the stream up-stream of the sampling station. Since the composition of the groundwater samples is very different from the surface water samples, please provide a conceptual model of where the groundwater in each of the streams is originating.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-091.2	30-Oct-2016	Hugh McCreadie, MEM	Water (Ground)	Addiitonal work to reconcile surface water quality with groundwater quality will be required during operations.	AuRico acknowledges the comment.	21-Dec-2016
MEM-092	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	The range of groundwater quality composition is very large at some of the groundwater wells (e.g., DH-03-02A, KN-11-19, DH-03-16, GW08-05S, WQ-CW, GW-02-02), sometimes as the result of a few outliers. Groundwater composition normally does not vary much unless it is affected by seasonal influences. Considering that the groundwater age has been placed in the range of 1000's of years, such a large seasonal range seems inconsistent. Please explain the cause of this range and how it is consistent with the groundwater age, and provide backup information that confirms the integrity of these sampling results.	The response is provided in memo **20160819_KUG_Comments_MEM_Hydrogeo_Clarification_Permitting_Lorax_Memo**	19-Aug-2016
MEM-092.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	Re: Kemess South, please provide specific justification for any wells that exhibit the large range in groundwater quality composition that is described or identify outlying data that should be eliminated from the database. Additional baseline groundwater samples may be required prior to permitting.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-092.2	30-Oct-2016	Hugh McCreadie, MEM	Water (Ground)	A minimum of an additional one year of seasonal groundwater samples will be required prior to starting operations. (MA Permit Requirement)	AuRico acknowledges further discussion on the comment is deferred to permitting.	21-Dec-2016
MEM-093	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Elevated SO4 in wells KN11-13 and KN11-15 on the shore of Amazay Lake is attributed to groundwater from "the gossan area." Please clarify whether this reference is the gossan area located in the headwaters of East Cirque Creek. If so, this interpretation seems inconsistent with the interpretation of the groundwater divides. If not, please clarify the location of the gossan being referenced.	Gossan material has been mapped outside of the East Cirque Creek Catchment, including the headwaters of catchments containing the wells KN11-13 and KN11-15. The reviewer is referred to geology maps provided in Figure 2.2-2 in Appendix 9-A and Figure 2.2-1 in Appendix 9-B (shows KN11-series wells).	19-Aug-2016
MEM-094	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Please clarify whether the groundwater samples affected by drilling and well installation (as discussed in Appendix 4-G of Appendix 9-A) were excluded from data plots and discussion of groundwater sampling results.	Samples identified as being influenced by drilling artefacts in Appendix 4-G of Appendix 9-A have been excluded from Figures 4.2-1 through 4.2-8. Note that there is an erroneous statement near the beginning of Section 4.2.2 which states...."Also, 2004 samples collected from wells DH-03-15A/B and DH-03-14A were omitted from the Piper plot as they are inconsistent with more recent data collected at these locations and are believed to reflect drilling artefacts." These samples were, in fact, included in the piper plot (Figure 4.2-1) and subsequent parameter plots, but were excluded from discussion of the piper plot. While trace element concentrations were in line with subsequent sampling events, the 2004 major ion equivalents did not cluster with the more recent data. This was attributed to a difference in sampling methods (and not drilling artefacts, as was orginally stated).	19-Aug-2016
MEM-094.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	Please justify that these samples should be included in the baseline data set. Please provide the figures that include these samples and include labels that will identify the affected samples. Additional baseline groundwater samples may be required prior to permitting.	The response is provided in the memo **20161102_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater2**	4-Nov-2016
MEM-094.2	30-Oct-2016	Hugh McCreadie, MEM	Water (Ground)	A minimum of an additional one year of seasonal groundwater samples will be required prior to starting operations. (MA Permit Requirement)	AuRico acknowledges further discussion on the comment is deferred to permitting.	21-Dec-2016
MEM-095	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Please interpret why groundwater samples from DH03-14A/14B, which are located immediately downstream of the gossan and have a strong downward gradient, have lower electrical conductivity and SO4 than three monitoring wells on the south side of the ridge (KN11-02, 13 and 14)?	The response is provided in memo **20160819_KUG_Comments_MEM_Hydrogeo_Clarification_Permitting_Lorax_Memo**	19-Aug-2016
MEM-095.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	This interpretation seems inconsistent. East Cirque Creek has been interpreted to have a losing reach in proximity to DH03-14, which indicates that water from East Cirque Creek would be recharging the groundwater system. Therefore, the groundwater quality would generally be expected to be fairly similar to East Cirque Creek. Please describe the conceptual model that includes streamflow losses to groundwater in this area and groundwater quality that is distinct from the surface-water quality.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-095.2	30-Oct-2016	Hugh McCreadie, MEM	Water (Ground)	Addiitonal field-based characterization of gaining and losing reaches will be required before operations commence. (MA Permit Requirement)	AuRico acknowledges further discussion on the comment is deferred to permitting.	21-Dec-2016
MEM-096	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	The influence of sulphate on the groundwater quality at KN-11-19 was attributed to mineralization at depth. Please clarify whether any mineralization was logged in the drill core (none indicated on the log) or whether other data are available to indicate mineralization on the south side of the ridge.	The response is provided in memo **20160819_KUG_Comments_MEM_Hydrogeo_Clarification_Permitting_Lorax_Memo**	19-Aug-2016
MEM-097	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Changes in redox chemistry results over time suggest that many of the wells were still equilibrating with the groundwater system during the baseline sampling period. Additional baseline groundwater sampling prior to operations will be required.	The Proponent will comply with necessary requirements at time of permitting. It is important to note that fluctuating levels of redox sensitive parameters may be a reflection of natural variability in the groundwater system and not necessarily indicate that the wells have not equilibrated with the groundwater system.	19-Aug-2016

Kemess Underground Application Review - Working Group Issues Tracking Table - January 6, 2017

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
MEM-098	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Please confirm if and when the camp water supply wells (CW and CW1) have been pumping since groundwater monitoring started at Kemess South. If they have been operating, please provide a table that summarizes the history of pumping volumes and an appropriate time series plot of average pumping rates. Please also use these data in conjunction with interpreted drawdown to estimate a bulk hydraulic conductivity and confirm whether the hydraulic conductivities assigned in the groundwater model are reasonable.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-098.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	This comment is addressed in MEM-125	The proponent thanks the reviewer for the feedback.	28-Oct-2016
MEM-099	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	GW-01 and GW-02 are immediately next to one another but the posted water levels on Figure 9.4-11 differ by 7m. The hydrogeological conditions that cause this head difference are likely not included in the numerical model. Please explain this large difference in water level, including a hydrogeological cross section through GW02-01, 02 and 03, and describe how it might influence the interpretation of seepage pathways, if at all.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-099.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	The history of water levels was very thoroughly addressed. The water level in the shallow overburden well has remained very stable at about 1244 m for seven years compared to the upward-trending water level in the well completed at the bedrock-overburden contact. 1. Please confirm that the water level in the shallow well represents the groundwater elevation and is not simply measuring stagnant water trapped in the bottom of the well. 2. Considering this contrasting behaviour, the permeability of the shallow horizon appears to be considerably lower than the deeper horizon. Please describe how this contrast would affect the interpretation of effects for Kemess Creek and Waste Rock Creek, if at all?	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-100	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	The baseline groundwater quality database in LSA2 is quite comprehensive. These data show the effect of the PAG waste rock that was temporarily placed beside the pit between 2001 and 2011.	The comment is acknowledged.	19-Aug-2016
MEM-101	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	The Application does not seems to include an estimate of groundwater discharge from the decline after closure. Even when the plug is designed and installed according to the state of practice, some outflow from the decline can be expected. This outflow could potentially affect the baseflow and/or water quality in LSA1. Please update the Application to include estimates of the rate and source of groundwater seepage around the plug and downgradient of the plug for comparison with field measurements that will be collected after closure.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-101.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	The reference does not seem to account for total driving head when providing an estimate of achievable seepage, and does not seem to account for the potential effect of geological structures. The cited reference also does not provide supporting summary of measured leakage rates. The response indicated that leakage around the plug was simulated by applying a range of "arbitrary" specified-flux values at the decline portal. However, please clarify the following: 1. Discussions during the September 12 hydrogeology meeting indicated that the highest seepage rate of 20 L/s was simulated by applying a specified head boundary at the portal. Therefore, 20 L/s seems to be the estimate of maximum possible seepage rather than an arbitrary value. Please clarify. 2. Discussions during the September 12 hydrogeology meeting indicated the plug seepage was estimated by simulating the plug midway along the decline. Please clarify the approach to simulating seepage from the decline and the role of the simulations that used a specified flux boundary. 3. Modeling results presented during the September 12 hydrogeology meeting indicated that the elevation of the post-closure water table was well above the decline elevation on the down-gradient side of the plug. Please justify conceptually why this elevated water table would be maintained. The response to MEM-116 asserted that the water table would not be materially affected by drainage into the decline but a conceptual justification is required.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-101.2	30-Oct-2016	Hugh McCreadie, MEM	Effects and Mitigation	Monitoring of the flow from access tunnels for the decline will be required.	AuRico acknowledges the comment.	21-Dec-2016
MEM-102	27-Jun-2016	Hugh McCreadie, MEM	Closure and Reclamation	Given the importance of the decline plug in preventing the migration of subsidence zone contact water to LSA1 along groundwater pathways, partial or complete failure of the decline plug is a potential malfunction worth assessing. This issue is significant particularly because the baseline water quality in LSA2 is already naturally affected whereas the baseline water quality in LSA1 is relatively good. Please update the Failure Modes and Effects Analysis to include the decline plug.	The risk of a partial or complete failure of the decline plug during Post-Closure would be considered to have a 'Moderate' Environmental Consequence, and the Likelihood of the failure is considered 'Rare'. Being ranked as a low risk (L17), the event would not have been discussed further in the Application. However, supporting background information for the low risk nature of the partial or complete failure of a decline plug is presented in responses to ECCC-065 and MoE-070. In addition, engineered structures are designed with precise factors of safety (FoS) to account for issues such as maximum expected seismic events and maximum load, with FoS values typically +/-1.5. For the KUG decline bulkhead application, significantly higher FoS values can be applied to effectively provide a design that will not fail under any circumstances. In addition, a length of decline above each bulkhead can be filled with NAG waste rock to provide an additional buffer.	5-Aug-2016
MEM-102.1	22-Sep-2016	Hugh McCreadie, MEM	Closure and Reclamation	Even though it is ranked as a low risk, an updated Failure Modes and Effects Analysis that includes the decline plug will be required at permitting.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-103	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	The predicted flowpaths for contact water from the subsidence zone will depend strongly on the recharge rates applied to high elevations and mountain peaks, and on the boundary conditions applied to the model for the upper reaches of surface water drainages such as Central Cirque Creek, East Cirque Creek and the small drainages at high elevations along the ridge through which the decline penetrates. Please provide details on the boundary conditions that represent the upper reaches of surface water drainages (i.e., location, head, transfer rate, etc.). Please also summarize the inflow and outflow rates for boundaries representing drainages upstream of the subsidence zone, precipitation for the upstream catchment and recharge in the upstream catchment.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-103.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	The "zero inflow rate" constraint is appropriate for preventing excessive recharge in the ridges above the subsidence zone so this part of the comment has been resolved. The response also confirmed that recharge is the only inflow to the groundwater model upslope of the subsidence zone. However, one of the other responses stated that at least part of East Cirque Cr is losing water to the groundwater system. Please describe how losing and gaining reaches within Central Cirque and East Cirque Creeks were distinguished based on field data or otherwise. Also, please provide the reason(s) for simulating the streams as only gaining reaches, especially considering that East Cirque Creek in the area of DH03-14 was interpreted as a losing reach. DH03-14 is the only monitoring location beside a creek and this location measures a downward gradient from the stream to the water table (based on the information provided in a response).	The response is provided in the memo **20161102_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater2**	4-Nov-2016
MEM-104	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Please provide a preliminary estimate of the time required for the groundwater divide to re-establish itself in the east-west ridge that separates the subsidence zone from Kemess South. Even if the groundwater divide is established, please comment on the potential for southward seepage if the water level in the subsidence zone builds faster than the groundwater divide in the ridge.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-104.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	Even if a groundwater divide is maintained in the ridge throughout mining, please provide the estimate of the time required for groundwater levels in the ridge to recover to post-closure equilibrium levels after mining is complete and the method used for developing this estimate. Please also address the second part of the comment related to water levels building faster in the cave zone than in the ridge.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-105	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	The Application stated unambiguously that a groundwater divide between the subsidence zone and Central Cirque Creek will be established after closure. However, this statement is based on an interpretation of recharge distribution that is loosely based and a groundwater model where the sensitivity to the recharge distribution has not been evaluated. Although the surface-water divide is clear, no piezometric data have been collected even under baseline conditions to verify that a groundwater divide exists currently. Please describe the basis for the definite statement in the Application.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-105.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	No recent groundwater level data were presented in the EA Application for the ridge that separates East Cirque Cr from Central Cirque Cr. Based on the discussion during the September 12 hydrogeology meeting, data from previously installed piezometers have recently been located that are reported to be consistent with the presence of a groundwater divide between Central Cirque Cr and East Cirque Cr. Please provide the following information: - an updated map that encompasses the headwaters of Central Cirque Cr and East Cirque Cr, and shows the locations of these old piezometers and all existing piezometers, and topographic contours - updated version of cross section F-F' (or similar) that shows the drill hole trace(s), piezometer completion zone(s) and groundwater level(s) - drill hole logs and completion details for the old piezometers - a table that summarizes the groundwater elevation data for the old piezometers. The sensitivity analysis was useful but was incomplete for two reasons: 1. all of the fundamental assumptions (especially including strong systematic decrease in hydraulic conductivity with depth and very strong orographic effect on recharge) underlying the groundwater model will bias the model to simulate a groundwater divide underneath each topographic divide; 2. the changes to the parameters would naturally emphasize the development of a groundwater divide e.g. recharge was increased more at high elevation than at low elevation. Additional sensitivity analyses may be requested pending the responses to this round of comments.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-105.2	30-Oct-2016	Hugh McCreadie, MEM	Effects and Mitigation	New piezometer nests will be required prior to any tunneling in or around the ridge between East Cirque and Central Cirque, and in the ridege between KUG and KS. (MA Permit Requirement)	AuRico acknowledges further discussion on the comment is deferred to permitting.	21-Dec-2016

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MEM-106	27-Jun-2016	Hugh McCreadie, MEM	Closure and Reclamation	The estimated pond/water table elevation in the subsidence zone is 1590m while the highest head contour shown for the groundwater divide between the subsidence zone and Central Cirque Creek is 1600m. This difference in elevation is probably well within the accuracy of the model and suggest that a groundwater divide does not necessarily separate East Cirque Creek from Amazay Lake. Please examine sensitivity scenarios that would test the uncertainty of the presence of this groundwater divide under post-closure conditions.	The response is provided in memo **20160812_KUG Comment MEM-106_memo.**	12-Aug-2016
MEM-106.1	22-Sep-2016	Hugh McCreadie, MEM	Closure and Reclamation	A key assumption underlying the model development and sensitivity analysis is the orographic effect on recharge. This effect is about 40 times larger than the proposed orographic factor of 5% per 100 m for total precipitation and a justification has been requested in a separate comment. The sensitivity scenarios increased the orographic effect, particularly above the subsidence zone, which would tend to further encourage the development of a groundwater divide. The comments on the quality of calibration are acknowledged. Regarding the baseflow aspect of model calibration, the baseflow targets may be too low because they are based on late-winter low flows. The current baseflow targets are equivalent to approximately 10% of 800 mm/yr (the average annual precipitation at 1600 m) on a catchment basis. Therefore, modelled baseflows that are, for example, 2 times higher than the current flow targets are reasonable (representing approximately 20% of MAP). Modelled baseflows that are, for example, as much as 3 times higher than the current flow targets are within the realm of possibility and worth considering in a sensitivity analysis. While this comment has been closed, further sensitivity scenarios may be requested pending the responses to other comments provided in this round.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-107	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	The K's assigned to the upper 100m of the numerical model appear to be 10 to 1000 times lower than the conceptual model (except for the fault). Please clarify whether this understanding is correct. If so, please describe the basis for this difference between the conceptual model and the numerical model.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-107.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	The response referred to the field data. However, the comment was referring to the conceptual model. For example, Figure 9.4-7 illustrates the conceptual model of hydraulic conductivity along Cross Section A-A', which is within the area of interest. The hydraulic conductivity assigned to the upper 100 m of the conceptual model ranged from 5e-7 to 1e-5 m/s, which is 10 to 1000 times higher than the numerical model. Please describe the basis for this difference between the conceptual model and the numerical model.	The reponse is provided in the memo **20161107_KUG_Comments_MEM_Hydrogeo_Lorax Memo3_Groundwater3.**	9-Nov-2016
MEM-108	27-Jun-2016	Hugh McCreadie, MEM	Closure and Reclamation	The solutions calculated by FEFLOW sometimes do not balance the inflow and outflow. Please provide a table for each version of the model that summarizes each component of boundary inflow and outflow, the total inflow and outflow, and the percent flow balance error. These models will include steady state baseline, transient baseline and mine model. This summary will provide fundamental information on the integrity of the model solution.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-108.1	22-Sep-2016	Hugh McCreadie, MEM	Closure and Reclamation	Agreed that the flow balance errors of 0.0% to 0.1% are acceptable.	The proponent thanks the reviewer for the feedback.	28-Oct-2016
MEM-109	27-Jun-2016	Hugh McCreadie, MEM	Closure and Reclamation	The decline and gallery nodes were assigned a zero pressure head condition to represent the construction and operation phases of mining. Please describe the boundary conditions that were used to represent the post-closure phase, and provide a corresponding plan and cross section that illustrates the boundary conditions in the mine area.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-109.1	22-Sep-2016	Hugh McCreadie, MEM	Closure and Reclamation	The response indicated that boundary conditions under post-closure conditions included recharge and creeks. However, the discussion during the September 12 indicated that a specified head boundary was assigned at the decline portal to simulate leakage from the decline. Please confirm.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-110	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Please clarify the potential risk level that the subsidence zone could break back into Central Cirque Creek, and the basis of this evaluation in the context of the field performance of subsidence zones at other mines. If the subsidence zone extends to Central Cirque Creek, how is the interpretation of post-closure groundwater flowpaths affected?	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-110.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	An update to the post-closure groundwater effects assessment based on the actual breakback of the subsidence zone will likely be required at mine closure.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-111	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	The Application concluded that only subsidence zone K and porosity are Type IV parameters (sensitive with respect to predictions but insensitive with respect to calibration, and therefore poorly constrained). However, the intact rock K and storage are probably also Type IV. The sensitivity of the model with respect to the distribution of recharge was not assessed. The recharge distribution is likely also a Type IV parameter. Please assess the sensitivity of recharge distribution with respect to calibration and predictions.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-111.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	The geographical distribution of recharge was varied in the sensitivity analysis by increasing the intensity of the orographic effect but the exceptionally large orographic effect was always maintained. Further sensitivity evaluation may be requested pending the responses to this round of comments.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-112	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Partial failure of the decline plug could cause the water level in the subsidence zone to be somewhat depressed, there-by generating a long-term source of metal loading that may discharge from the decline. Please complete some preliminary simulations that would assess the degree of failure required to generate this condition.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-112.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	See MEM-101.	Please refer to response to MEM-101.1.	28-Oct-2016
MEM-113	27-Jun-2016	Hugh McCreadie, MEM	Closure and Reclamation	The water table profile and piezometric contours along primary groundwater flowpaths are needed to understand and evaluate the interpretation of post-closure groundwater flowpaths. Please illustrate the modelled water-table profile and piezometric contours on cross sections A-A', B-B' and C-C' for post-closure conditions. Please also illustrate the same information on cross sections that are perpendicular to A-A', B-B' and C-C' at appropriate locations.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-113.1	22-Sep-2016	Hugh McCreadie, MEM	Closure and Reclamation	Please show the decline plug on Section A-A' Please explain why the flow lines are not concentrated in the shallow, high-permeability horizon?	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-114	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Please present a contingency plan to cover the possibility that the decline plug does not perform as expected.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-114.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	The response referred to "excess seepage" from the portal. The contingency plan is intended to handle any and all post-closure seepage from the portal. It's understood that a contingency plan is being provided in response to discussion during the September 8 Working Group Meeting.	The comment is acknowledged. Details on conceptual contigency measures for post-closure flows from the portal are provided in memo '**20161109_A.1 KUG_Action Item#2_Sept 8 2016_Declines Closure Water Mgmt_Memo**'.	10-Nov-2016
MEM-115	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Please describe the reasoning that was used to rule out a preferential groundwater flowpath from Amazay Lake to the subsidence zone.	A review of the detailed geology map of the area (Daikow, 2001) indicates that there are no mapped faults connecting Amazay Lake to the underground development; therefore, there is no reason to infer a highly permeable pathway connecting the two. Observation nodes were activated along the margin of Amazay Lake (Figure 6.1.4 of Appendix 9-B) and no head changes were observed at these nodes (Figure 6.1-7 of Appendix 9-B). The groundwater model simulates a groundwater divide separating East and Central Cirque Creek drainages through all stages of mine life, which hydraulically isolates Amazay Lake from the development. Diakow (2001): Geology of the Southern Toodoggone River and Northern McConnell Creek Map Areas, North-central British Columbia (Parts of NTS 94E/2, 94D/15 and 94D16); B.C. Ministry of Energy and Mines , Geoscience Map 2001-1, 1:50 000 scale.	19-Aug-2016
MEM-115.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	The results of geological mapping are influenced by the mapping objectives and the mapping by Daikow (2001) would not have been looking for groundwater flowpaths. Therefore, while the value of the mapping by Daikow is acknowledged, the strong assertion "there is no reason" to infer a permeable pathway seems a little overstated. At permitting, a requirement may be included related to geological mapping pertaining to preferential flowpaths. The absence of model response in the observation nodes on the margin of Amazay Lake would be expected because those nodes are adjacent to a head boundary. The issue of groundwater divides simulated by the model is addressed elsewhere.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-116	27-Jun-2016	Hugh McCreadie, MEM	Closure and Reclamation	The decline might be expected to cause water-table drawdown in the ridge during the life of mine. Please explain why the hydraulic head contours in these figures do not seem to be influenced by the decline down-gradient of the plug.	During the period of decline and gallery construction, and during the mining phase, the declines are expected to depressurize surrounding rock and cause localized dewatering near the portals. Following installation of the plugs and mine reflooding, hydraulic heads are expected to recover close to initial conditions, except in the local vicinity of the cave zone where the hydraulic gradient is expected to be flattened and somewhat lower than initial conditions. Figures 6.2-5 to 6.2-7 (Appendix 9-B) illustrate particle tracking for the post closure condition with plugs situated at two locations (near portals and approximately half way along the declines). Under post closure conditions, hydraulic head contours are not expected to be distorted near declines as they are not acting to depressurize the rock. Figures 7.4-1 and 7.4-2 (Appendix 9-B) show particle tracking for two post closure cases where the subsidence zone is much larger than predicted by the geomechanical model and for a hypothetical fault between the cave zone and Amazay Lake. Again, under post closure conditions, the declines are not expected to cause distortion of the head contours as they are not acting to depressurize or dewater the rock.	19-Aug-2016
MEM-116.1	22-Sep-2016	Hugh McCreadie, MEM	Closure and Reclamation	Further responses related to this comment will be covered by MEM-101.	Please refer to response to MEM-101.1.	28-Oct-2016
MEM-117	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Please clarify whether the reflooding time was estimated with a groundwater model simulation.	The reflooding time was calculated using the groundwater model and calculations carried out using a spreadsheet. When the model is run in transient mode to simulate reflooding of the mine, significant computational time was required near the end of reflooding when gradients were close to equilibrium, but not at steady state. For this reason, the inflow rates were determined from the model that were representative between different reflooding elevations. A separate spreadsheet was used to generate a relationship between cumulative void volume in the cave zone vs elevation. The reflooding time was then calculated using the inflow rates and cumulative void volume relationships.	19-Aug-2016

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MEM-117.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	The response seems to suggest that inflow rates at successive "reflooding" elevations were calculated with a steady state version of the groundwater model. Then a spreadsheet that accounted for the void volume of the cave zone was used to calculate the transient inflow rate. Please confirm. If this is the case, please clarify how storage in the surrounding country rock was handled e.g. assumed to be insignificant and therefore excluded from the calculation? If so, please provide a quantitative justification.	The response is provided in the memo **20161102_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater2**	4-Nov-2016
MEM-118	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Calibration statistics were calculated with the full range of groundwater elevations across a very high mountain range. As such, the range of observed heads was very large and the calibration statistics verify only that the hydraulic gradients in the groundwater model are generally consistent with the topographic gradients, which is a foregone conclusion because the boundary conditions were assigned to be consistent with the topographic gradients. Calibration statistics that assess the fit of the model to observed data in proximity to the subsidence zone would be useful but only one pair of monitoring wells has been installed in this area. Future versions of the model will require localized targets so that its ability to predict groundwater flowpaths can be assessed more easily.	The comment is acknowledged. The monitoring plan outlined in Appendix 9-D makes provisions for additional monitoring well installations in the subsidence area which will be used to validate the groundwater model.	19-Aug-2016
MEM-119	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	The Application stated that the intact bedrock K is "well constrained" by the baseline model calibration. However, considering the sparse database of groundwater levels and low-flow streamflow measurements for such a large area, and considering that the baseline model was steady state, the bedrock K remains relatively uncertain. This uncertainty is likely acceptable at the EA stage but should be acknowledged. The groundwater model will require updating during operations with an improved estimate of bedrock K that results in a reasonable match to the transient piezometric response to dewatering.	Under Section 8.2 of modeling report (Appendix 9-B), data limitations and uncertainties are acknowledged. The monitoring program outlined in Appendix D calls for monitoring of water levels, creek baseflow and undergound inflows which will be used to evaluate model predictions and update the model where warranted.	19-Aug-2016
MEM-120	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	MEM will require that the groundwater model be updated during operations to improve the history matching to the transient piezometric response and decline flows caused by mine development, and to measured low-flow streamflows. Updates to predictions of the potential post-closure effects will also be required.	The comment is acknowledged. See also response to MEM-119.	19-Aug-2016
MEM-121	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	MEM will require an expanded network of low-flow monitoring stations to expand the conceptual understanding of groundwater recharge and discharge, and to be used as targets in the history matching of the model.	The comment is acknowledged. It is anticipated during Permitting that baseflow monitoring requirements will be determined.	19-Aug-2016
MEM-122	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	The water quality model relies heavily on the hydraulic plug proposed for the decline. Even when underground plugs are designed and installed according to state of practice, some seepage can be anticipated around the plug. Please provide examples of plugs that have worked in environments with similar head and similar rock type, including their age, the pressure head behind the plug and the seepage rate.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-122.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	Of the four examples provided in the bullet list, only one included information on the actual performance of the plug. However, the five examples provided in Table 122-1 were thoroughly documented.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-123	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	The most permeable flowpath in LSA2 is likely in proximity to the bedrock-overburden contact. Please confirm whether the final water level in the KUG TSF is below the bedrock-overburden contact at all locations around the pit perimeter, and by how much.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-123.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	The most permeable flowpath in Kemess South may be the bedrock-overburden contact. if the pit lake is high enough to saturate the bedrock-overburden contact along a portion of the pit wall, loading and seepage may be considerably higher than a pit lake below the bedrock-overburden contact. Six of the eight drill holes listed in Table 123-1 have bedrock elevations that are close to or below 1270 m. Three drill holes located near the southern pit rim appear to locate bedrock at an elevation of 1270 m (Figure 126-2), which is the same as the expected post-closure water level in the KUG TSF. Considering this information, please clarify why the response indicates that the water level will be below the bedrock-overburden contact along the south wall?	The response is provided in the memo **20161102_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater2**	4-Nov-2016
MEM-123.2	30-Oct-2016	Hugh McCreadie, MEM	Effects and Mitigation	The uncertainty in final pond elevation and the bedrock elevation in the pit wall suggest that the pond has a reasonable chance of saturating the overburden-bedrock contact for at least a portion of the pit. Down-gradient groundwater monitoring will be required in several locations at the overburden-bedrock contact. A geophysical survey is required to better define the bedrock surface.	AuRico acknowledges the comment.	21-Dec-2016
MEM-124	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	The groundwater flow system between the KUG TSF and Kemess Creek was characterized as an equivalent porous medium. This approach may be reasonable on the scale of this flow system. However, please clarify the basis for concluding that preferential pathways along faults and/or concentrated fracture zones were not significant. For example, mapping the pit walls, geophysical surveys, review of the geological model for the open pit, etc.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-124.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	Thorough response. A detailed monitoring program that includes the area south of KUG TSF will be required at permitting.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-125	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Considering that water-supply well WQ-CW1 seems to be completed in the bedrock with a well yield of 60 US gpm, and that effects from the PAG waste rock were observed at WQ-CW (also possibly completed in bedrock?), the hydraulic conductivities assigned to the upper two bedrock horizons in the groundwater model ($1x10^{-7}$ and $5x10^{-8}$ m/s) seem quite low. Please comment on whether these hydraulic conductivities seem reasonable in the context of these two observations.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-125.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	The portion of the response that documented the pumping history, pumping data and data gaps was very thorough. Also, the inadequacy of the available data for a quantitative evaluation of hydraulic conductivity based on pumping history and/or the pumping test is acknowledged. At permitting, the reasonableness of the hydraulic conductivities assigned to the model should be evaluated by simulating the operation of the pumping well to verify that a credible water-level response is generated.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-126	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Please provide the following information for LSA2 to help with understanding the shallow groundwater system: 1. contours of the interpreted bedrock surface, 2. contours of the interpreted overburden thickness, and 3. mapping of the overburden in the pit walls, if available.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-126.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	All information was provided as requested. The most permeable flowpath in Kemess South may be the bedrock-overburden contact. if the pit lake is high enough to saturate the bedrock-overburden contact along a portion of the pit wall, loading and seepage may be considerably higher than a pit lake below the bedrock-overburden contact. Pit-wall mapping of the elevation of the bedrock-overburden contact in the pit wall around the pit perimeter, particularly along the south and east walls, will be required at permitting.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-127	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	An effective porosity of 0.001 was assumed for estimating travel times from the south wall of the KUG TSF to the water supply well and Kemess Creek. However, the transport porosity of the bedrock is relatively uncertain, particularly in the absence of any field measurements. The factor of 2 that was applied to the sensitivity analysis seems optimistically small. Please justify this relatively small range or update the upper and lower bound estimates of transport porosity, and the corresponding travel times.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-128	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	The seepage estimate from the KUG TSF is best interpreted in the context of baseflow measured at station WQ-01. The Application stated that the seepage rate was small compared baseflow at WQ-01 but field measurements could not be located in Table 8 of Appendix C of Appendix 10-A nor Table E-2 of Appendix E of Appendix 10-A. Please indicate where these flow measurements are presented in the Application or provide this information if it is not currently included in the Application.	Field measurements for WQ-01 for the period of baseline study (i.e., to end 2013) are reported in Appendix 10-A (Baseline Hydrology Study), Appendix E.1. Rating Curve Data Tables, Table E.1-2: Stage-discharge measurements for Kemess South (2008-2013). Site- and regional annual low flow data are also discussed in Chapter 10 Surface Hydrology (VC Report) and the reader is referred specifically to Section 10.4.4.4 of the document. With respect to WQ-01, annual low flow data is summarized from multiple sources (i.e., spot measurements, continuous measurements, 2015 winter low flow survey, synthetic record) in Table 10.4-9, Annual Low Flow Summary for Project hydrometric Stations (L/s/km2).	19-Aug-2016
MEM-128.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	At permitting, please include Kemess Creek and Waste Rock Creek in the low-flow streamflow measurement program to develop a database of low flows to better characterize the hydrogeological regime for the purpose of the effects assessment of Kemess South.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-129	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Please clarify whether any geophysical surveys were completed between the KUG TSF and Kemess Creek to help with interpolating the overburden-bedrock contact between drill holes.	Ground geophysical surveys have not been conducted between the KUG TSF and Kemess Creek.	19-Aug-2016
MEM-129.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	At permitting, a geophysical survey to delineate the bedrock surface may be required.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
MEM-130	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	MEM may require development of a 3D groundwater model of the area surrounding the KUG TSF during the operations phase of the mine.	This comment will be addressed at the permitting stage.	12-Aug-2016
MEM-131	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Please provide a plan that illustrates the expected reach of Kemess Creek where seepage from the KUG TSF is expected to discharge so that the area of potential effect is clear. Please also clarify whether the creek has fish habitat along this reach.	The response is provided in memo **20160819_KUG_Comments_MEM_Hydrogeo_Clarification_Permitting_Lorax_Memo**	19-Aug-2016
MEM-132	27-Jun-2016	Hugh McCreadie, MEM	Cumulative Effects Assessment	The Application stated that "the KS TSF has had little to no effect on groundwater quality downgradient of the dam owing to operational mitigation measures" and that "seepage from the KS TSF … quickly reports as surface flow downgradient of the dam.". However, apparently no monitoring wells are installed down gradient of the KS TSF. Please clarify how the groundwater quality is being evaluated, and the basis for concluding that seepage quickly reports as surface flow.	The response is provided in memo **20160819_KUG_Comments_MEM_Hydrogeo_Clarification_Permitting_Lorax_Memo**	19-Aug-2016
MEM-132.1	22-Sep-2016	Hugh McCreadie, MEM	Cumulative Effects Assessment	The response confirmed that no data are available to characterize the groundwater quality. The water quality samples from the Seepage Recovery Pond would mostly reflect the surface runoff into this pond. Samples from Kemess South Creek would also mostly reflect surface runoff. Furthermore, groundwater discharge to Kemess South Creek is inferred and no data are available on the location of discharge. Therefore, it does not appear that there is data available on the quality of groundwater seepage from the KS TSF.Therefore, please clarify how the impact of KS TSF seepage on groundwater quality is being evaluated for the KUG EA.	The response is provided in the memo **20161021_KUG_Comments_MEM_Hydrogeo_Lorax Memo_Groundwater**	28-Oct-2016
MEM-132.1	30-Oct-2016	Hugh McCreadie, MEM	Cumulative Effects Assessment	The quality of seepage from the KS TSF has a bearing on cumulative impacts. Two monitoring wells are recommended down-gradient of the KS TSF to verify the quality of the seepage from the KS TSF and reconcile the quality of that seepage against low-flow water quality at the next stream monitoring station. These wells may not require long-term monitoring.	AuRico acknowledges the comment.	21-Dec-2016
MEM-133	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Please clarify whether the monitoring wells installed at the waste rock dump (GW-05S, 06S and 15S) were completed within the waste rock or within the foundation of the waste rock dump (information not available in Table 9.4-2).	The response is provided in memo **20160819_KUG_Comments_MEM_Hydrogeo_Clarification_Permitting_Lorax_Memo**	19-Aug-2016
MEM-134	27-Jun-2016	Hugh McCreadie, MEM	Effects and Mitigation	Residual groundwater effects in LSA2 were described as not significant because the resultant loading to Kemess Creek is minor. Please provide a reference where the water quality effect on Kemess Creek due to groundwater loading was evaluated using the water quality model.	Potential effects to Kemess Creek from groundwater is considered in the predictive water balance and water quality model (assessment node: WQ-01; Appendix 11-D). Water quality model predictions in turn supported the effects assessment for surface water quality and related value components (VCs). Groundwater pathways to Kemess Creek incorporated in the model are discussed Section 2.2.3 of Appendix 11-D; the corresponding source term representing geochemical loading from seepage as well as associated water quality predictions are discussed in Section 3.2.3 an Section 3.5 of Appendix 11-D.	5-Aug-2016
MEM-134.1	22-Sep-2016	Hugh McCreadie, MEM	Effects and Mitigation	These references provide only the results of the water quality model. Please provide a table that summarizes the following average monthly values for water quality nodes WQ-01 and Waste Rock Creek to Attichika, respectively: - groundwater seepage rate from KUG TSF - groundwater seepage concentration from KUG TSF for each parameter of interest - groundwater loading for each parameter of interest - surface water runoff - background surface water concentration for each parameter of interest - background surface water loading for each parameter of interest - flow rate of discharge from KUG TSF - concentration of KUG TSF discharge for each parameter of interest - loading from KUG TSF for each parameter of interest Check p. 2-7 and Table 2.2.6 of Appendix 11-D	The reponse is provided in the memo **20161007_KUG Comment MEM-134.1_Clarification_Memo.**	19-Oct-2016
MEM-134.2	30-Oct-2016	Hugh McCreadie, MEM	Effects and Mitigation	The Round 2 comment was intended to have the requested information in a reviewable format rather than assembling the information from multiple sources in the Application, as suggested in the Round 2 response. Please provide the information in a summary table as requested in the original Round 2 comment.	The response to this comment was provided partially in memo 20161007_KUG Comment MEM-134.1_Clarification_Memo, the rest of the information is available within the EAC Application, nofurther response required.	21-Dec-2016
MEM-135	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Please describe the reasoning for excluding the existing monitoring wells between KUG TSF and Kemess Creek from the groundwater monitoring plan.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-135.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	Several drill holes appear to indicate that the bedrock elevation in the southern pit wall is at or near the elevation of the post-closure pit-lake water level (see MEM-123). At permitting, the proposed groundwater monitoring program proposed should include the rationale for the depths of proposed monitoring zones, including bedrock vs. bedrock-overburden contact vs. overburden in Kemess South.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-135.1	30-Oct-2016	Hugh McCreadie, MEM	Water (Ground)	The uncertainty in final pond elevation and the bedrock elevation in the pit wall suggest that the pond has a reasonable chance of saturating the overburden-bedrock contact for at least a portion of the pit. Down-gradient groundwater monitoring will be required in several locations at the overburden-bedrock contact. A geophysical survey is required to better define the bedrock surface. (MA Permit Requirement)	AuRico acknowledges further discussion on the comment is deferred to permitting.	21-Dec-2016
MEM-136	27-Jun-2016	Hugh McCreadie, MEM	Closure and Reclamation	MEM will require an updated groundwater monitoring plan that includes several components in addition to those included in Appendix B of the Lorax memo dated April 21, 2016.	This comment will be addressed at the permitting stage.	12-Aug-2016
MEM-137	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	A site-wide water balance that incorporates both groundwater and surface-water components is an integral step in confirming that the interpreted groundwater flow and recharge rates are consistent with the overall hydrological regime. Considering that synthetic hydrographs were generated to represent streamflow in most of the catchments, it's not clear that a hydrological model was developed to enhance the understanding of groundwater-surface-water hydrology in LSA1. Please clarify.	The response is provided in memo **20160812_KUG_Comments_MEM_Hydrogeo_Lorax Memo.**	12-Aug-2016
MEM-137.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	At permitting, improved monitoring of low-flow streamflows, precipitation and snowpack may be required.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-138	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Please provide tables or references to tables that summarize the monthly flows of each component of the site-wide water balance, including groundwater flows and storage, for KEM-03, KEM-07, WQ-01 and Waste Rock Creek.	Please note that the GoldSim model (Appendix 11-D) is a surface runoff model (not an integrated surface-groundwater model), and focuses on reliably predicting total runoff (i.e., sum of overland and subsurface flow including groundwater discharge). Given this well-known limitation of surface runoff models in distinguishing surface and subsurface components of flow, wherever potential contact groundwater discharge could occur in the Project area (e.g., contact water seepage into East Cirque Creek, seepage from KUG TSF into Waste Rock Creek), these groundwater components are imported from the groundwater model (Appendix 9-B) into the surface water model (Appendix 11-D). As discussed in Section 2.3 of Appendix 11-D, two types of watersheds exist within the Project area: • At WQ-13, KEM-01, KEM-02, KEM-03, KEM-04, KEM-07, and Attycelley d/s East Cirque, flows were based on synthetic time-series for total runoff. Components of total runoff (i.e., overland flow and groundwater discharge cannot be distinguished for these watersheds. However, when contact groundwater discharge occurs (i.e., in case of contact groundwater seepage into East Cirque Creek during Post-Closure), the contact water component, which is the output of groundwater model (Figure 2.2-5 in Appendix 11-D) is given a load different from baseline load. • At WQ-01, WQ-03, WQ-04, WQ-05, and Waste Rock Creek, flows were based on the precipitation-runoff module. For these watersheds, total runoff (i.e., sum of overland flow and groundwater discharge) was calibrated to observed runoff (Section 2.2.3 in Appendix 11-D). Individual overland and subsurface components of modelled total runoff may not be as robust as modelled total runoff values which show a strong match with measured values (Section 2.2.3 in Appendix 11-D). When contact seepage occurs, the contact water component, which is the output of groundwater model (e.g., 1.7 L/s seepage from KUG TSF into Kemess Creek, and 0.3 L/s seepage from KUG TSF into Waste Rock Creek)) is given a load different from baseline load.	5-Aug-2016
MEM-138.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	Please provide summary tables or references to summary tables in the Application that summarize the monthly flows of each component of the water balance for each relevant catchment (at least KEM-03, KEM-07, Waste Rock Creek and WQ-01).	Monthly flow predictions for WQ01, KEM03, and KEM07, including the base case and sensitivity cases, under the No-KUG and With-KUG conditions are provided in Tables A1-1, A1-8, and A1-11 of Appendix 11-D of the Application. As mentioned in the original response to Comment MEM138, at KEM-03 and KEM-07, runoff was not calculated in the water balance model. Rather, it was directly imported from the synthetic time-series for total runoff that are presented in A1-8 and A1-11 of the Appendix 11-D of the Application. At WQ01, the precipitation-runoff module within the water balance model was used to predict runoff. Components of base case predicted runoff at WQ01, under the With-KUG and No-KUG conditions, are provided in Tables B-1 and B-6, and Figures A-7 and A-12 of a memorandum prepared for the Tse Key Neh (20160805_KUG Comment TKN-064,066_Water Balance_Memo.)	28-Oct-2016
MEM-139	27-Jun-2016	Hugh McCreadie, MEM	Water (Ground)	Figure 2.3-2 illustrates the conceptual precipitation-runoff module. Please clarify whether "total runoff" includes or excludes groundwater discharge, and whether "To_GW" is simply groundwater storage or includes groundwater discharge to a stream node and groundwater bypassing a stream node.	Total flow includes both overland runoff and groundwater discharge. "To_GW" is equivalent of storage. Please note that the GoldSim model (Appendix 11-D) is a surface runoff model (not an integrated surface-groundwater model), and focuses on reliably predicting total runoff (i.e., sum of overland and subsurface flow including groundwater discharge). Given this well-known limitation of surface runoff models in distinguishing surface and subsurface components of flow, wherever potential contact groundwater discharge could occur in the Project area (e.g., contact water seepage into East Cirque Creek, seepage from KUG TSF into Kemess Creek, and seepage from KUG TSF into Waste Rock Creek), these groundwater components are imported from the groundwater model (Appendix 9-B) into the surface water model (Appendix 11-D)	5-Aug-2016

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MEM-139.1	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	Please confirm that "Total flow" referenced in the response is the same as "total runoff" referenced in Figure 2.3-2. The conceptual model shows water going into groundwater storage but no water being released from groundwater storage. Please explain if this was intended or does the model allow for groundwater outflow from storage? If the model does not allow for groundwater outflow from storage, please justify.	Yes, "Total flow" is the same as "total runoff" referenced in Figure 2.3-2 of Appendix 11-D. The reviewer is correct - in the GoldSim model, water is released from groundwater storage into Total Runoff. In fact, "Slow Flow" in Figure 2.3-2 is a function of groundwater storage.	28-Oct-2016
MEM-140	12-Jul-2016	Liz Murphy MEM	Terrain and Soils	Section 12.5.3.1 Key Mitigation Approaches states that " reclamation: re-establishing appropriate composition, structure, pattern, and ecological processes necessary to make systems sustainable, resilient, and healthy under current and future conditions" will be implemented to mitigate for the VC Soil Quality and Quantity. As reclamation is listed specifically as mitigation for this VC more details regarding reclamation should be provided in order for reviewers to evaluate the liklihood of mitigation success. MEM suggests that the mitigation proposed would be strengthened by providing more detailed supporting information/examples of reclamation work that has successfully mitigated project effects on terrain stability, soil quality and quantity at the KS site.	During reclamation planning and application at Kemess South, an emphasis was placed on the use of native species and the promotion of successional processes. The Kemess South revegetation monitoring program was established to document species composition and vegetation cover over time in areas where reclamation efforts have been applied. Since the monitoring program was established in 2011, there has been a documented increase in vegetation cover and number of plant species in all of the reclamation units assessed. Please refer to the 'Kemess South 2014 Revegetation Monitoring Report' for more information and examples of reclamation work that has been performing well. EDI. 2015. Kemess South Mine 2014 Revegetation Monitoring. Prepared for AuRico Gold by Environmental Dynamics Inc. January 2015.	5-Aug-2016
MEM-140.1	28-Sep-2016	Liz Murphy MEM	Terrain and Soils	The supporting information provided is appropriate. The permitting process will require more details regarding how the information directly relates to the new disturbance areas, specifics on how the metrics measured are intended to assess the success of the reclamation programs for addressing the reclamation standards/objectives for both the KS and KUG sites.	AuRico acknowledges further discussion on the comment is deferred to permitting.	28-Oct-2016
MEM-141	12-Jul-2016	Liz Murphy MEM	Terrestrial Ecology and Wildlife Habitat	Details of reclamation monitoring and subsequent contingency planning would strengthen the position that reclamation will mitigate effects as proposed. Risk and contingency information with regard to reclamation was not found. Please comment on specific contingencies for Valued Components in which successful reclamation is listed as mitigation. This includes commenting on the probability of reclamation success and specifically how success of reclamation will be measured for Valued Components.	Restoration measures identified as mitigation for valued components in Chapter 13 Terrestrial Ecology include: • exposed soil surfaces will be progressively re-vegetated during the appropriate growing season and conditions using seeds (and/or plants) suitable for the local area and ecosystems to avoid erosion and sedimentation, introduction of invasive plants, and to facilitate the re-establishment of ecological functions in the affected areas; and • monitoring of reclaimed areas will be conducted periodically to ensure they are re vegetated 1) with seeds (and/or plants) suitable for the local area and ecosystems; 2) during the appropriate growing season and conditions to ensure maximum survival rate and to avoid establishment of invasive plants; and 3) to facilitate the re-establishment of ecological functions and their associated attributes (e.g., species diversity and productivity). Aurico has extensive reclamation experience based on their Kemess south reclamation activities and will use this to develop practical and successful reclamation plans and planting prescriptions (Northgate 2010). Based on their extensive experience regarding planting success of various species, Aurico will identify the level of risk associated with re-establishing the prescribed vegetation in each treatment unit (TU). The calculation of risk will include the consideration of the environmental consequences associated with that particular TU, such as slopes (increased sedimentation), proximity to watercourses and other environmental values. The likelihood of revegetation success will be based on past experience and informed through the ongoing monitoring of revegetation. In areas where risk is moderate or high additional contingency measures will be identified. For example in a TU on steep slopes located above an environmentally important feature with site conditions such as dry soil moisture regimes or south facing slopes where revegetation could be problematic, reclamation activities will include additional contingency measures be included in the prescriptions. Contingency measures would include: • greater amounts of CWD application to reduce erosion and provide microsites for plant establishment; • creation of micro-sites using soil pockets (imported soil suitable for plant establishment and survival) in rocky soils; • supplemental fertilizer applications when plant foliar nutrient concentration testing or visual signs of deficiency are noted; • in-fill planting where plant density goals or cover are not achieved (as defined in the final reclamation prescriptions); • application of additional growing medium when plant survival is below acceptable thresholds (as defined in the final reclamation prescriptions); • employing bioengineering such as live staking and construction of wattle fences in areas where erosion is problematic and site conditions are suitable; • recountour or re-roughen slopes where soil erosion rates exceed acceptable rates or revegetation success indicates this as required; and • application of organic soil stockpiles to help improve soil conditions. *Continued below*	5-Aug-2016
MEM-141	12-Jul-2016	Liz Murphy MEM	Terrestrial Ecology and Wildlife Habitat		*Continued from above* Reclamation Success for VegetationT arget planting densities and habitat characteristics criteria will be identified to guide reclamation planning for permitting. These criteria will provide clear end goals for assessing reclamation success; however, it is recognized that the targets will not be met over the short-term in many cases, due to the time required to establish ecological functions necessary to support the target densities. The assumption is that as vegetation communities and structural elements converge on the targets for each TU, the related functional characteristics will also be met. To identify if reclaimed areas are converging with the targets for each TU, monitoring criteria will be used to identify the trends of successional indicators. For example, monitoring of vertebrate species richness, mycorrhizal colonization rates, soil and vegetation nutrient concentrations, and vegetation composition, biomass and productivity will provide important indications of long-term productivity and successional pathways. These indicators will help identify if nutrient cycles are being established and biochemical functions restored. Indicator data will be used to evaluate trends in biodiversity that will help determine if reclaimed areas are becoming more diverse (colonization and establishment of native species), stagnating, or losing diversity after planting. Where negative trends are identified, the monitoring criteria will provide data to identify potential causal factors, which can be used to adapt reclamation practices to help meet reclamation and end land use goals. Benchmark sites will also be used to compare reclaimed and undisturbed ecosystems to identify convergence of ecosystem characteristics such as species composition and restoration of ecological functions. Establishing monitoring plots in areas where undisturbed and reclaimed areas abut will help identify which native species are colonizing edge areas. This will inform reclamation practices and identify additional species for seeding or planting if required. Monitoring of these areas will also provide insight into the long-term successional pathways of reclaimed ecosystems and help identify if reclamation practices will lead to convergence with TU targets and meet the end land use objectives. Wildlife habitat and agriculture end land use and capability objectives will be assessed through monitoring of the development of habitat characteristics, wildlife use, and grassland productivity and will be built into key management plans which will be updated for the closure and reclamation, including the Wildlife Management and Vegetation Management Plan. *Continued below*	5-Aug-2016
MEM-141	12-Jul-2016	Liz Murphy MEM	Terrestrial Ecology and Wildlife Habitat		*ontinued from above* Monitoring activities related to achieving end land use and land capability objectives will include: • photo point monitoring at specified locations across multiple years to track changes to vegetation composition; • long term transects for assessing vegetation biomass (above and below ground), species composition, and spatial characteristics in both reclaimed and native undisturbed sites (to identify degree of convergence); • mapping of connectivity between native undisturbed sites and reclaimed lands (biodiversity functions; • mapping of reclaimed areas, including treatment types and assessments of reclamation success based on monitoring results; • foliar nutrient and metal concentration in forage species (assessment of biochemical functions); • soil assessments to identify soil profile development on reclaimed sites (biochemical functions); • assessments of mycorrhizal fungal colonization rates for planted and seeded species (biochemical functions); • visual surveys of vertebrate species on reclaimed sites and the habitat features they are associated with to identify changes in species richness and habitat use over time (biodiversity and habitat functions); • rangeland health and productivity assessments (biochemical functions); and • weed and invasive plant monitoring and control measures. The results of the monitoring programs will inform changes in approach to adaptively manage reclamation strategies to meet end land use objectives. An assessment of any emerging negative trends and probable causes will be completed, and strategies to address these will be developed. Monitoring frequency will be annually for the Decommissioning and Closure phase (5 years) and continue during the Post Closure phase for a further 5 years. At the conclusion of this 10 year monitoring period, it has been assumed that closure objectives will be attained and monitoring activities will be discontinued. However, monitoring will continue until objectives are met post the 5 year post closure phase as required. All monitoring activities, results, and recommendations will be reported in the annual reclamation plan.	5-Aug-2016
MEM-142	12-Jul-2016	Liz Murphy MEM	Terrain and Soils	Table 12.5-1. Screening of Project Effects on Terrain and Soil Valued Components lists ' loss of soil under component footprint' as a potential effect of the project on this VC. The Soil Handling Management Plan (Section 24.13) indicates that all salvageable soil will be salvaged. Please explain the areas where soil is expected to be lost under component footprints. Please also explain limitations for salvage in these areas.		5-Aug-2016
MEM-143	12-Jul-2016	Liz Murphy MEM	Reclamation and Closure	Section 6.3 CLOSURE PLAN SCOPE AND OBJECTIVES states "The scope of the RCP includes new disturbances that will be created by the Project and does not incorporate the areas described in the Reclamation and Closure Plan for the KS Mine (Figure 6.3-1). The closure of existing infrastructure (process plant, camps, and ancillary infrastructure) will be consistent with the closure and reclamation plans described in the KS Reclamation and Closure Plan (Northgate 2010) and are not repeated in this chapter. With the exception of the KS open pit which is to be used as the KUG TSF, all other existing infrastructure to be utilized for the KUG Project are likewise covered under the KS Mine Reclamation and Closure Plan." While a focus on the effects of new disturbance may be appropriate for EA purposes, the Mines Act permit application will be required to include a site wide reclamation and closure plan that incorporates both KS and KUG reclamation and closure. In addition, AuRico should provide for EA review monitoring results of reclamation conducted on KS to demonstrate the reasoning behind future reclamation proposed to mitigate effects of the KUG project.	• photo point monitoring at specified locations across multiple years to track changes to vegetation composition;	5-Aug-2016

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MEM-144	12-Jul-2016	Liz Murphy MEM	Reclamation and Closure	Section 6.6.1 of the Reclamation and Closure Plan states "The existing closure and reclamation plan for the KS Mine will complement the reclamation and closure plan for the KUG Project." If details of the Northgate 2010 plan are referenced in the site wide plan, specific sections and page numbers should be included.	• long term transects for assessing vegetation biomass (above and below ground), species composition, and spatial characteristics in both reclaimed and native undisturbed sites (to identify degree of convergence);	5-Aug-2016
MEM-145	12-Jul-2016	Liz Murphy MEM	Reclamation and Closure	Section 6.4.4 Soil Balance states that "Overburden for KUG TSF reclamation will be available from stockpiles OB1, OB4 and OB5 which are located close to the KS Pit and estimated at more than 2,800,000 m3." How will the use of this material for KUG reclamation effect the reclamation planning for KS? That is, are these stockpiles excess to the needs of KS reclamation? Please note that the site wide reclamation and closure plan required at permitting will require an analysis of soil balance for KS and KUG end land use and land capability requirements.	• mapping of connectivity between native undisturbed sites and reclaimed lands (biodiversity functions;	5-Aug-2016
MEM-146	12-Jul-2016	Liz Murphy MEM	Wildlife and Habitat	Please note that a new (2016) document entitled Best Management Practices for Bats in British Columbia is available and contains BMPs for mining: http://a100.gov.bc.ca/pub/eirs/viewDocumentDetail.do?fromStatic=true&repository=BDP&documentId=12460. Consideration of how these BMPs will be applied to the Project are required in the Mines Act permit application.	• mapping of reclaimed areas, including treatment types and assessments of reclamation success based on monitoring results;	5-Aug-2016
MEM-147	12-Jul-2016	Liz Murphy MEM	Terrain and Soils	The conceptual Sediment and Erosion Control Plan provided in Section 24 Environmental Management Plans contains a comprehensive list of contents and objectives of the plan. The the Mines Act permit application will require a site specific Erosion and Sediment Control Plan. A guidance document has been developed to guide proponents in the requirements of the plan: http://www2.gov.bc.ca/assets/gov/environment/waste-management/industrial-waste/industrial-waste/mining-smelt-energy/erosion_sediment_control_plan_guide.pdf. Consideration of soil characteristics from the Terrain and Soils Baseline Soil (Appendix 12-B) should inform appropriate prescriptions and further the site specific requirements of this plan for future permitting purposes. Erosion and Sediment Control Plans submitted with Mines Act permit applications should include all calculations and a map of the erosion potential. An event-based effectiveness monitoring program directed by a site-specific trigger, action, response plan is also required.	• foliar nutrient and metal concentration in forage species (assessment of biochemical functions);	5-Aug-2016
MEM-148	12-Jul-2016	Liz Murphy MEM	Reclamation and Closure	Section 6.4.3 states that "Large woody material will not be salvaged or included in the stockpiles, as its decomposition may potentially cause instability." MEM understands that woody debris will not be stored within soil stockpiles however no futher mention of salvaging and storing woody debris could be found. Placement of woody debris is mentioned for reclamation of the East Dam Shell and the Portal Laydown Area. Please clarify where woody debris will be salvaged and stored for reclamation. MEM notes that woody debris was successfully used in reclamation on the KS site and should be continued in KUG reclamation planning.	• soil assessments to identify soil profile development on reclaimed sites (biochemical functions);	5-Aug-2016
MEM-149	12-Jul-2016	Liz Murphy MEM	Reclamation and Closure	The application indicates the closure and reclamation cost will be $33.17 million. Liability costing for the KUG and KS projects will be evaluated in detail at the Mines Act application stage. Please note that all cost estimate details, including the assumptions made, must be provided for permitting.	• assessments of mycorrhizal fungal colonization rates for planted and seeded species (biochemical functions);	5-Aug-2016
MEM-150	12-Jul-2016	Liz Murphy MEM	Reclamation and Closure	Please note that the *Mines Act* permit requirements of equivalent land capability pre- and post-closure must be based on the mine footprint, not the LSA or RSA. Ecosystem mapping at the site series level is required for the pre-mining and post-mining, with tabulated inventories for comparison. A reclamation research program to be developed early in mine life and conducted throughout life of mine should include provisions for evaluating strategies for reclaiming challenging habitats and ecosystems.	• visual surveys of vertebrate species on reclaimed sites and the habitat features they are associated with to identify changes in species richness and habitat use over time (biodiversity and habitat functions);	5-Aug-2016
MEM-151	12-Jul-2016	Liz Murphy MEM	Management plans - Soil Salvalge and Handling Plan	For the *Mines Act* Permit Application, Standard Operating Procedures (SOPs) should be developed prior to any disturbance activities to ensure that appropriate controls are effectively implemented to protect soil resources during the salvage and stockpiling activities proposed.	• rangeland health and productivity assessments (biochemical functions); and	5-Aug-2016
MEM-152	12-Jul-2016	Liz Murphy MEM	Management Plans	A Vegetation Management Plan, nor reference to monitoring metal uptake in plants could not be found in the application. A Mines Act application will require details on vegetation management, including rare plants and monitoring of metal uptake in plants.	• weed and invasive plant monitoring and control measures.	5-Aug-2016
MEM-153	12-Jul-2016	Liz Murphy MEM	Reclamation and Closure	Please note that a *Mines Act* permit application will require pre- and post-mining details, including maps and inventories for land capability and land use that go beyond a conceptual level of detail.		5-Aug-2016
MEM-154	12-Jul-2016	Liz Murphy MEM	Reclamation and Closure	Reclamation research is *Mines Act* requirement. A program should be initially developed based on a gap analysis to ensure that site-specific information required for reclamation and closure planning will be effectvely collected based on identified timing requirements. Reclamation research must be included in the *Mines Act* permit application and site-specific research needs will be considered in future permit conditions.	The results of the monitoring programs will inform changes in approach to adaptively manage reclamation strategies to meet end land use objectives. An assessment of any emerging negative trends and probable causes will be completed, and strategies to address these will be developed.	5-Aug-2016
MEM-155	18-Jul-2016	Michael Cullen, MEM	Geotechnical	Part 1 from July 18, 2016 submission: The application states that slope runoff and the ephemeral creek water will be diverted around the southeast side of the subsidence zone. We consider that this diversion will be challenging to construct and unlikely to be fully effective on the talus material. If this diversion is still part of the mine plan please provide details of the proposed diversion construction. If the diversion is no longer part of plan please confirm that water from the southern slopes is appropriately included into the subsidence zone surface and groundwater models.	Monitoring frequency will be annually for the Decommissioning and Closure phase (5 years) and continue during the Post Closure phase for a further 5 years. At the conclusion of this 10 year monitoring period, it has been assumed that closure objectives will be attained and monitoring activities will be discontinued. However, monitoring will continue until objectives are met post the 5 year post closure phase as required. All monitoring activities, results, and recommendations will be reported in the annual reclamation plan.	28-Oct-2016
MEM-156	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	New Comment: The steady state model, which simulates average annual conditions, was calibrated to a baseflow that was measured in late winter. However, baseflow varies seasonally with the lowest baseflow in late winter and highest baseflow during the rainy season. As such, this target may be too low to simulate average annual conditions. Although average annual baseflow is challenging to estimate based on streamflow measurements alone, it is expected to be higher than winter low flow and an estimate must be developed. Furthermore, winter low flow is challenging to measure and the database of low-flow measurements is relatively sparse, both of which contribute to uncertainty in the model calibration. EA Information Requirement: Please estimate a reasonable range for average annual baseflow that incorporates the uncertainty associated with individual measurements, the relatively sparse database and the seasonal variation in baseflow. Note: Appendix 9-D did not address the average annual baseflow in the context of accounting for seasonal variation. An alternate model calibration using these revised estimates of baseflow may be requested pending the responses to this round of comments.	• rangeland health and productivity assessments (biochemical functions); and	9-Nov-2016
MEM-156.1	30-Oct-2016	Hugh McCreadie, MEM	Water (Ground)	Ongoing evaluation required during operations	• weed and invasive plant monitoring and control measures.	21-Dec-2016
MEM-157	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	New Comment: The sum of monthly recharge for the transient model (i.e. the total annual recharge) presented in Figure 5.3-1 is about 500 mm/yr. This recharge rate is close to the total annual streamflow at KEM-03 of 554 mm (Chapter 10, Table 10.4-4) and far greater than the average annual recharge applied to the steady state model. Therefore, perhaps the wrong information was inadvertently presented or the monthly recharge in the model is incorrect (most likely the former). Please clarify whether the monthly recharge presented in Figure 5.3-1 is actually the recharge applied to the transient model. If it is, please justify this recharge being higher than the steady state model. If not, please update Figure 5.3-1 with the actual monthly recharge (mm/month) used in the model.		28-Oct-2016
MEM-158	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	New Comment: The monthly recharge for the transient baseline model was not presented in Appendix 9-B. The monthly recharge in the transient mine model appears to be approximately distributed throughout the year based on the monthly distribution of total streamflow. However, a typical baseflow hydrograph (which is a time-lagged surrogate for recharge) has less contrast in monthly flow compared to total streamflow. Therefore, depending on the quantity of water going into groundwater storage, this method of distributing annual recharge throughout the year may or may not be appropriate. Further information is required to adequately review this aspect of the Application. Please provide a summary table that summarizes each of the following quantities by month for each relevant catchment in the transient baseline model and transient mine model (at least KEM-03, KEM-07, WQ-01 and Waste Rock Creek) as L/s: • Recharge • Groundwater storage outflow • Groundwater storage inflow • Discharge to streams. Based on these monthly values, please also present the annual values for each of these flow components (L/s).	The results of the monitoring programs will inform changes in approach to adaptively manage reclamation strategies to meet end land use objectives. An assessment of any emerging negative trends and probable causes will be completed, and strategies to address these will be developed.	4-Nov-2016

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MEM-158.1	30-Oct-2016	Hugh McCreadie, MEM	Water (Ground)	Please provide transient baseflow for WQ-01 and Waste Rock Cr. as requested even though the model was not calibrated to these flows. Please provide transient baseflow for the mine model assuming consistent catchment boundaries and simply include the cross-catchment flows. Calibration of the groundwater model to estimated transient baseflows in LSA2 will be required during operations. This comment will be closed upon receipt of the information.	Monitoring frequency will be annually for the Decommissioning and Closure phase (5 years) and continue during the Post Closure phase for a further 5 years. At the conclusion of this 10 year monitoring period, it has been assumed that closure objectives will be attained and monitoring activities will be discontinued. However, monitoring will continue until objectives are met post the 5 year post closure phase as required. All monitoring activities, results, and recommendations will be reported in the annual reclamation plan.	21-Dec-2016
MEM-159	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	New Comment: As presented in Appendix 9-D (Proponent Response: Line 1209), an upper bound baseflow of 30 L/s was estimated, which was about 50% higher than the 20 L/s used in the model presented with the Application. The resulting mine inflow rates from this re-calibrated baseline model using the higher baseflow assumptions were predicted to be 28% higher (50 L/s) compared to the results of the "expected case" groundwater model (39 L/s) carried forward in the EA application (Appendix 9-B). This outcome demonstrates that the groundwater model results are sensitive to the selection of the baseflow target used in the steady-state (average annual) baseline model calibration. Based on review of the calibration of the baseline model presented in the EA application, the baseflow targets used for calibrating the model, which were measured in March, may underestimate the average annual baseflow. Flow measurements in March are considered to be more representative of minimum baseflows that typically occur in late winter. Accordingly, the mine inflow rates carried forward in the EA may also be underestimated, which could affect the resulting water quality predictions in the KUG TSF and ultimately Attichika Creek during operations. Please justify why the dewatering rates estimated from the groundwater model recalibrated to upper-bound baseflow (Appendix 9-D) were not carried through to the water quality model as a sensitivity scenario.	The reponse is provided in the memo **20161107_KUG_Comments_MEM_Hydrogeo_Lorax Memo3_Groundwater3.**	9-Nov-2016
MEM-160	22-Sep-2016	Hugh McCreadie, MEM	Water (Ground)	New Comment: To evaluate the potential effect (or lack of effect) of post-closure groundwter seepage from the subsidence zone to Amazay Lake, please evaluate the potential for water quality effects on Amazay Lake due to seepage from the subsidence zone in the context of historical loadings from Central Cirque Cr. This assessment should generally include the following components: - calculation of historical loadings from Central Cirque Cr to Amazay Lake for all parameters of concern - assessment of the corresponding effect of loading from Central Cirque Cr on current water quality in Amazay Lake - assuming that a groundwater divide does not separate the subsidence zone from Central Cirque Cr after closure, an estimate of upper bound groundwater seepage rate from the subsidence zone to Amazay Lake - estimate of the corresponding groundwater loading - finally, an assessment of the potential effect of this post-closure groundwater loading in the context of the historical effect of Central Cirque Cr on Amazay Lake.	The response is provided in the memo **20161021_KUG Comment MEM-160_memo_final**	10-Nov-2016
MEM-160.1	30-Oct-2016	Hugh McCreadie, MEM	Water (Ground)	This memo was very useful. 2.2.2.1 The background flow entering Amazay Lake was calculated as the difference between total flow leaving the lake and the flow entering from Central Cirque Cr. Please clarify whether the flow in Central Cirque Cr., for the purpose of this background flow estimate, was based on KEM-07 or was scaled up to the full catchment of Central Cirque Cr, which is about 20% larger than the catchment for KEM-07. 2.2.2.1 This assessment assumed that Central Cirque Cr, as represented by loading measured at KEM-07, is the only source of non-background loading to Amazay Lake. Please comment on the following: a) The basis for assuming that other creeks discharging to Amazay Lake contribute only background values and whether this assumption is conservative for the purpsoe of this assessment. b) The basis for assuming that flow entering Central Cirque Cr downstream of KEM-07 represents background loading and whether this assumption is conservative for the purpose of this assessment. Please describe the general approach that will be used to assess potential effects on Amazay Lake during operations and after closure, including any addiitonal monitoring points that might be required.	Following discussions with the BC EAO, AuRico understands that information provided to date is sufficient to inform EAO's assessment report, thus no furhter response has been prepared.	21-Dec-2016
CEAA-001	26-Jul-2016	Quincy Leung, The Agency		Both chapters 20 & 21 reference a "guidance" document from the Agency (Overview: Assessment of Impacts to Rights in the EA process (handout for the Murray River Coal Project)). This document is NOT a guidance document, and should not be characterized as such. It was intended as a discussion piece to promote transparency and flexibility when consulting with Aboriginal Groups on the Murray River project. For Kemess, the proponent can use the framework and/or concepts if they decide it is useful to them, through consultation with the groups, but in no way should it be characterized as official guidance. It is our expectation that this characterization would be corrected for the final version of the Application. It is our expectation that this characterization would be corrected for the final version of the Application.	Chapter 21 (Sections 21.2.4.4, 21.8.1; Table 21.2-1) was updated to remove reference to "Overview: Assessment of Impacts to Rights in the EA process (Hand out for the Murray River Coal Project)" as a reference document, or provide clarification on its status; tracked changes are provided in Word.	12-Aug-2016
CEAA-002	26-Jul-2016	Quincy Leung, The Agency		P. 21-71 there is a reference to Métis "treaty rights" which is incorrect (only potential rights apply to the Métis).	Chapter 21 (Section 21.4.12.3) was updated to correct the use of 'treaty rights' to 'Aboriginal rights' in regards to the Métis; tracked changes are provided in Word.	12-Aug-2016
CEAA-003	26-Jul-2016	Quincy Leung, The Agency		P. 21-8 (and elsewhere in chapter 21) "infringement" is used – it should be determining potential "impacts" to rights, not infringement. It is not within the scope of an EA to determine infringement.	Chapter 21 (Sections 21.2.4.2, 21.7.1) was updated to correct and clarify the use of "infringement" and "impact" in relation to Aboriginal and treaty rights; tracked changes are provided in Word.	12-Aug-2016
CEAA-004	26-Jul-2016	Quincy Leung, The Agency		In Chapters 20 and 21, it was mentioned that there is already restricted access to the mine site, which is part of the baseline, so as a result there will be no CULRTP issues. The Agency does not agree with the inclusion of restricted assess as part of the baseline, especially when that type of argument/rationale is used in a rights context. It is important for the Crown to understand the historic context for why a group(s) may or may not currently use an existing area. Are there previous impacts to rights, or effects to current use, that we should be aware of so we can better understand the existing context and assess impacts to rights more accurately? If there is not any, a statement should be provided in the Application to that effect. This can always happen through consultation between the groups and the EAO, or perhaps there is info in the TKN TLUS that would be helpful. Also, this kind of information may impact the 5(1)(c) assessment as well, see p. 20-118 for the current definition of "context" in the characterization of changes to hunting and trapping activities	Mineral exploration has taken place in the Kemess area since 1889. A gold and copper deposit in the Kemess North area (the same area as the Kemess underground deposit) was first explored between 1966 and 1971. Aboriginal groups' use of the proposed mine site area was restricted in 1996 when construction of the Kemess South Mine commenced, primarily for safety reasons, as per guidance under the Mines Act. The Kemess South Mine was in operation until 2011. Most of the ground disturbance occurred as the mine site was constructed, including the airstrip, tailings starter dam, pumphouses and operational dump ponds, service and process plant complexes, accommodation camp, haul roads, open pit, and waste rock dump. During the operations phase of the KS Mine, the area of disturbed land resulted from the gradual expansion of the waste rock dump, permitted pit expansions, and the incremental raising of the tailings dam. The total area of primary disturbance was approximately 1,240 ha,(including open pit & tailings pond surface areas) of which 525 ha has been reclaimed. The KS Mine site is currently under care and maintenance. Construction and operation of the KUG project will result in continued access restrictions for Aboriginal peoples and others with respect to the mine site, primarily for safety reasons. The disturbance footprint of the KUG project is 100 hectares, when including a buffer of an average of 250 m, amounts to 487 ha. This represents additional access restriction in comparison with baseline conditions, considering that the Kemess South Mine is continuing to reclaim areas that would be available for Aboriginal use without the KUG project. However, the KUG Project will minimize its use and footprint on areas already reclaimed and the Proponent's existing closure and reclamation plan for the KS Mine will complement the closure and reclamation plan for the KUG Project. Given that only a percentage of the remaining un-reclaimed land from the Kemess South Mine would be available to Aboriginal groups following reclamation (for example, the mine pit will not be available for use), the amount of new access restriction resulting from the KUG project is anticipated to be negligible and there are no changes to conclusions presented in the Application.	12-Aug-2016
CEAA-004.1	5-Sep-2016	Quincy Leung, The Agency		It is the Agency's approach to assess CULRTP using pre-disturbance baseline. Should such baseline information is not available, the proponent should clearly state so.	Aboriginal use of lands and resources in the vicinity of Thutade and Amazay Lakes is well-documented (Crossroads Cultural Resource Management Ltd. 2015). Both the Tse Keh Nay and the Gitxsan claim an interest in the Project area. These areas continue to be used for hunting, fishing, gathering, and spiritual activities. In recent times and prior to disturbance, the area was used by the Bob Patrick family of the Takla First Nation (Dewhirst 1995). Members trapped along the lower valley of Kemess Creek and North Kemess Creek. This area had been used by the Bob Patrick family for caribou hunting in the past. No other information about pre-disturbance Aboriginal use of lands and resources for traditional purposes has been identified. Crossroads Cultural Resource Management Ltd. (2015). Tse Keh Nay Kemess Underground Proejct Traditional Knowledge and Land Use Study. Prepared for the Tse Keh Nay Alliance by Crossroads Cultural Resource Management Ltd. Smithers, BC. Dewhirst, J. (1995). An Aboriginal Sustenance Impact Assessemnt of the Kemess South Gold-Copper Project: Status Report. Prepared by Archeo Tech Associates for El Condor Resources Ltd. Victoria, BC.	7-Oct-2016

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CEAA-004.2	19-Oct-2016	Quincy Leung, The Agency		As requested as follow-up to comments CEAA-004, CEAA-012, and CEAA-004.1, the Agency would like to clarify that additional information is required in the Application to describe the historical setting, prior to the access restrictions related to the Kemess South (KS) Mine, which began in about 1996. In the definition of CULRTP (p. 20-13 of the Application), recent past is defined to include the era before the KS Mine, yet this conflicts with using the baseline of pre-existing restrictions. Current use should include traditional practices that have ceased due to external factors and could reasonably be expected to resume once conditions change. For a fulsome analysis of the Project's effects on how Indigenous peoples could use these lands for traditional purposes, detailed historic information - such as that provided by the proponent in response 004.1 related to earlier trapping and hunting - needs to be captured by the baseline and included in the Application for assessing effects and determining whether residual effects exist, to be brought through not only a significance analysis, but also an analysis of cumulative effects (as described on p. 20-145 as temporal crowding and additive effects). In addition to the information provided in response 004.1, there are several inconsistencies in the way information on use is presented in the Application. For example, on one hand it is stated that the Project will have no impact on current use or Aboriginal rights (e.g. hunting caribou) due to existing access restrictions, while on the other hand reference is made to the site returning to "pre-disturbance harvesting conditions". This gap is made evident when references are made to the fact that caribou used to migrate across the site, and that caribou would be hunted if their populations recover (e.g. p. 20-47 and 20-108), and that more effort is now required to hunt animals that have moved away from increased human activity on the landscape since the road (p. 20-22). Such references indicate that information is available that is being excluded from analyses because the baseline does not consider traditional practices prior to disturbance by external factors. It is important that historic context, such the information in response 004.1 and references to previous migration and hunting of caribou, is captured by the baseline and used in the assessment of effects on current use and impacts to rights, as this could potentially change the "neutral context" in relation to the residual effects of wildlife availability, impacts to hunting and related cultural intangibles, and cumulative/additive effects of extending disturbances to caribou movement/recovery. A baseline that captures use of the land and resources prior to access restrictions is required so that the Agency can brief the Minister on potential effects under s. 5(1)(c) as well as the potential impacts to Aboriginal rights, and that this includes both direct and cumulative effects. As it stands, the Agency doesn't feel that the Application provides complete information that would allow this analysis.	The response is provided in the memo **20161107_A.1_KUG Comment CEAA-004.2_CULRTP_Memo.**	9-Nov-2016
CEAA-005	26-Jul-2016	Quincy Leung, The Agency		Re: 5(1)(c) – although intangible cultural heritage is assessed later on, and that section does make a reference back to CULRTP, there should be a corresponding acknowledgement of cultural and/or spiritual uses of the land in the CULRTP section as it relates to the definition and should be factored into the overall determination of effects for CULRTP. Since there was a residual effect found to hunting activities in the CULRTP section, factoring in cultural uses related to that may actually change the outcome of the assessment. This relates to our usual critique of CULRTP assessments in that they are often too "biophysical" focused, a more holistic and activity based perspective should be applied.	Table 20.6-1 identifies "Use of Culturally Important Areas" as a sub-component of the CULRTP VC. The effect pathway for this sub-component identifies that "the use of culturally important sites and features (e.g. spiritual and ceremonial sites) could be affected by displacement of cultural or spiritual uses, or changes to the quality of the experience (e.g., noise or visual disruption)." Section 20.6.1.1 identifies that changes to the environment during construction and operations hold the potential to displace Aboriginal peoples from culturally-important areas. Section 20.6.1.2 identifies that the Project holds the potential to reduce Aboriginal peoples' quality of experience at culturally important areas. Following mitigation measures for displacement and quality of experience described in Section 20.6.2, no residual effects on culturally important areas were identified.	12-Aug-2016
CEAA-006	26-Jul-2016	Quincy Leung, The Agency		Re: 5(1)(c) and mitigation measures - IBA, that is in the works, is referenced as potentially being able to mitigate effects to culture. Mitigation measures need to be something that we can rely on and objectively assess in terms of effectiveness, etc. The measures that they mention may be a part of the IBA seem really great and responsive, but as they are described in relation to an IBA that is currently being negotiated (and whose contents we may never be aware of), the Agency do not think they suffice as adequate mitigation. We need more certainty to work with	Measures to be confirmed in an IBA are considered to be additional to mitigation measures identified in the Application. As noted in Section 20.6.2.1, "The provisions of the IBA are not confirmed but may provide additional measures to support the ongoing use of lands and resources by the TKN First Nations."	12-Aug-2016
CEAA-007	26-Jul-2016	Quincy Leung, The Agency		There is also not much reference to ATK – which could be due to a dearth of that kind of info from the groups. It is suggested to double check against the TLUS and consultation record.	Incorporation of Aboriginal Traditional Knowledge into the Assessment is identified in Sections 21.4.2.5, 21.4.3.5, 21.4.4.5, 21.4.5.5, 21.4.6.5, 21.4.7.4, 21.4.8.5, 21.4.9.5, 21.4.10.5, 21.4.11.5, and 21.4.12.5. The TKN TLUS and the consultation record were reviewed to complete these sections.	12-Aug-2016
CEAA-008	26-Jul-2016	Quincy Leung, The Agency		The Agency has not reviewed the TKN TLUS, but wonders if there is info in there that is not reflected in the Application, particularly their views in relation to impacts to rights. In Chapter 20, the Application does provide the groups' perspective on effects, but in Chapter 21 the proponent does not present any views from the groups they engaged with re: the proponent's determination of impacts to rights (for the most part, low or no impacts). If there is information available, it should be presented in the Application.	The Application was provided to Takla Lake First Nation, Tsay Keh Dene Nation, and Kwadacha Nation for review 45 days prior to submission of the Application to the EAO for screening review. The three First Nations submitted comments during the Application screening review phase, that were addressed, and comments during the formal review phase which have also been responded to. In both cases, comments received were focused on the assessment of effects on biophysical resources rather than an impact on rights.	12-Aug-2016
CEAA-009	26-Jul-2016	Quincy Leung, The Agency		Re: impacts to rights – a reminder to the proponent that an assessment of impacts to rights is not just focused on indirect/environmental effects pathways. Though that may indeed comprise the foundation of an assessment, they should also be factoring in any direct impacts (that are not modified through the environment). Information in the TLUS or other studies may be brought in here, particularly information related to the seasonal round or interconnectedness. Of course, such information may not be currently available, as the groups may not have raised these kinds of concerns, but if these types of conversations come up through consultation with the proponent or the EAO, then the Agency needs to be confident that that perspective is being addressed in some way so we can consider it for adequacy.	Section 21.2.1 defines Aboriginal rights as "practices, customs or traditions which are integral to the distinctive culture of the Aboriginal group ." Section 21.7.1 identifies potential effects pathways between the Project and the exercise of Aboriginal rights. Pathways are defined as Project components and activities resulting in changes to lands and resources, as well as human presence on the landscape, that result in changes in: access to lands and resources; availability of resources; confidence in the safety of resources; sense of place; mobility; and sense of connection with land, spirit, and culture. As identified in Section 21.7.1, these pathways could result in limits on the spatial extent, utility, and/or continuity of Aboriginal peoples' customs, practices and traditions. CEAA-009 identifies direct impacts as impacts that are not modified through the environment. AuRico notes that non-environmental impacts can be both direct (e.g. imposition of laws restricting the exercise of Aboriginal rights) and indirect (e.g. policies resulting in diminution of traditional knowledge and culture such as residential schools). CEAA-009 suggests that information related to the seasonal round and interconnectedness can inform the assessment of direct effects of the Project on Aboriginal rights. Chapter 21 assesses non-environmental direct effects on the seasonal round (where information is available) and interconnectedness with respect to direct curtailment of Aboriginal peoples' access to sites where they can exercise Aboriginal rights as part of a seasonal round and/connect with land, spirit, and culture.	12-Aug-2016
CEAA-010	26-Jul-2016	Quincy Leung, The Agency		Overall, the proponent have done good work with the key Indigenous groups and has presented a well-structured chapters to capture their work on environmental effects and Indigenous interests.	The Proponent thanks the reviewer for the feedback	12-Aug-2016
CEAA-011	26-Jul-2016	Quincy Leung, The Agency		The direct/editorial comments that we provided previously (included on the "other comments" tab of the EAO spreadsheet) appear to have been addressed, including: use of the word "guidance" referring to a handout; correction to Metis "treaty" rights; and, uses of "infringement" instead of "impacts".	The Proponent thanks the reviewer for the feedback	12-Aug-2016
CEAA-012	26-Jul-2016	Quincy Leung, The Agency		A comment [provided above] (also on the 'Other Comments' tab) related to the framework/baseline still presents some uncertainties: o The proponent (e.g. p. 20-103-4) puts forward that there will be no displacement of CULRTP because the site has already had restricted access (since 1998). Using this baseline could be problematic if any information is available on CULRTP prior to the initial disturbance and access restrictions. If there is a difference between the pre-disturbance uses and the baseline of the existing access restrictions, that needs to made transparent. In that section, the report mentions an eventual return to "pre-disturbance harvesting conditions", so any available information on the pre-disturbance harvesting activities should be included. o Similarly, Thutade Lake and Amazay Lake are noted to be "preferred harvesting areas" for some TKN members, but the overall context of the effect is found to be neutral because the area has been partially diminished (p.20-118). Such potential inconsistencies would benefit from greater transparency, so that it's clear what information, including Indigenous perspectives, is available and how it has been considered.	Please refer to the response to comment CEAA-004.	12-Aug-2016
CEAA-012.1	5-Sep-2016	Quincy Leung, The Agency		It is the Agency's approach to assess CULRTP using pre-disturbance baseline. Should such baseline information is not available, the proponent should clearly state so.	Please refer to the response to comment CEAA-004.	7-Oct-2016
CEAA-013	26-Jul-2016	Quincy Leung, The Agency		The comments on the "TOC comments" tab of the EAO's spreadsheet also remain relevant as reminders to the proponent and EAO. Although it was requested that we identify "must haves" vs. "nice to haves", that it not possible due to the iterative nature of EAs and consultation. The comments remain valid as flags for risk management: the more transparent the information, the higher its credibility, and the less likely it is that new/iterative information will require further work. Our previous comments (related to: linkage to holistic cultural/spiritual effects within CULRTP section; more clarity on mitigation measures and input from Indigenous groups; improved reference to where ATK has been incorporated; information of Indigenous views related to the findings on impacts to rights; and, consideration of any potential direct impacts to rights, including effects on interconnectedness or the seasonal rounds) are still relevant in that any improvements to demonstrating how Indigenous input was used provides greater certainty that no contradictions or information gaps will arise.	Please refer to the response to comment CEAA-007.	12-Aug-2016
CEAA-014	26-Jul-2016	Quincy Leung, The Agency		Related to the finding of no residual effects on cultural identity (text on p. 20-139 and Table 20.8-3), "agreements negotiated with TKN" does not provide the Crown with enough certainty about the proposed mitigations or their likelihood to prevent residual effects.	Please refer to the response to comment CEAA-008 and CEAA-009.	12-Aug-2016
CEAA-015	26-Jul-2016	Quincy Leung, The Agency		In relation to the "low impact" findings and associated confidence findings throughout chapter 21, it is unclear whether the Indigenous groups have provided their perspectives on the findings.	Please refer to the response to comment CEAA-008 and CEAA-009.	12-Aug-2016
FLNRO-140	22-Jul-2016	Vanessa Foord, FLNRO		Comment: Disagree with the statement "Project GHG emissions are also considered negligible…." which appears throughout the report. They are measurable and significant enough to require reporting provincially are therefore not negligible. This statement is made by the proponent itself in Section 5.1. Total annual project emissions are 0.5% of the amount BC is aiming to reduce emissions by, and are therefore not negligible in the context of current provincial reduction commitments.	Estimated annual emissions are considered negligible in comparison to provincial, federal, and global inventories as project emissions would constitute from > 0.1% (Provincial) to > 0.0001% (Global) inventories. It is acknowledged that emissions are expected to exceed federal reporting threshold during Construction and thus were identified as a low magnitude residual effect. It is acknowledged that Construction and Operation emissions are expected to exceed provincial reporting requirements. The Project's Operating Phase GHG emissions are measurable; however, are considered not significant due to the small contributions to relevant GHG inventories.	12-Sep-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
FLNRO-140.1	28-Sep-2016	Vanessa Foord, FLNRO		Project emissions are not negligable provincially.	It is appreciated that characterization of the magnitude of estimated emissions can be viewed differently bewteen AuRico and FLNRO. However, AuRico firmly believes that regardless of the characterization, GHG emissions from the Project will be small contributions to relevant GHG inventories and have no potential to result in significant adverse effects in the context of the environmental assessment.	12-Sep-2016
FLNRO-140.2	16-Oct-2016	Vanessa Foord, FLNRO		Additionally, I recommended to the EAO in developing your draft technical report that you refrain from using the term negligible when referring to the GHG emissions from this project, which is the language used by the proponent. Negligible implies un-measureable or un-accountable and the emissions from this project are indeed measureable and qualify for reporting.	AuRico acknowledges the comment; no further response is required.	20-Oct-2016
FLNRO-141	22-Jul-2016	Vanessa Foord, FLNRO		Clarification required Section 2.2: Please provide more information on what is meant by re-vegetated areas previously cleared during the construction phase? For example seeding would create very different results than reforestation.	AuRico is committed to reclaiming as much as possible of the land disturbed or cleared during the Construction Phase with the development of a comprehensive and appropriate plant species composition, comprised primarily of native species. Seeding would be completed initially, with transition expected to a forested community in many of the areas with time. Further detail on the Project's reclamation and closure plan is provided in Chapter 6 of the Application. Revegetation as part of the mine site reclamation will help sequester atmospheric GHGs through the carbon cycle. It is acknowledged sequestration rates for reclaimed areas would be different (and perhaps lower) than present vegetation communities for an extended period following reclamation.	12-Sep-2016
FLNRO-142	22-Jul-2016	Vanessa Foord, FLNRO		Error in Section 2.3.1. The project is within the Omineca Natural Resource Region and therefore the wrong Deforestation Emissions factors have been used. Please correct the information in Table 2.3-1 with the Omineca values and redo the calculations in Table 2.3-3. Omineca deforestation emission factor for uproot and decay is 149 CO2e/ha and decay from year 1-19 is summed as 196 CO2e/ha. The new total emissions from land clearing is 84870 tonnes CO2e	The Project is located in the Omineca Natural Resource Region, it is acknowledged that inappropriate land clearing emission factor was used. An attached memo **20160908_ KUG Comment FLNRO-142, 143_GHG_Memo** now reflects this change. It is estimated that the Project will emit 84,793 tonnes of CO_2e during the Construction phase over a 5 year period or 16,959 tonnes of CO_2e/year.	12-Sep-2016
FLNRO-143	22-Jul-2016	Vanessa Foord, FLNRO		Error in Table 2.13-12: Land clearing emissions per year are 16974 tonnes, which makes the total construction GHG emissions per year: 58256 tonnes CO2e. Incorrect values in Table 2.6-1 as well and throughout the report.	An attached memo **20160908_ KUG Comment FLNRO-142, 143_GHG_Memoreflects** this correction.	12-Sep-2016
FLNRO-144	22-Jul-2016	Vanessa Foord, FLNRO		Comment 4.1: Afforestation of another area outside the mine site would contribute significantly to mitigating the deforestation emissions. Have you considered BC Forests Carbon Offset Investment Opportunities? https://www.for.gov.bc.ca/ftp/het/external/!publish/web/climate/carbon_investment_opportunities_info_book.pdf	A general goal of reclamation for the Kemess Underground Project is to restore, where practical, the equivalent land capability so that these land-use objectives can be achieved for the Project site. AuRico Metals strives to be a good neighbor and understands the importance of supporting and contributing to the communities near the Project and region in which the Project is situated. AuRico has not considered BC Forests Carbon Offset Investment Opportunities, but may do so in the future.	12-Sep-2016
FLNRO-144.1	28-Sep-2016	Vanessa Foord, FLNRO		Resolved, with hopes the proponent will consider BC Forest Carbon Offset opportunities in the future	AuRico acknowledges the comment; no further response is required at this time.	12-Sep-2016
FLNRO-145	22-Jul-2016	Vanessa Foord, FLNRO		Clarification required. In Section 2.3.1 the proponent states that the harvested carbon will be 100% emitted but in section 4.1 it mentions recovery of merchantable timber. If the merchantable timber being cleared is recovered and sold to a mill for processing and storage in a wood product, the proponent can use a lower deforestation emission factor and report land clearing emissions as less than is currently estimated. If this option is available it is a suitable mitigation opportunity. Distance from the mine site to the nearest mill should also be considered in the potential reduction of emissions if this option is to be pursued.	AuRico decided to use a more conservative approach to estimating land clearing GHG emissions and assumed that harvested timber would be 100% emitted as opposed to recovering merchantable timber. It is unlikely that there will be any economic value in transporting felled material off-site due to the limited areas to be deforested and the haul distance to potentially interested consumers. Some reuse of wood onsite may occur.	12-Sep-2016
FLNRO-145.1	28-Sep-2016	Vanessa Foord, FLNRO		Resolved, with hopes the proponent will manage the removal and potential destruction of timber with GHG emissions in mind.	AuRico acknowledges the comment; no further response is required at this time.	12-Sep-2016
FLNRO-146	16-Oct-2016	Vanessa Foord, FLNRO		I have reviewed the second round responses to my comments and I have no major issues. My comments can be closed.	AuRico acknowledges the comment; no further response is required.	20-Oct-2016
MOE-113	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		Only Scope I emissions, i.e. direct emissions, are considered. No scope II or indirect emissions (electricity related) are considered yet?	The Canadian Environmental Assessment Agency (CEAA) and the BC Environmental Assessment Office (EAO) requested an assessment of project related direct greenhouse gas emissions. Per the request, this report included an accounting of the direct greenhouse gas (GHG) emissions associated with all phases of the Project presented by individual pollutant and summarized in carbon dioxide equivalent units (CO_2e) per year. Calculation of indirect GHG emissions was not required.	12-Sep-2016
MOE-113.1	28-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		The proponent's response is understandable by following the agencies' requests, but it is a common and better practice to include the indirect emission information, if it can be done so.	AuRico acknowledges the comment; no further response is required at this time.	12-Sep-2016
MOE-114	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		"The rating of not significant is due to the Project's annual average GHG emissions during the Operations phase not exceeding the federal reporting requirement threshold and being similar to other proposed underground mining projects in the province." Is it reasonable to draw a conclusion based on this criterion? (page 3 of 44)	This comparative method is consistent with guidance by the CEAA. Please refer to the CEAA Guidance, *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners* (CEAA 2004).	12-Sep-2016
MOE-114.1	28-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		The federal reporting threshold is 50,000 t CO2e, however, the BC provincial reporting threshold is 10,000 t CO2e, furthermore, when emissions over or equal to 25,000 tonnes of CO2e (excluding CO2 from biomass in Schedule C), the emissions report must be verified by an accredited third pary verifier. Since the emissions during operations of the Project is over 37 kt CO2e based on the current estimate, well over either 10k or 25k tonnes of CO2e thresholds, thus the emissions must be reported to the province and the report be verified properly, therefore, they are considered "significant" in the context of reporting. Therefore, reconsidering the statement is advisable.	Again, it is acknowledged that Construction and Operation emissions are expected to exceed provincial reporting requirements. The Project's Operating Phase GHG emissions are measurable; however, are considered not significant due to the small contributions to relevant GHG inventories.	12-Sep-2016
MOE-115	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		What kinds of reagents will be used during grinding and floatation process? Any acid? This may result in another emission source.	The grinding and flotation circuit will employ electrical drive equipment such as electrical motors, pumps and blowers and therefore not considered a direct GHG emission source. The Project flotation process employs the roughing process which produces a rougher concentrate as a coarser particle size requires less energy to process. The Project will ship a gold-copper rough concentrate as a product and will not refine the concentrate at the site. At this time, the final chemistry is not known in the flotation cells; however, it is expected that acid will not be required. The reagents used in the Process Plant during Operations are listed in Chapter 24.6.4.1 of the Application and include Aero Promoter 3477, potassium amyl xanthate (PAX), methyl isobutyl carbinol (MIBC), antiscalant and flux (possibly Magnafloc 156 & Magnafloc 158). Sulphuric Acid will be used in the water treatment lab assay. Since the amount of reagent to be used, as well as the organic content of the ore, is not accurately known at this time, an estimate of potential GHG emissions could not be conducted. It is expected that the amount of fugitive GHG emissions in the form of volatile organic compounds (VOCs) from the floatation cells would be negligible. A more material direct GHG emission source of gold and copper processing is smelting which is not conducted at the Project.	12-Sep-2016
MOE-115.1	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		The proponent mentioned in the 1st Round Response that sulphuric acid will be used in the flotation process for water treament, it would be reasonable to think that this acid will contact the ore, which may contain carbonaceous component. Thus, potential CO2 will be produced. Furthermore, the chemistry related to the use of reagents should also be paid attention. All the above info should be provided in detail in the Application.	The reagents used in the Process Plant during Operations are listed in Chapter 24.6.4.1 of the Application and include Aero Promoter 3477, potassium amyl xanthate (PAX), methyl isobutyl carbinol (MIBC), antiscalant and flux (possibly Magnafloc 156 & Magnafloc 158). Sulphuric Acid will be used in the water treatment lab assay, not in the floatation process. Potential GHG emissions from the concentration process are considered to be immaterial in the context of identifying signficant adverse effects for the project.	12-Sep-2016
MOE-116	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		Land clearing emissions and CH4 liberation from subsurface rock formation is confused here? (page 12 of 44)	The paragraph referred to in Section 2.2 Source Categories is meant to state that land clearing GHG emissions does not include methane liberation emissions. The report does not calculate methane liberation emissions as the Project's geology is not a tight rock formation where tight gas (methane) would be present.	12-Sep-2016

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MOE-116.1	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		There may be a misunderstanding of the methane formation in underground. Methane doesn't necessarily only form in tight geological conditions, rather, methane may form in any kinds of geological formations once the geological conditions permits/favors.	It is understood that methane can form in any geological formation; however, since the Project does not involve mining hydrocarbons, estimating theoretical methane liberation from a non-hydrocarbon bearing deposit would not provide an accurate result and therefore cannot be reported. AuRico will manage methane in the underground mine as a health and safety concern. During operations, if significant methane liberation is encountered, CO2e emissions will be reported as required.	12-Sep-2016
MOE-117	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		Table 2.3-6 CO2e value doesn't match Diesel Generator's sum.	The total CO_2e emissions for the Diesel Generator should be 3,790 tonnes CO_2e; however, the total annual construction stationary fuel combustion remains the same at 31,151 tonnes CO_2e.	12-Sep-2016
MOE-117.1	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		The values of CO2e for the items in the Table 2.3-6 are not correct, GWPs are not applied yet.	There is a typo in the Diesel Generator total GHG emissions row of Table 2.3-6. It should be 3,970 tonnes CO2e and not 3,789 tonnes CO2e. The remainder of values in Table 2.3-6 is correct including the total GHG emissions.	12-Sep-2016
MOE-118	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		During Closure and Post-closure phases, no any mobile equipment will be used? If any mobile equipment will be used, then the GHG emissions associated with the mobile equipment must be estimated and included in the report.	Specific mobile equipment usage during the Closure and Post-Closure phases of the Project is not known at this time; however, it is expected that only a small portion of the mine fleet will be employed during Closure and primarily light duty vehicle during Post-Closure. As mobile equipment usage during Closure and Post-Closure phases will be less than during the Construction and Operations phases, GHG emissions will likewise be less. As such, effects associated with GHG emissions during the Closure and Post-Closure phases would also be considered to be non-significant.	12-Sep-2016
MOE-118.1	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		It is understandable that the precise number of equipment will not be clearly known at this stage, just as that for the constrtuction phase, however, a rough estimate can be still available and thus "detailed" info based on this rough estimate should be provided in a reasonable manner. Thus, simply saying " effects associated with GHG emissions during the Closure and Post-Closure phases would also be considered to be non-significant" is groundless.	Project activity during the Closure and Post-Closure phases will be lower than activity during either Contstruciton or Operations. GHG emissions during the Closure and Post-Closure phases will be less than the 37,802 tonnes CO2e per year estimate for the Operations phase. As such, effects associated with GHG emissions during the Closure and Post-Closure phases are also considered to be non-significant.	12-Sep-2016
MOE-119	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		Table 3.1-1 Comparison of Estimated Project Emissions (page 25 of 44), the quoted value for British Columbia should be 61.5 Mt, rather than 64Mt in 2012, which should be expressly indicated, otherwise it could be confusing with the year 2014, in which the reference report published.	64 Mt was used for comparison as it was the most recent estimate of BC's GHG inventory for Industrial Facilities in 2014 (http://www2.gov.bc.ca/gov/content/environment/climate-change/reports-data/industrial-facility-ghgs). Using 61.5 Mt, the Project's estimated average annual construction emissions of 58,241 tonnes CO2e are 0.1% of the most recent BC total estimate of GHG emissions. The remaining comparisons remain the same.	12-Sep-2016
MOE-119.1	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		Regarding the provincial inventory, when citing it, please clearly indicate which year's emission it is and what source it refers to, to avoid any confusion.	AuRico acknowledges the comment; no further response is required at this time.	12-Sep-2016
MOE-120	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		Emissions during operations should also be compared to the targeted provincial inventory in 202 and 2050, respectively, if applicable, in order to produce a much clear projection of the Project's contribution	The Greenhouse Gas Reduction Targets Act (GGRTA) has set targets for GHG reduction for 2020 and 2050. As compared to 2007 levels, emissions must be reduced by a minimum of 33% by 2020 and 80% by 2050. Total greenhouse gas emissions in BC in 2007 were 64.3 Mt CO_2e. The 2020 and 2050 targets are thus 42.9 and 12.9 Mt CO_2e, respectively. The Project is expected to emit 37,802 tonnes CO_2e per year during Operations. The Project GHG emissions as a percentage of 2020 GHG reduction targets is 0.09%. The Project is expected to enter Closure phase by 2033, thus a comparison to the 2050 target is not warranted.	12-Sep-2016
MOE-120.1	28-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		The reviewer agrees with this response, and suggests to include it in adequate application document(s).	AuRico acknowledges the comment; no further response is required at this time.	12-Sep-2016
MOE-121	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		Table 5.1-1 "Reversible" – is it true?	Reversibility was ranked as reversible due to the fact that natural and restored carbon sinks can remove GHG emissions over a long period of time.	12-Sep-2016
MOE-121.1	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		"Reversible" precisely means a state can be restored completely after a process under the same conditions. However, here obviously there are conditions change: extra emissions brought into the atmsphere and land deforested; and the reforestation even won't bring the condition to its previous status because there are many years delay.	In the context of the environmental assessment, the effect of GHG emissions to the atmosphere is considered to be reversible because over time natural processes exist at the global scale that can reduce GHG levels. Whether this would occur considering other human activities is not material to the characterization of whether it can be reversed. While it is appreciated that this characterization can be debated, AuRico considers the reversibility of the residual effect to be immaterial to the overall conclusion of non-significance.	12-Sep-2016
MOE-122	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		Page 30 of 44 "In addition, estimated reportable direct emissions during both Construction and Operations phases are expected to fall below federal GHG reporting requirements", and "Therefore, the magnitude of the residual effect is ranked as low". This is not a reasonable logical inference.	The incremental effect of GHG emissions on climate change cannot be directly assessed on a project specific basis. Thus, it is standard practice in environmental assessment to gauge the magnitude of residual effects associated with GHG emissions by comparing project specific emissions to provincial and federal GHG emission inventories and relevant regulatory thresholds (*Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners* , CEAA 2004.). As the assessment was completed specifically to address a federal requirement, the federal threshold for GHG reporting was used to rank the magnitude of effect. The Construction phase GHG emissions magnitude was ranked low since it exceeded the federal reporting threshold but only accounts 0.008% of national GHG emissions and the Operations phase GHG emissions magnitude was not ranked (not identified as a residual effect) as it was below the federal reporting threshold. Land clearing emissions (not including biomass combustion) are not included in federal GHG emission reporting according to Environmental & Climate Change Canada guidelines; however, as per the CEAA and BC EAO GHG Inventory request, land clearing emissions were included as a direct GHG emission source for the assessment report. Therefore, there is some uncertainty as to whether land clearing emissions during the Construction phase will be reported to the federal GHG database. This was the basis for the statement "In addition, estimated reportable direct emissions during both Construction and Operations phases are expected to fall below federal GHG reporting requirements" since if land clearing GHG emissions are not included (no biomass combustion) then the Construction phase GHG emissions do not exceed the federal GHG reporting threshold.	12-Sep-2016
MOE-122.1	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		The Proponent responded that "it is standard practice in environmental assessment to gauge the magnitude of residual effects associated with GHG emissions by comparing project specific emissions to provincial and federal GHG emission inventories and relevant regulatory thresholds… . As the assessment was completed specifically to address a federal requirement, …" However, It is not completed yet, it should also consider the provincial requirement.	A GHG assessment to support the federal review of the proposed project has been completed. The assessment considered provincial GHG inventory and regulatory reporting thresholds but did focus on federal environmental assessment guidance. Once the project enters the construction, assessment and reporting compliant with the BC Greenhouse Gas Emission Reporting Regulation will occur. AuRico does not believe any further consideration is required to inform the current environmental assessment.	12-Sep-2016
MOE-123	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		Again, "Natural carbon sinks can remove GHG emissions over a long time; hence, the reversibility of the residual effect was ranked as reversible. Much of the Project disturbed area will be reclaimed and the carbon sink partially restored." This statement is not reasonable, the carbon sinks exist continuously somewhere beyond the disturbed area during the operation, which is true, doesn't mean the emissions from the Project can be reversed.	The intent of the statements is not to say that GHG emissions are 100% reversible. The intent is to state that natural and restored carbon sinks can remove GHG emissions over a long period of time; therefore, there exists some reversibility of the GHG emissions.	12-Sep-2016
MOE-123.1	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		The thoughts is understandable, but still the statement is reluctant, and reconsideration is advised.	AuRico acknowledges the comment; no further response is required at this time.	12-Sep-2016
MOE-124	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		Page 32 of 44 in Conclusion "will be negligible during the Closure and Post-closure phases" is unreasonable, which should be stated as like "small" or alike and which should be estimated	Mobile equipment usage during the Closure and Post-Closure phases of the Project is not known at this time; however, it will be substantively less than from the mine fleet employed in Operations during Closure and primarily light duty vehicle during Post-Closure. Since mobile equipment usage is expected to be limited during these phases, it is expected that project emissions during these phases can be reasonably considered negligible (less than 0.06% of provincial inventory estimated for the Operations phase) compared to likely provincial GHG inventories at that time.	12-Sep-2016
MOE-124.1	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		Then, please refer to Comment MoE-118 and provide the appropriate estimate to support the conclusion.	Please refer to response provided for MOE-118.1.	12-Sep-2016

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MOE-125	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		It is noted that new components and associated activities include electrical substation and explosive magazines for underground facilities (Project Description, page 2 of 86). (1) According to this, a substation will be constructed, in this case no SF6- or HFCs/PFCs-containing transformers or other electric equipment will be involved and no gas leak is expected? (2) What kind of and how much explosive will be used and what emissions are expected from the explosive explosions?	At this time, it is not known if Sulphur Hexafluoride (SF_6) will be used in voltage step down electrical equipment at the Project site. The substation at the Project is designed to step down the voltage from the Kemess South substation to the underground mine. The Project will rely on the existing Kemess South substation which is supplied by the existing 230 kV BC Hydro Kennedy Substation. BC Hydro switchgear may contain SF_6 prior to entering the Project site boundary; however, BC Hydro electrical equipment is not a direct GHG emission for the Project. The Project is estimated to use 2,233 tonnes of emulsion explosive during the Construction Phase and 4,986 tonnes of emulsion explosive during the Operations Phase. Applying an emission factor of 0.17 tonnes CO_2e / tonne of emulsion explosive (National Greenhouse Accounts (NGA) Factors, 2008, Australia), total GHG emissions for the Operations and Construction phases are 380 (over 5 years) and 848 tonnes CO_2e (over 13 years), respectively. Emulsion explosive GHG emissions represent 0.1% of the total Construction and 0.2% of the total Operations Phase GHG emissions.	12-Sep-2016
MOE-125.1	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		Not sure if the explosive use of 2233 tonnes during construction phase and of 4986 tonnes during operational phase are an annuausage or total usage, respectively.	The 2,233 tonnes of emulsion explosive during the Construction Phase and 4,986 tonnes of emulsion explosive during the Operations Phase are totals and not annual. The remainder of the paragraphs states that "total GHG emissions for the Operations and Construction phases are 380 (over 5 years) and 848 tonnes CO2e (over 13 years)". Therefore, annual explosive GHG emissions during the Construction and Operation phases are 76 and 65 tonnes CO2e.	12-Sep-2016
MOE-126	22-Jul-2016	Qinghan Bian, Climate Action Secretariat, MOE		It's noticed that ventilation is inevitable in this underground extraction activity because of the safety concerns. Has the Proponent ever monitored/surveyed the gas stream vented from underground operation? What are its compositions and how much methane is contained? This methane liberation from underground operation must be included, if any. If the Proponent hasn't done yet, it should be done now.	No underground development has occurred as the project remains in the environmental assessment process. Ventilation will be required for the underground development. However, the report does not calculate methane liberation emissions as the Project's geology is not a tight rock formation where tight gas (methane) would be present.	12-Sep-2016
MOE-126.1	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		Please refer to Comment MoE-116 above, and estimate is still required, if methane exists.	Please refer to response provided for MOE-116.1.	12-Sep-2016
MOE-127	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		The Province now has a carbon price at $30 per tonne carbon, it is reasonable to think that in the future this price will go up, or other mechanism for reducing GHG emissions will emerge, and thus taking into account the envisioned increased carbon price in the benefit analysis and feasibility study is advisable.	AuRico acknowledges the comment; no further response is required at this time.	12-Sep-2016
MOE-128	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		Adaptation to the changing climate is not mentioned yet, but should be considered during the project design, construction and operational phases, in order to keep the project operational through its lifetime.	Consideration of potential effects to the project related to anticipated climate change is provided in Chapter 23 (Effects of the Environment on the Project).	12-Sep-2016
MOE-129	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		Though various possible measures for mitigating GHG are listed in the GHG Assessment Report, feasible/practical measures should be planned in details properly. Further, offsetting is another avenue for consideration, which may bring the Proponent extra benefits in future.	AuRico acknowledges the comment; no further response is required at this time.	12-Sep-2016
MOE-130	22-Sep-2016	Qinghan Bian, Climate Action Secretariat, MOE		RE: FLNRO 120: This was originally commented by Vanessa Foord from FLNRO, and it seems that the Proponent has a different opinion on the magnitude of the GHG contribution to the provincial, and federal as well as global inventories. The current reviewer also agrees with Vanessa on that the potential GHG contribution to all the inventories mentioned is not and cannot be negligible. Actiually the emissions are unnegligible and must be accounted appropriately at the operational phase and reported to the province and Fed's. 0.1% of current provincial inventory and 0.0001% of global level are both big enough factors when considering the magnitudes of the inventories. Thus, the proponent should reconsider the use of the terms.	Please refer to response provided for comment MOE-140.1. AuRico will comply with the relevant provincial and federal GHG reporting requirements throught the life of the project.	12-Sep-2016
MOE-131	16-Oct-2016	Qinghan Bian, Climate Action Secretariat, MOE		Thank you very much for circulating this to us. I reviewed the responses and no further comments will be provided. However, please advise the Proponent that well understanding the chemistry involved in the process and potential emissions is important when coming to reporting, when details will be required for support. Regarding the "Reversibility" and "Significance", obviously we have different opinions with the Proponent, this may come from the different standpoints and the understanding of requirements. However, we will leave this to EAO.	The Proponent thanks the reviewer for the comment. No further action is required.	12-Oct-2016
MEM-161	10-Oct-2016	Michael Cullen, MEM	Geotechnical	I have reviewed the document "Consideration of 2016 Feasibility Study Update with respect to the EAC Application for the Environmental Assessment Certificate". Although not explicitly stated my understanding is that the elevation of the extraction level will be lowered by approximately 40m. The extent of the surface disturbance (cave and subsidence zone) is related to the depth of the extraction level. The submitted document does not discuss if the change in extraction level elevation is expected to result in a change in the surface disturbance area. Here are my questions: • Please provide a cross section showing the change in mine configuration. • Please provide an assessment of whether or not the change in extraction level elevation will alter the predicted extent of surface and subsurface cave and subsidence zones.	The extraction level is now at the 1140m elevation compared to 1160m previously presented in the EA (as per Project Description document), so 20m lower and not 40m as inferred by the reviewer. The bottom of the declines are now 40m lower and that's due to both the extraction level being lower (by 20m) and effect of direct tipping into primary crushers on the extraction level (so lowering of return ventilation level). Note, that the final elevation will be determined during post-permitting mine optimization studies, and is expected to be in the 1140-1160 range based on cave optimization work to-date. The 20m change in extraction level elevation is not anticipated to result in any meaningful change in the surface and subsurface disturbance area, particularly within the limits of accuracy of the subsidence modeling software used by Itasca. When considering this, one needs to consider the small increase in total tonnage mined and swell of caved rock from the extraction level to surface. It should also be noted that while the mined tonnage has increased slightly (107.4Mt v 100.4Mt), the number of drawpoints has decreased from 640 to 582, resulting in a smaller fooprint with slightly increased average draw column height. At the scale of the cave footprint (and more so if one includes the triple declines) there will be little/no noticeable difference between the two mine designs. Both designs have the same main levels with just a 20m difference between undercut and extraction levels, 40m difference between the bottom of the triple declines, and ventilation (intake and return) levels adjusted to suit these changes.	10-Nov-2016
MEM-162	10-Oct-2016	Michael Cullen, MEM	Geotechnical	With respect to question ID# MEM-008: Do the predicted effects on groundwater, surface water, terrain stability, change if more conservative values (e.g. those estimated from empirical assessment) are used for the angle of cave and angle of subsidence? The plan view submitted by AuRico (titled subsidence area original and update) shows an area identified as "Footprint included in EA". Was this footprint the extent of the area used to assess the effects of subsidence on groundwater, surface water, and terrain stability, presented in the EA application?	The "Footprint included in the EA" was the extent of the area used to assess the effects of subsidence on terrain stability, soils, terrestrial ecosystems, wildlife, and archaeology assessments. The effect of subsidence on surface water and groundwater was based on the modeled extent of the 0.5 m displacement as discussed in the memo response **20161110 KUG Comment MEM-007.1, 008.1_Subsidence_Memo.**	10-Nov-2016
MEM-162.1	23-Nov-2016	Michael Cullen, MEM	Geotechnical	MEM believes that bed rock permiability may be significnatly changed at subsidence displcaments less than 0.5m, and that surface water drainage patterns could be altered at displacements less than 0.5m. Please provide further discussion/justification of using 0.5m vertical dispacement as the criteria to assess the extent of the effects of subsidence on surface water and groundwater.	In response to Michael Cullen's request for further clarification of the potential effects from the subsidence zone (comment MEM-162), and subsequent clarification provided by EAO regarding the original request (shown below), I believe our memo response addressed Mr. Cullen's query (**20161110 KUG Comment MEM-007.1, 008.1_Subsidence_Memo**). Clarification provided by EAO:"MEM believes that bed rock permeability may be significantly changed at subsidence displacements less than 0.5m, and that surface water drainage patterns could be altered at displacements less than 0.5m. Please provide further discussion/justification of using 0.5m vertical displacement as the criteria to assess the extent of the effects of subsidence on surface water and groundwater". In reference to the vertical displacement of 0.5 metres and justification for its use. As per the memo, a 0.1m vertical displacement has been modelled, please refer to page 3 Section 3.4.1.1 and Figure 1, of the memo **20161110 KUG Comment MEM-007.1, 008.1_Subsidence_Memo**. Where we present the results of the model refinement that demonstrate the following vertical displacements are nearly identical; (a) 0.5 m expected, (b) 0.5 m conservative and (c) 0.1m expected. Therefore, we are confident that there is no detectable changes from the various cases and that would affect our water balance model. The potential groundwater and surface hydrology effect from the 0.1 m displacement is presented in the remainder of Section 3.4.1.1. The effect of the subsequent capture of the ephemeral stream and its local catchment (22 ha) is addressed in Section 3.4.1.2. The effect of terrain stability is addressed in Section 3.4.2.	11-Nov-2016

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ID #	**Comment Date (i.e. 22-May-16)**	**Reviewer Name / Agency (i.e. Alex Kwang, MEM)**	**Subject (See "instructions" tab)**	**Comment (Include Memo reference as applicable)**	**Proponent Response (Include Memo reference as applicable)**	**Response Date**
MEM-163	10-Oct-2016	Michael Cullen, MEM	Geotechnical	With respect to question ID# MEM-155 :The application states that the runoff water and the ephemeral creek water will be diverted around the southeast side of the subsidence zone. It is understood that this diversion is no longer part of the Mine plan and that the southeast slope runoff water and ephemeral creek water will now report to the cave. This being the case has this water been accounted for in the effects assessment?	Please refer to response to TKN-034.1 in memorandum **20161110_KUG_Comments_TKN_Hydrogeo_Lorax Memo**.	17-Oct-2016
MEM-164	10-Oct-2016	Sean Shaw, MEM	Geochemistry	The components that caught my attention were the proposed changes to the tailings/waste rock amounts and deposition schedules and the additional subaerial tailings beach development. Based on this, my questions are: 1. Please confirm that the existing TSF design is sufficient to handle the additional waste rock and tailings amounts. 2. Please indicate the amount of additional capacity remaining in the TSF at closure based on the revised amounts of tailings and waste rock 3. Please provide an overview of the tailings kinetic testing methodology, a summary of the data collected to-date and demonstrate how the source terms applied in the revised water quality model were developed. 4. Please provide the subaerial tailings loadings conceptual model, including a rationale for the use of a 10cm reactive depth.	The response is provided in memo **20161116_KUG_Comment_MEM-164_Geochem_Lorax_Memo**	17-Oct-2016
MEM-165	10-Oct-2016	Sean Shaw, MEM	Geochemistry	The information request related to the tailings beach source term development I believe was already part of MEM-034, but I can't recall how that issue was left after the phone discussion with Lorax last month. Regardless, given the added emphasis placed on the tailings beach in this revision, I would like to see the supporting data and explanations.	The response is provided in memo **20161116_KUG_Comment_MEM-164_Geochem_Lorax_Memo**	17-Oct-2016
MEM-166	21-Oct-2016	Sean Shaw, MEM	Reclamation and Closure	• Please comment on how increasing the tailings and waste rock tonnage in the TSF will effect current closure plans.	The increase in tailings and waste rock tonnage to be stored within the KUG TSF will result in substantively larger exposed tailings beach at Closure than what was considered in the EAC Application. The larger beach will result in a benefit of reduced Closure/Post-Closure risk associated with long-term storage behind the East Dam, At Closure, a growing medium, sourced from OB1/OB4/OB5, will be placed on the tailings beach for final reclamation and revegetated with suitable plant species. The reclamation prescription for the tailings beach is the same as that presented in the EAC Application, however, the quantity of growing medium required will be adjusted depending on the final area of the exposed tailings beach at Closure. There are no concerns with meeting the required volume of soil medium with the existing overburden storage piles. The increase in tailings and waste rock tonnage in the TSF is not anticipated to result in any meaningful changes to the current Closure plans.	10-Nov-2016
MEM-167	21-Oct-2016	Sean Shaw, MEM	Reclamation and Closure	• Please comment on how the increase in waste rock tonnage removed from the underground will affect the subsidence zone and does this effect current closure plans? MEM understands that the current plan does not include reclamation or mitigation for any VCs in the subsidence zone.	The 20m change in extraction level elevation is not anticipated to result in any meaningful change in the surface and subsurface disturbance area. Furthermore, a 250m buffer area around the projected subsidence zone was considered in the effects assessments for soils, terrestrial ecosystem, wildlife, and archaeology and thus the updates in mining are not expected to change these assessment conclusions.	10-Nov-2016
ECCC-118	21-Oct-2016	Nadine Parker	Air -GHG	ECCC notes some discrepencies between Table 5.6-3 and Table 2.3-10 (Aboveground Construction Equipment) within the Supplementary Greenhouse Gas Assessment Report. Table 5.6-3 does not include all of the types of equipment presented in Table 2.3-10, specifically haul truck, tanker, dump truck, tanker and transport truck.	Information in Table 5.6-3 of the Application was based on the 2013 Feasibility Study (SRK 2013). Additional mobile equipment was identified during the emissions inventory effort to support the GHG assessment. The additional surface equipment included in the GHG assessment included haul trucks (4), tanker (1), dump trucks (3), tanker (1) and transport truck (3). The inclusion of this additional equipment allowed for a more conservative assessment of GHG emissions than the earlier equipment list identified from the 2013 feasibility study.	10-Nov-2016
ECCC-119	21-Oct-2016	Nadine Parker	Air -GHG	ECCC notes that as different tiers of standards have different associated emissions factors, using Tier 3 emissions standards to estimate air emissions would result in a more conservative approach than using Tier 4 emission standards. ECCC cannot verify the accuracy of the emissions estimates presented without confirming the emission standard the proponent used. ECCC therefore requests that the proponent provide information on the expected stringency of the emission standards (Tier 3 or Tier 4) for off-road diesel equipment to be used on site. ECCC would also remind the proponent that the most stringent Tier 4 standards for off-road diesel equipment under the Off-Road Compression-Ignition Engine Emission Regulations will be fully phased in as of 2021.	Emission factors for off-road diesel equipment were taken from NONROAD 2008a, EPA emission factor software which incorporates both Tier 3 and 4 emission factors. Tenders for all construction contracts will require mobile equipment to meeting Tier 4 standards. Additionally, all mobile equipment purchased by AuRico for the KUG Project will adhere to the latest emission standards.	10-Nov-2016
NH-062	25-Oct-2016	Melissa Aalhus, Northern Health	Human Health	Surface Water Quality It is not clear how the updated surface water quality predictions compare to health-based water quality criteria. It is of concern that Section 4.3 predicts surface water elevations above water quality guidelines. Please clarify how these predicted concentrations compare to health-based guidelines. Given the point we are at in the EA process we recommend the following: - That updated contaminant predictions in surface water are compared to health-based criteria; - If health-based water quality criteria exceedances are predicted, proactive measures are implemented to ensure human health is protected (i.e. the earlier initiation of the metal removal water treatment plant; posting signage to prevent land users from drinking surface water at high-risk areas; etc.); AND - That the potential for health impacts is considered in the design of the surface water monitoring program (and the selection of parameters), and that monitoring data is compared to human health-based criteria.	As described in Section 4.3 (Surface Water Quality) of the Feasibility Study Update evaluation (ERM 2016), updated surface water quality predictions were compared to health-based criteria: the BC water quality guidelines for drinking water (BC MOE 2016) and the CCME drinking water quality guidelines (Health Canada 2015). All parameters were below health-based water quality criteria for drinking water. However, the parameters shown in Table 4.3-1 of ERM (2016) exceeded CCME and BC MOE water quality guidelines for the protection of aquatic life and thus were selected as COPCs. While exceedances of water quality guidelines were predicted to occur, the guidelines that were exceeded do not apply to human health. The potential for health impacts will be considered in the design of the surface water monitoring program and monitoring data will be compared to human health-based criteria (i.e., BC MOE and Health Canada drinking water quality guidelines). BC MOE. 2016. Approved Water Quality Guidelines. http://www2.gov.bc.ca/gov/topic.page?id=044DD64C7E24415D83D07430964113C9 (accessed August 2016). Health Canada. 2015. Guidelines for Canadian drinking water quality - summary table. Federal-Provincial-Territorial Committee on Drinking Water of the Federal-Provincial-Territorial Committee on Health and the Environment. http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/index-eng.php (accessed January 2015). ERM. 2016. Kemess Underground Project: Consideration of 2016 Feasibility Study Update with respect to the EAC Application for the Environmental Assessment Certificate. Prepared for AuRico Metals Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.	10-Nov-2016
NH-062.1	28-Nov-2016	Melissa Aalhus, Northern Health	Human Health	Thank you for the additional information. We request that a table is provided that shows the CCME and/or BC MOE drinking water quality guidelines that were used to screen for each parameter, and shows how these compare to the respective updated surface water quality predictions. These results were not clearly communicated in the FSU evaluation, and further, should have been provided in the Human Health section of the FSU evaluation. This will be important to ensure human health is protected. We are pleased that health impacts will be considered in the design of the surface water monitoring program, and that monitoring data will be compared to human health-based criteria. We look forward to further discussions on the surface water monitoring program.	As described in the previous response, the most up to date drinking water quality guidelines (which were used in the comparison with predicted water quality) can be found at the following links: Health Canada (not CCME): http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/sum_guide-res_recom/index-eng.php BC MOE (approved and working guidelines): http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines Health Canada and BC MOE drinking water quality guidelines used in the original assessment were also provided in Table 18.2-5 of the EAC Application. Section 4.3 (5th paragraph, page 4-2 of ERM 2016) describes that water quality model predictions were screened (i.e., compared) against various guidelines, including health-based drinking water quality guidelines. Base case and upper case surface water quality model predictions are found in Appendix G of ERM 2016. Predicted water quality is below drinking water quality guidelines, and no COPCs for human health due to drinking water guideline exceedances were identified (the only exceedances were of aquatic life guidelines, as described in the text of Section 3.3.2 of ERM 2016). A table with the requested information is not provided here because no exceedances of drinking water quality guidelines were identified. ERM. 2016. Kemess Underground Project: Consideration of 2016 Feasibility Study Update with respect to the EAC Application for the Environmental Assessment Certificate. Prepared for AuRico Metals Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.	21-Dec-2016
NH-063	25-Oct-2016	Melissa Aalhus, Northern Health	Human Health	Metals in Dust It is not clear how the updated PM10 concentration prediction at the camp would affect the assessment of metals bound to PM10. How do the updated concentrations of metals bound to PM10 at the camp compare to health-based criteria? Given the point we are at in the EA process, we advise that: - The air quality management plan and air monitoring program consider metal contaminants contained in fugitive dust at receptor locations (including the camp); AND/OR - Predictions of metal concentrations bound to PM10 at the camp (as contained in Table 3.3-2 of Appendix 18-B of the Application) are recalculated using the new PM10 predictions, and are compared to the relevant air quality guidelines; AND/OR - The Proponent implements proactive measures to manage metals in dust. We continue to recommend that air quality mitigation measures including HEPA filtration of all indoor environments. Household dust monitoring for content of these metals may also be needed.	The response is provided in memo **20161108_A.1_KUG Comments NH-063_HH_Metals in Dust_Memo**	10-Nov-2016

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NH-063.1	28-Nov-2016	Melissa Aalhus, Northern Health	Human Health	Thank you for the additional information. Given that total chromium concentrations in dust are high (and exceed the 24-hour hexavalent chromium AAQO), we ask that monitoring for metals includes sampling specifically for hexavalent chromium. If hexavalent chromium levels exceed criteria, we ask that appropriate mitigation strategies are implemented. It should be noted that the annual Ontario AAQO for hexavalent chromium in PM10 is 0.00007 ug/m^3. Why was this value not used? Comparing total chromium to the hexavalent chromium objective may indeed be conservative. However, the modelled total chromium concentration in PM10 (0.000483 ug/m^3) is well above both the 24-hour and annual objectives for hexavalent chromium. Even if hexavalent chromium only constitutes a portion of total chromium in dust, it is possible that the hexavalent chromium concentration in PM10 will exceed the objectives for hexavalent chromium.	AuRico is committed to the best management practices and mitigation measures outlined in the memo **20161108_A.1_KUG Comments NH-063_HH_Metals in Dust_Memo**. A detailed Air Quality Management Plan will be developed during permitting. The predicted concentrations of metals associated with PM10 reported in Table 1 of **20161108_A.1_KUG Comments NH-063_HH_Metals in Dust_Memo** are based on a 24-hour averaging period. The concentrations predicted for the annual averaging period would be lower than the 24-hour averaging period. It is not appropriate to compare a predicted concentration for a 24-hour averaging period to an annual objective. It is conservative to use the 24-hour averaging period predicted concentration in risk assessment since it overestimates the risk during long-term exposures, which is what was done in the Application. The metal concentration associated with PM10 depends on the source of the dust. Note that the chromium concentrations in PM10 due to road dust are below the Ontario AAQC, while only the dust due to ore contains elevated chromium concentrations (assuming all of it is hexavalent chromium). People could receive exposure to metals in PM10 in air with PM10 sourced from both road dust and from ore. Further, neither BC or Canada have air quality objectives for chromium and the air quality objectives for metals in air provided in the Application and in ERM 2016 may or may not be health-based. The objectives used in the Application and in ERM 2016 were used for the purposes of identifying contaminants of potential concern (COPCs) for carrying forward for further evaluation in the multimedia human health risk assessment. Ambient air quality objectives derived in Texas or in Ontario do not apply in BC. Chromium was selected and evaluated as a COPC in the human health risk assessments provided in the Application. Potential risks (defined as a hazard quotient greater than 0.2) were identified only for toddlers. The upper right graph in Figure 18.5-2 shows the hazard quotients calculated from the various exposure pathways for chromium. Exposure via inhalation (i.e., breathing metals in air) represents a negligible exposure pathway for chromium (i.e., the blue color representing the inhalation pathway contribution to overall exposure is not even visible in the stacked bar for total exposure to chromium). ERM. 2016. Kemess Underground Project: Consideration of 2016 Feasibility Study Update with respect to the EAC Application for the Environmental Assessment Certificate. Prepared for AuRico Metals Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.	21-Dec-2016
NH-064	25-Oct-2016	Melissa Aalhus, Northern Health	Human Health	Particulate Matter We disagree that increased PM2.5 and PM10 concentrations would not affect the conclusions of the HHRA. We recognize that modelled PM2.5 and PM10 continue to fall below their corresponding objectives, but note that PM is a non-threshold contaminant with no safe exposure level. Incremental increases in PM have been associated with both mortality and morbidity in epidemiological studies; effects can be observed at any concentration (in fact, recent literature suggests that the dose response curve is steepest at lower concentrations). Health effects of short-term exposure to particulate matter can reduce lung function, trigger heart attacks and exacerbate asthma and chronic obstruction pulmonary disease (COPD). Even more important are the health impacts from long-term cumulative exposures of the finer fractions which include a wide array of chronic cardiopulmonary morbidities and mortalities. We ask that this is acknowledged, and that efforts are made to reduce particulate matter levels to as low as reasonably achievable (including measures to reduce PM concentrations in indoor environments). Please refer to our previous comments on PM.	As stated in the 2nd round comment response to NH-035, it is acknowledged that health effects from PM can be observed at concentrations below air quality criteria, since PM is a non-threshold contaminant. It is also acknowledged that any incremental change in PM levels can lead to a theoretical incremental change in health effects; however, the predicted incremental change in PM associated with the Feasibility Study Update does not alter the conclusions of the HHRA, that there were no residual effects identified due to the Project for the Human Health VC. In a human health risk assessment, the dose of COPCs from the different exposure pathways (i.e., inhalation, soil ingestion, dermal contact with soil, and country foods ingestion) are summed. As shown in Tables 4.7-1 and 4.7-2 of Appendix 18-B of the Application, the inhalation route is a minor route of exposure compared to the dose of COPCs from ingestion of country foods, drinking water, and soil. Therefore, there would have to be a significant increase in PM concentrations for the inhalation route to change the overall risk to human health. Mitigation measures for air quality are presented in the Air Quality Management Plan (Section 24.3 of the Application), and the mitigation measures include "operational measures that will be established to avoid, control, and mitigate air emission impacts." The air emissions referred to in the statement include PM2.5, as described in Section 24.3.3 of the Application.	10-Nov-2016
NH-064.1	28-Nov-2016	Melissa Aalhus, Northern Health	Human Health	Given that an incremental change in PM is predicted due to the FSU changes, and as stated by the Proponent, that "any incremental change in PM levels can lead to a theoretical incremental change in health effects", we do not agree that the conclusions of the HHRA will not be altered. As noted previously, we do not agree with the conclusion that "there were no residual effects identified due to the Project for the Human Health VC". For Particulate Matter, the only exposure route assessed was inhalation (recognizing that metals carried in PM10 were assessed separately). Thus the following argument made by the proponent is not valid: that "the inhalation route is a minor route of exposure compared to the dose of COPCs from ingestion of country foods drinking water, and soil. Therefore, there would have to be a significant increase in PM concentrations for the inhalation route to change the overall risk to human health". As was completed in the Application, PM is assessed only based upon exposure through inhalation. We stand by our original comment, and ask that the potential for health effects is acknowledged and appropriately mitigated.	Page 4-16 of ERM 2016 states: "...the inhalation exposure route for **metals** is relatively minor compared to other exposure routes...". The statement in the previous response to this comment is referring to metals, which were the only parameters identified as COPCs in the risk assessment in the Application and the re-evaluation in ERM 2016. It has been acknowledged that sensitive individuals may be affected by particulate matter exposures below the concentrations specified in the objectives. However, the ambient air quality objectives specified by either the federal (Canada) or provincial governments (British Columbia) were used as the screening criteria for determining whether criteria air contaminants (such as particulate matter) warranted further evaluation in the Application or in ERM 2016. At the camp bunkhouse, the predicted concentrations of both PM10 and PM2.5 are substantially lower than the objectives for both 24-hour and annual averaging periods. In addition, the predicted concentrations of PM2.5 are below the planning goal described by BC MOE of 6 ug/m3. These results are the same as what was presented in the Application (as shown in the comparison in Table 3.1-3 of ERM 2016); hence the human health effects assessment would remain unchanged based on the Feasibility Study Updates. Until such a time as the ambient air quality objectives are modified, the use of these objectives as screening criteria is standard practice in BC environmental assessment, use of different standards is deemed not appropriate. Note that as of November 17, 2016, the BC MOE updated their BC Ambient Air Quality Objectives (http://www.bcairquality.ca/reports/pdfs/aqotable.pdf) and the PM10 and PM2.5 criteria shown in Table 3.1-2 of ERM 2016 remain unchanged after this update. AuRico is committed to the best management practices and mitigation measures outlined in the Air Quality Management Plan (Section 24.1 of the Application) and in 20161108_A.1_KUG Comments NH-063_HH_Metals in Dust_Memo. The commitments represent industry standard practices to ensure proponents maintain air quality at levels that are consistent with the expectations put forward by the federal and provincial governments. ERM. 2016. Kemess Underground Project: Consideration of 2016 Feasibility Study Update with respect to the EAC Application for the Environmental Assessment Certificate. Prepared for AuRico Metals Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.	21-Dec-2016
NH-065	25-Oct-2016	Melissa Aalhus, Northern Health	Human Health	Groundwater As communicated previously, we continue to have outstanding concerns regarding groundwater, and are waiting for supplemental information (that we will forward to our Environmental Health Officers). It is our understanding that we will be provided with additional information on predicted groundwater contaminant concentrations, and that the Proponent will also identify any predicted exceedances of health-based criteria. If any additional groundwater modelling/monitoring is conducted to assess the FSU project updates, we ask that these updated modelling predictions are included in the supplemental information we receive.	AuRico will include information from the latest model predictions when communicating with Northern Health as committed in comment response NH-010.1.	10-Nov-2016
NH-066	25-Oct-2016	Melissa Aalhus, Northern Health	Human Health	Accidents and Malfunctions It is not clear how the FSU updates will impact the likelihood and consequences of accidents and malfunctions. We ask that it is considered how these changes could impact human health in the event of an accident or malfunction. It should be determined if updates need to be made to emergency response plans (i.e. how will the additional tailings and waste rock tonnage (3.0 Mt of waste increased from 2.3 Mt) impact the potential contaminant concentrations that could be spilled in the event of a dam failure?). As noted previously, we emphasize the importance of considering the potential impacts of a dam failure. This is particularly important given the experience with Mount Polley. Because the KUG Project area drains into the Peace River watershed (and will contain PAG rock), the health impacts could be much more catastrophic than what was experienced with Mount Polley. It is advisable that updated modelling predictions of contaminant concentrations in the tailings pond are considered. This will ensure that any changes necessarily to prevent and respond to these impacts can be made at the pre-approval stage.	As noted in Section 3.1 of the Feasibility Study Update evaluation (ERM 2016), the increase in tailings and waste rock volumes necessitates that a larger subaerial tailings beach be incorporated as part of the tailings management for the Project. A substantive benefit of an extended tailings beach is that standing water will be located further back from the East Dam, which would reduce the consequence of any dam failure scenario by reducing the ability of water and tailings to mobilize downstream. Additional information on dam breach considerations of the KUG TSF with an extended beach are discussed in Appendix 4-C (Alternatives Analysis for Tailings and Waste Rock Disposal, Chapter 8 - Application of Best Available Technology for Tailings Storage) of the Application. As such, environmental effects associated with the failure of the East Dam with an extended beach would be lower in all respects to those described in Section 22.7.7 of the Application. ERM. 2016. Kemess Underground Project: Consideration of 2016 Feasibility Study Update with respect to the EAC Application for the Environmental Assessment Certificate. Prepared for AuRico Metals Inc. by ERM Consultants Canada Ltd.: Vancouver, British Columbia.	10-Nov-2016
NH-066.1	28-Nov-2016	Melissa Aalhus, Northern Health	Human Health	Thank you for the clarification. We do not understand the implications of this change, as we have not been involved in the technical aspects of the tailings storage design. However, we ask that public health impacts are considered throughout all phases of the project and that efforts are taken to ensure that health impacts will be reduced to as low as is achievable. Specifically, we ask that both the acute and chronic health effects are considered. Ch. 8 of Appendix 4-C of the Application proposes that the extended beach would be constructed in the last years of operations. Prior to closure, would the FSU changes result in more considerable health effects in the event of a dam failure? If so, we ask that the potential health effects are assessed, such that any changes to the design and/or emergency response procedures that are deemed necessary to prevent/respond to these impacts can be made.	The construction period of the proposed extended beach will not change, the beach will be developed in the final years of mine operations as per the original design. The material forming the beach (i.e. tailings sand) will be essentially of the same source as per the original design, simply recovering more sand to complete the extended beach. The engineering concept of the extended provides an incremental safety margin of reducing the possibility of dam failure and with the corresponding reduced ponded water volume, it also reduces the potential dam failure and reduces the potential subsequent discharge of sand and water from the impoundment. As a result there is no requirement to adjust our emergency responses procedures, all procedures established for the original design are appropriate for the minor addition of an extended beach, as well, the original reclamation and closure prescription is also appropriate for the dam configuration.	21-Dec-2016
MOE-132	26-Oct-2016	Tracy Henderson, MOE		The updated water quality model includes base and upper case results for three model assessment nodes downstream of discharge locations from KUG TSF (i.e., IDZ_WQ-17, WQ-18 and Thutade Lake). Predicted water quality of Attichika Creek is similar to predicted water quality presented in the EAC Application; however, there are new chemicals of potential concern (COPC) identified within Attichika Creek downstream of the proposed effluent discharge location. These are related to the small increases in waste rock and tailings to be stored in the KUG TSF. The COPCs identified in the base case include: total and dissolved aluminum and total cadmium. These COPC were identified as low magnitude (minor exceedance of guideline), short-term (one or two months of duration), and limited to the late construction and early operation phases. The definitions of characterization criteria for residual effects on surface water quality wasn't included in the Feasibility Study, so I reviewed Table 11.6-10 in the original EAC Application.	Table 11.6-10 provides a summary of customized definitions relevant to the assessed indicators for the surface water quality VC for the Application and is applicable to the updated surface water quality assessment presented here; definitions of the criteria are customized, if necessary, for each VC and are presented within the relevant assessment chapter in the Application. Note, the characterization of effect magnitude as either negligible, low, medium, or high is not informed by the predicted magnitude of guideline exceedance as is suggested in comment ID#-MOE-132. Rather, the magnitude of residual effects is characterized by the predicted change relative to existing surface water quality conditions.	10-Nov-2016

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MOE-133	26-Oct-2016	Tracy Henderson, MOE		1. Please provide clarification on how resilience was defined. A discussion of the key contributors to resilience and the extent to which the KUG mine might affect the mechanisms of resilience is essential. Dissolved aluminum (base and upper cases) and dissolved cadmium (upper case only) concentrations are predicted to be greater than 30-day (chronic) guidelines in spring and/or fall of Year -2,-1 and Year 1. The chronic guidelines are intended to protect the most sensitive species and life stage against sub-lethal and lethal effects for indefinite exposures. While exceeding a long-term water quality guideline does not imply that an unacceptable risk exists, but rather the potential for adverse effects may be increase. Additionally, the Application conducted a significance rating for all the COPC combined. A significance rating should be included for each COPC as they can behave differently in the receiving environment (i.e., what are the most sensitive species and life stages for dissolved aluminum). Please update the assessment accordingly.	The characterization of residual effects on surface water quality presented in Section 4.3.3 is consistent with the established framework of the effects assessment of the original Application both in terms of methodology for the characterization of residual effects as well as significance determination (please see Section 11.6 of the Application). Characterization of residual effects of analogous COPCs (with respect to water quality predictions, existing concentrations, and known geochemical behavior) is grouped for clarity and efficacy in discussion of results only. For example, concentrations of total aluminum, total copper and total molybdenum in Waste Rock Creek are predicted to be measurably different from existing conditions (i.e., greater than background plus 10%, indicating an effect to water quality), and applicable water quality guidelines in some high flow months in Closure an Post-Closure; these water quality parameters similarly exhibit large seasonal variation in existing conditions (i.e., ~an order of magnitude). For organizational purposes and efficacy in discussion of these results, characterization of residual effects of these COPCs was grouped under a single heading in Section 11.6.2.3. Actual residual effects characterization was not informed by the organizational grouping- residual effects for each of these COPCs are characterized as being of high magnitude, discrete in geographic extent, far future in duration, regular frequent in occurrence. Resilience is not an intuitive criterion for a non-biological VC such as surface water quality. However, in the context of the effects assessment, surface water quality resilience is indicated by frequently wide ranges in concentrations of water quality parameters under existing conditions. Variability in background concentrations therefore indicates that the VC has some resilience to change. Base case dissolved aluminum and dissolved cadmium concentrations, as predicted in the updated model, are within the range of natural variation of the system (Section 11.4.3 of the EAC Application). For these COPCs, the context for the surface water quality VC was characterized as neutral as existing background concentrations can vary seasonally by up to an order of magnitude (see Section 11.4.3 and Appendix 11-A), indicating the receiving environment has a neutral resilience to imposed stresses and may be able to respond and adapt to the effect.	10-Nov-2016
MOE-134	26-Oct-2016	Tracy Henderson, MOE		2. Please provide clarification on how the assessment methodology pre-defined how the combination of ratings for all the attributes used to characterize residual effects was classified. Was a matrix used which incorporated all the attributes used to characterize residual effects and how was each one weighted (i.e., a high rating in magnitude will always result in a high severity etc.). Where are the confidence ratings and definitions (i.e., how was the concept of confidence and uncertainty were factored)?	The characterization of residual effects on surface water quality presented in Section 4.3.3 is consistent with the established framework of the effects assessment of the original Application both in terms of methodology for the characterization of residual effects as well as significance determination (see Section 11.6 of the Application). Further details of residual effect significance assessment are provided in Section 8.5.4 of the Assessment Methodology chapter. For the surface water quality VC, non-significant residual effects have negligible to medium magnitude and are of discrete to local geographic extent; short- or medium-term duration; could occur at one-time to sporadic frequency, and are reversible or partially reversible in either the short or long-term. The effects on the VC are indistinguishable from background conditions or occur within the range of natural variation as influenced by physical, chemical, and biological processes. Follow-up monitoring of these effects may be required if the magnitude is medium. Significant effects have high magnitude, regional or beyond regional geographic extent; duration is long-term or far future; and occur at regular to continuous frequencies. Residual effects on VCs are consequential (i.e., structural and functional changes in populations, communities, and ecosystems are predicted) and are partially reversible or irreversible. To support the residual effects assessment, confidence is defined as the level of uncertainty associated with the residual effects assessment (including significance determination) and is a measure of how well residual effects are understood and the quality of the input data; confidence definitions as relevant to surface water quality VC and updated model predictions are provided in Table 11.6-13 of the Application and discussion of confidence in water quality predictions and the residual effects assessment of COPCs is provided in Section 11.6.2.6 of the Application and is applicable to the updated predictions and assessment completed to support the Consideration of 2016 Feasibility Study Update with respect to the EAC Application for the Environmental Assessment Certificate	10-Nov-2016
MOE-135	26-Oct-2016	Tracy Henderson, MOE		3. Table 4-7.1 (Relevant Water Quality Guidelines for Wildlife) isn't inclusive (i.e., missing molybdenum, selenium).	The information presented in Table 4.7-1 includes only the potential COPCs for which there was an indicated change in concentration as a result of updated modelling with regards to the 2016 Feasibility Study. The updated water quality model predictions show changes in total cadmium, total aluminum, and dissolved aluminum within Attichika Creek (see Section 3.3.2; Figures 3.3-1 to 3.3-18). Therefore, the relevant guidelines for wildlife for these COPCs are presented in Table 4.7-1. Relevant water quality guidelines for wildlife of all potential COPCs are presented in Table 15.5-4 of the Application/EIS, which includes selenium and molybdenum.	10-Nov-2016
NRCan-010	2-Aug-2016	Angeles Albornoz , Natural Resources Canada	Other	Our experts have reviewed the responses that the Proponent provided to NRCan's 1st round of comments. NRCan is satisfied with the responses provided. There are no further comments or follow-up questions. We look forward to continued collaboration on this review	The Proponent thanks NRCan for the review.	17-Oct-2016
NRCan-011	26-Oct-2016	Veronica Mossop, Natural Resources Canada	Other	NRCan has noted two sections in the "Effects Evaluation of Updated Feasibility Study" mention our expertise: 4.1 Hydrogeology (PDF p. 42) • not expected to be significant changes that would warrant revisions to groundwater quantity and quality predictions presented in the EAC Application 4.5 Terrain and soils (PDF p. 53) • no changes to the characterization of residual effects for the terrain and soils VC We have no concerns at this time. If you have any questions feel free to give me a call.	The Proponent thanks NRCan for the review and acknowledges the comment.	17-Oct-2016
HC-017	26-Oct-2016	Eleanor Setton, Health Canada	Human Health	Thank you for the opportunity to review the effects evaluation of changes to the proposed Kemess Underground mine from an updated feasibility study. Assuming the revised predicted COPC levels are accurate, we have no further comments with respect to the human health risk assessment based on these inputs. Health Canada would need to review any new results should the predicted levels change given adjustments made to the modelling due to comments from other reviewers.	The Proponent thanks Health Canada for the review and acknowledges the comment.	17-Oct-2016
CEAA-016	21-Nov-2016	Quincy Leung, The Agency	Explosives	With respect to CEAA 2012 s.5(2): The Agency agrees that the explosives storage facility could involve minimal ground disturbance. However, the proponent should provide information on the context and provide an analysis to support their conclusion that environmental effects are assessed to be negligible, such as where the facility be will be located, will it be placed in an area of sensitive wildlife habitat, if it would displace a SARA listed plant species, etc.	The response is provided in memo **20161117_8.1_KUG Comment CEAA-016_Section 5(2)_Memo**	18-Nov-2016
FLNRO-147	7-Nov-2016	James Jacklin, FLNRO	20161028_KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo	1) Section 3.2. Were roads constructed prior to 2009, such as exploration roads, that haven't been reclaimed because they are still in use included in the analysis?	Yes, all roads visible on the Spot 6 satellite imagery (2013) at a scale of 1:50,000 were included including exploration roads.	14-Nov-2016
FLNRO-148	7-Nov-2016	James Jacklin, FLNRO	20161028_KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo	2) Section 4.1, in reference to the statement ' only five locations of caribou observations that overlapped……' . While this may be true, it is of note that only a small percentage of caribou in the area actually have active collars. It is the reviewers understanding that of the reported 100 caribou in the Thutade range, 10 GPS collars were deployed in the area.	Caribou observations from animals that had GPS collars were used as well as observations from Kemess baseline surveys as stated in Section 3.1.	14-Nov-2016
FLNRO-149	7-Nov-2016	James Jacklin, FLNRO	20161028_KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo	3) 4.3.1.2. 'using the average and maximum number of caribou per season observed within 500 m of existing disturbance….. the percentage .. potentially affected by the project between 2-9.5%. Is this reflective of the actually percentages when considering only a very small number of caribou have functioning collars? Or, has this been accounted for?	Caribou observations within 500 m of existing disturbance used data from GPS collared animals as well as observations from Kemess baseline surveys as stated in Section 3.1. No adjustments were made to the calculations based on only a percentage of the proposed Thutade herd animals having GPS collars.	14-Nov-2016
FLNRO-150	7-Nov-2016	James Jacklin, FLNRO	20161028_KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo	4) 4.3.1.2 Although potential direct and indirect effects to the proposed Thutade herd are proportionately higher, the displacement of nine animals is unlikely to result in significant effects to this herd. Is this 9 based on collared caribou, or an extrapolation from the collared animals? Would that change the prediction for an effect on the herd?	The original estimate of 9 individuals being observed in summer as the maximum for this season was based on data collected during aerial and ground surveys in 2003 (Table 4.1-2). The displacement of 9 animals was estimated from row 4 of Table 4.3-2 representing the highest percentage of the Thutade herd being affected during each season.	14-Nov-2016
FLNRO-151	7-Nov-2016	James Jacklin, FLNRO	20161028_KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo	5) 4.3.1.3 unclear on the combination of low elevation habitat and matrix for the 65%. After searching the federal recovery strategy, can not find the quotation used by ERM. A current state of 48% disturbed low elevation exceeds "within the Northern and Central Groups that contain low elevation winter range, a perpetual state of a minimum of 65% undisturbed habitat in order to provide an overall ecological condition that will allow for an ongoing recruitment and retirement cycle of habitat;"	The quotation is taken from the Executive Summary of the recovery strategy, page v. Although the estimated level of disturbance for low elevation winter range exceeds the 35% target in the candidate Chase local population unit (LPU), the 65% minimum undisturbed low elevation winter range threshold applies to the current Chase LPU as represented in the publically available recovery strategy, which is south of the Kemess local study area.	14-Nov-2016
FLNRO-152	7-Nov-2016	James Jacklin, FLNRO	20161028_KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo	6) Table 4.3-2. Example, 3rd row, %Thutade Herd (95). Clarification, is this based on the actual number of collared caribou, which is a low percentage, or was a number extrapolated to give an estimated impact based on percentage collared to numbers in herd?	The averages and maximums used in Table 4.3-2 are based on the results of the analysis in section 4.1. Averages per season are summarized at the bottom of Table 4.1-2 while maximums are throughout the same table. The observations were based both on GPS collared animals as well as observations of animals during Kemess baseline aerial and ground studies.	14-Nov-2016

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FLNRO-153	7-Nov-2016	James Jacklin, FLNRO	20161028_KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo	7) 4.3.1.3 The amount of candidate critical habitat that will be lost due to Project infrastructure is 97.6 ha. Using the candidate critical habitat polygons, 95.4 ha of this will be in high elevation winter/summer range while 2.2 ha will be in low elevation winter range. Is this consistent with the strategy that suggests: This recovery strategy identifies as critical habitat: all habitat in high elevation summer and winter range; This strategy considers at this time that very minimal disturbance for high-elevation winter and/or summer ranges in all Groups… As identified in the first round of comments related to the Province's Environmental Mitigation and Offset Policy, has any additional thought been put to offsetting for this project?	AuRico would consider additional measures specific to critical caribou habitat if the revised Chase LPU is formally adopted and overlaps with the Project in a revised and published recovery strategy.	14-Nov-2016
FLNRO-154	7-Nov-2016	James Jacklin, FLNRO	20161028_KUG Comment_ECCC-091.1, 093.1, 097.1, 098.1, 115 Memo	8) 4.3.1.3 "the surface material will remain the same as baseline conditions. The alteration that will occur is in the topography of the area. The slopes of the subsidence area are assumed to fill with the surrounding talus material to the angle of repose found on nearby slopes. This will occur within an area of alpine ridges between East Cirque Creek and and Amazay Lake that is already topographically very steep. As such, navigating through this area should be similar to what caribou already experience" I thought the subsidence was a 90m drop?	The bottom of the subsidence depression will be displaced by approximately 90 m and decrease to zero displacement at the edge of the subsidence zone with talus slopes forming at the natural angle of repose.	14-Nov-2016
ECCC-120	21-Oct-2016	Nadine Parker	Wildlife and Habitat	As part of CWS' internal assessment of potential impacts on caribou, we'd like to have access to the spatial data for planned infrastructure and other project activities for the LSA. This will guide us in our comments when the Proponent's caribou memo arrives.	The requested data was provided directly to the reviewer on November 2, 2016 (Zipped Folder name: **Kemess_Underground_Infrastructure.gdb**)	2-Nov-2016