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December 15, 2016
Project No.: 1125011

Krysia Zurakowski
Project Assessment Officer
Environmental Assessment Office (EAO)

Dear Ms. Zurakowski,

Re: Ajax Project EA/EIS – Response to 20161121_FLNRO_DThomson_Groundwater

Thank you for sharing the response memorandum containing the advice from Mr. Thomson of the Ministry of Forests, Lands & Natural Resource Operations (FLNRO) to EAO, regarding the GW Solutions memos that document the concerns of the Stk'emlupsemc Te Secwepemc Nation (SSN) (161121_FLNRO_DThomson_Groundwater). We have provided a general response to the concerns raised in this memo in this letter, and have highlighted what we believe to be some misunderstandings evident in that e-mail content. We note that significant work has been done to evaluate the uncertainties associated with concerns related to the Edith Lake Fault Zone (ELFZ) and to the potential for seepage from Jacko Lake. From Mr. Thomson's comments it is not clear that he has been privy to all of the responses to information requests provided by KGHM Ajax Mining Inc. (KAM). For FLNRO's benefit, these are referenced at the end of the letter (BGC 2016a,b,c,d,e).

The purpose of an Environmental Assessment (EA) is to evaluate the potential effects of a project on Valued Components (VCs) and to identify and bracket uncertainty that may be associated with VCs in some project areas. An EA is not intended to eliminate the uncertainty associated with areas of the study where, as is the case for the groundwater quantity VC regarding seepage rates from Jacko Lake and the potential hydraulic conductivity of the ELFZ, there is a conflict of professional opinion between the multiple Qualified Professionals retained by KAM to conduct hydrogeological studies in support of the EA and those retained by local stakeholders. In our view, the work completed to date has appropriately identified the areas where additional study is warranted at the next level of project study. KAM has proposed these additional studies and will complete them if the Project receives EAO's approval and the decision is taken to proceed to the project permit application stage. In addition, KAM respectfully submits that the EAO has an instrument to require these additional studies be completed as Conditions on an EA Certificate. KAM remains committed to working with EAO, the Canadian Environmental Assessment Agency (CEAA) and the reviewers (i.e., FLNRO and SSN) to prepare a work plan for additional

groundwater studies supporting the Ajax Project that is consistent with project permitting and construction timelines and is also reflective of the increasing level of study and understanding required at these future project stages.

In response to your email, we would like to express some concern as to the potential misunderstanding on the reviewers' behalf of some key technical aspects of the Project as they relate to groundwater. With regards to the ELFZ investigation and packer testing, we note that the work identified the presence of a fault structure. Three interpretations of orientation and thickness of the ELFZ were developed as a result: a 4 m wide geologic structure dipping steeply to the southwest; a 5 m wide structure dipping steeply to the northeast; and, potentially a 50 to 60 m wide structure with a vertical orientation.

Packer testing, which is a relatively short duration test that typically lasts a few hours, provides an estimate of the local scale hydraulic conductivity (e.g. order of metres extending approximately radially from the interval tested). A total of 6 packer tests were conducted and 3 of them indicated higher range hydraulic conductivity in one borehole advanced in the interpreted fault zone. One of the tests that indicated a potentially higher hydraulic conductivity (i.e., $>3x10^{-6}$ m/s) was successfully re-completed over a smaller interval within the same zone, and realized a value of $2x10^{-6}$ m/s. To capture the uncertainty associated with this structure for the EA, it was simulated in the numerical groundwater model as a zone a minimum of 50 m wide and up to 250 m wide and present through the full vertical and lateral extents of the model used to represent bedrock units. A hydraulic conductivity of 10 times that of the host rock was assigned in the groundwater model during the EA because the modeling was completed prior to the investigative work.

Further, in response to technical review comments received during the project EA review process, additional simulations were completed that assigned hydraulic conductivity of the feature of 30 times, 150 times and 1,500 times that of the adjacent host rock, again across a width of 50 m to 250 m, laterally extensive in the model and extended through the full vertical extent of the bedrock layers of the model. This is a very conservative assumption for an interpreted fault zone that lies under several to 10s of meters of dense, low hydraulic conductivity till and does not daylight within any of the proposed mine infrastructure as a result.

Mr. Thomson suggests re-entering the borehole to conduct additional testing at the local scale as an option to reduce uncertainty related to the ELFZ and its hydraulic characteristics; however, this will not be sufficient to characterize the larger scale hydraulic conductivity of this feature. KAM has proposed additional investigations and additional local scale testing at several locations along the ELFZ as well as a pumping test to further evaluate the larger scale hydraulic characteristics of this interpreted geologic structure. Given the scale of this work, and level of associated cost and disturbance, the appropriate timing of this work is post-EA, but prior to mining. The potential uncertainties associated with this feature have been conservatively considered and sufficient information is available to the reviewers and statutory decision makers to evaluate the potential effect of the ELFZ on the project. No additional work as part of the EA should be required.

Similarly, with respect to pumping test interpretations in PW01 near Jacko Lake, Mr. Thomson has highlighted a difference of professional opinion between KAMs Qualified Professionals (BGC Engineering Inc. (BGC), Klohn Crippen Berger (KCB)) and that of GW Solutions. However, BGC submits that GW Solutions has not actually provided a re-analysis of the data, but rather has raised some concern with respect to the analytical solution most appropriate for interpreting the results of the pumping test. No formal re-analysis was provided. Further, there is ample precedent in the literature for using data from pumping tests wherein the rate of drawdown has not fully stabilized (e.g. Theis, 1935; Kruseman and deRidder, 1994). There are alternative interpretations for the reason this change in rate of drawdown occurred – for example a change in pumping rate required to maintain a safe operating level above the pump intake. This was exactly the situation that BGC encountered during its pumping test in 2011, and supports the interpretation of barrier, rather than recharge, boundary conditions. Finally, KAM's consultants, recognizing the sometimes limited ability of any 2-dimensional analytical solution to accurately capture the 3-dimensional characteristics of a fractured bedrock flow system, also considered the pumping test data using the 3-dimensional groundwater flow model. This was completed in addition to interpretations of the data by multiple Qualified Professionals (i.e., hydrogeologists and hydrogeological engineers at BGC and KCB) using a suite of analytical models. The groundwater model was also calibrated to the results of those interpretations. This is a fundamentally more robust assessment of the data sets available from this testing than can be undertaken using 2-dimensional analytical solutions.

Mr. Thomson goes on to suggest that requiring KAM to advance another pumping well as part of permitting or as a Permit Condition prior to construction is likely not an onerous condition as the open pit depressurization system will use vertical depressurization wells. However, this is not completely accurate. The pit slope design will rely on horizontal drains with a budget contingency for installing up to 20 vertical wells in potentially higher hydraulic conductivity zones should they be encountered during mining. Nevertheless, KAM has committed to undertaking additional pumping tests in the areas between the proposed pit and Jacko Lake at a subsequent stage of design and in this regard concurs with the timing of this work suggested by Mr. Thomson.

KAM remains committed to discussing the issues raised within this correspondence with EAO, FLNRO and GW Solutions. Based on the work that has been completed to date, BGC believes the groundwater flow regime has been characterized using standard hydrogeologic analyses for the purposes of this Environmental Assessment. The responses prepared during the public review period are robust and technically sound, and it is likely that the level of additional investigative work requested by the reviewers for an EA is beyond precedent set in BC by other mining projects (e.g., the KSM, Brucejack, Red Chris Projects (Seabridge, 2013, Pretium, 2014, BC MOE 2016)). However, KAM is committed to conducting additional investigative work as a condition of the EA.

We look forward to continued engagement with EAO on the Ajax Project.

Yours Sincerely,

BGC ENGINEERING INC.
per:

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Principal Hydrogeological Engineer

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Reviewed by:

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REFERENCES

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BGC Engineering Inc. 2016a. Ajax Project EA/EIS - Responses to Information Requests SSN-328 and SSN-329. Project memorandum 0414_KAM_JL_Ptest_BGC-012 dated April 14, 2016.

BGC Engineering Inc. 2016b. Ajax Project EA/EIS - Responses to Information Requests from ECCC & FLNRO on the Edith Lake Fault Zone. Project memorandum 0706_KAM_ELFZ_BGC-002 dated July 6, 2016.

BGC Engineering Inc. 2016c. Ajax Project EA/EIS - Responses to Information Requests CEAA-047; COK-SLR569 and -570; ECCC-020 and -085; FLNRO-208 and -226; SSN-683, -813, -889, -891, -896 and -898. Project memorandum 0706_KAM_BGC-17 dated July 6, 2016.

BGC Engineering Inc. 2016d. Ajax Project EA/EIS - Responses to Round 2 Information Requests from SSN. Project memorandum 1213_KAM_BGC-023_SSN dated December 15, 2016.

BGC Engineering Inc. 2016e. Ajax Project EA/EIS - Responses to Round 2 Information Requests from FLNRO. Project memorandum 1213_KAM_BGC-022_FLNRO dated December 15, 2016.

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