Attachment 1
Lynn Lake Gold Project
Information Requirements for Environmental Impact Statement Technical Review

On July 23, 2021 the Impact Assessment Agency of Canada commenced Round 2 technical review of the Environmental Impact Statement and responses to Round 1, Package 2 Information Requests for the Lynn Lake Gold Project. The table below is to assist in the preparation of Information Requests that support full understanding of the Project's potential for significant adverse environmental effects and potential impacts to rights.

Reference IR#	Expert Dept. or group	EIS Guideline Reference	EIS Reference	Context and Rationale	The Proponent is Required to ...
Groundwater					
IAAC-57(2)	NRCan	Section 8 Follow-up and Monitoring Programs	Volume 1, Chapter 8, Section 8.1.4.1 Temporal Boundaries, Volume 5 Appendix F Section 5.4.1, and Appendix G, Section 5.4.1	As stated in the guidelines, the follow-up program should be designed to verify the accuracy of the effects assessment. For groundwater this verification should include the assessment of seepage flow pathways and seepage quantities from mine facilities. The response to IAAC-57 states that groundwater monitoring will continue for a period of 6 years following pit flooding. The response goes on to state that monitoring will cease when sites are restored to satisfactory conditions, and water chemistry is stable and below discharge criteria. It is not clear from the response but it appears that the stable water quality condition applies to the pit water quality. As groundwater seepage effects are forecasted to occur over much longer timelines than pit water quality stability (Appendix F Table 5-9, and Appendix G, Table 5-12), it is not clear that the 6 year groundwater monitoring period following pit flooding will be adequate to confirm the results of the groundwater seepage assessment.	Provide conditions for the cessation of the groundwater monitoring program that would be adequate to verify the results of the groundwater assessment.

				As groundwater seepage in post-closure is a pathway for effects to surface water quality and quantity, monitoring to confirm the assessment results is required.	
IAAC-61(2)	NRCan	Section 6.1.2 Geology and Geochemistry	Volume 1, Chapter 8, Section 8.2.2.1, Figure 8-13, Volume 4, Appendix H, Section 4.2.2.1	As stated in the guidelines, the assessment of groundwater should include a groundwater model representing the hydrostratigraphy and groundwater flow systems. As discussed in IAAC-61, bedrock topography can exert control on groundwater flow and should be represented using conservative assumptions in the absence of supporting data. The map of overburden thickness for the MacLellan Site provided in response to IAAC-61 (Map-61-2) confirms that the surface bedrock rises more than 25 m between GBHM-14 and GBHM-27. The response to IAAC-61 states that overburden thickness in this area is not relevant to the groundwater flow model given the similarity in hydraulic conductivity between the glaciolacustrine and diamicton overburden, and shallow bedrock. However, based on the assumed hydraulic conductivity profile implemented in the numerical model, a 25 m change in bedrock topography results in the upper bedrock being relevant to the discussion. The upper bedrock unit is more than an order of magnitude lower in hydraulic conductivity relative to the overburden and shallow bedrock. This variability in bedrock topography is relevant to groundwater flow. Additionally, as stated in the response to IAAC-67 bedrock topography appears to exert control over the development of artesian groundwater levels at the MacLellan site. This conceptualization is not consistent with the inferred irrelevance of the bedrock topography cited in the response to IAAC-61. As a 25 m variation in bedrock topography may affect groundwater flow patterns, in turn affecting the assessment of seepage from the Tailings Management Facility, the effect of this potential variability should be addressed in the assessment of groundwater flow.	Conduct a sensitivity analysis to address the potential for a continuous bedrock low from the east of the MacLellan Pit to North of Minton Lake. Discuss the effect of this variability in bedrock topography on groundwater seepage pathways, quantities, and travel times from the Tailings Management Facility.

IAAC-62(2)	NRCan	Section 6.1.5 Groundwater and Surface Water`	Volume 1, Chapter 8, Section 8.2.2.3 Hydraulic Conductivity, Volume 4, Appendix H, Section 4.2.1.3, Volume 4, Appendix H, Section 4.2.2.3 Volume 5, Appendix F, Section 3.3.5, Volume 5, and Appendix G, Section 3.3.5 Bedrock Hydraulic Conductivity	The description of the hydrogeological context of the project should include the delineation of stratigraphic and hydrogeological boundaries and the physical properties of the hydrogeological units. Hydraulic conductivity tests have not been completed within the deep bedrock at the Gordon Site, nor within the lower 100 m of the deep bedrock at the MacLellan Site. In response to the request to discuss the gaps in information and the related uncertainty associated with the limited testing of the deep bedrock unit at both sites, the response to IAAC-62 has cited the calibration of the model as evidence of low uncertainty for the groundwater assessment. Groundwater wells used in the calibration of the groundwater model extend to a maximum total depth of 80 m for the Gordon site, and 30 m for the MacLellan site. Calibration of the model would not be sensitive to the deep and potentially to the intermediate bedrock. Calibration of the model is not evidence of support for the parameterization of these units. The sensitivity analyses presented in Appendices F and G and cited in the response to IAAC-62 address the hydraulic conductivity of the shallow and faulted bedrock. While these units contribute the majority of the groundwater flow to the open pit under the calibrated conditions, they represent a small portion of the overall pit depth. The calibration of the model and the sensitivity analysis does not address any uncertainty in the hydraulic conductivity of the lower 90% of the MacLellan Pit, and the lower 50% of the Gordon Pit. The groundwater inflow to the open pits, and the associated drawdown has uncertainty resulting from the limited data for calibration over the deeper portion of the pits. This uncertainty should be discussed and quantified to complete the groundwater assessment.	Conduct a sensitivity analysis on the hydraulic conductivity of the intermediate and deep bedrock units. Discuss the potential effects of hydraulic conductivity variability on groundwater inflow to the open pits and the associated drawdown. Provide any information available on the dewatering of the historical Gordon pits to support the conceptual model presented in the groundwater assessment.

IAAC-65(2)	NRCan	Section 6.1.5 Groundwater and Surface Water`	Volume 4, Appendix H, Section 4.2.1.4	IAAC-65 requested a description of the conceptualization of the fault zone at the Gordon Lake site, consistent with the Guidelines which require delineation of the key hydrostratigraphic boundaries. The responses to IAAC-65 and IAAC-69 include an adequate description of the data support for the horizontal extent and hydraulic conductivity of the fault zone within the Gordon model. However, these responses do not outline the rationale used to support the termination of the fault zone within the upper 50 m of bedrock. As this fault zone provides enhanced hydraulic connectivity between Gordon Lake, the open pit, and Farley Lake, the depth of this fault zone affects the assessment of groundwater flow into the open pit, drawdown associated with this dewatering, and the efficacy of the groundwater interceptor wells.	Discuss the data used to limit the vertical extent of the fault zone to the shallow bedrock at the Gordon Site. Provide a sensitivity analysis of the effect of the depth of this zone on the groundwater assessment. Discuss how the depth of this fault zone may affect the design, feasibility, and efficacy of the interceptor well system.
IAAC-72(2)	NRCan	Section 4.3 Study Strategy and Methodology	EIS Volume 5, Appendix F, Gordon Lake Hydrogeology Assessment, Section 4.3.3, and Appendix G, MacLellan Hydrogeology Assessment, Section 4.3.3	The EIS Guidelines state that all models will be documented such that analyses are transparent and reproducible. This documentation includes the assignment of boundaries to represent groundwater interaction with surface water. IAAC-72 requested additional details on the boundary conditions assigned in the model. These details were provided by the Proponent in their response. As stated in IAAC-72(b), the southern boundaries of the MacLellan model were assigned as fluid transfer boundaries at the lakeshore at 2 m above the lake elevation. This statement is not consistent with the information provided in Table IAAC-72-1b which states that these boundaries were assigned at 0.01 m below the surface water elevation. As reported in IAAC-72(b), and Table IAAC-72-1b, the lakes at the southern boundary of the Gordon model (Swede and Simpson lakes) were assigned a constant head value of 314.25 m. This head is significantly higher than the head value assigned to the tributaries of these lakes (311.0 m at FAR3-SIM2 (Simpson Lake) and 305.40 m at FAR3-A1 (Swede Lake)). It is not clear that these	Clarify the discrepancy between the statement in IAAC-72(b), the values provided Table IAAC-72-1b regarding the MacLellan model boundaries. Discuss the rationale for the assigned difference between the boundary head and the surface water elevation. Discuss the data used to determine the head values for Swede Lake, Simpson Lake, FAR3-SIM2, and FAR3-A1, and the inferred surface water flow directions at these waterbodies.

				assigned heads are consistent with surface water elevations or flow directions. Boundary conditions exert significant control over the results of the groundwater models. Proper assignment and documentation is required to ensure confidence in model results.	
IAAC-73(2)	NRCan	Section 4.3 Study Strategy and Methodology	EIS Volume 5, Appendix F, Gordon Lake Hydrogeology Assessment, Section 4.4.2, and Appendix G, MacLellan Hydrogeology Assessment, Section 4.4.2	The EIS Guidelines state that all models will be documented such that analyses are transparent and reproducible. A component of the documentation is the presentation of calibration to observed groundwater levels. IAAC-73 requested information on the screened hydrostratigraphic unit for the calibration points, and a discussion of the larger differences between simulated and observed groundwater elevations for the MacLellan model. The screened hydrostratigraphic units were well described in the response to IAAC-73. Seasonal variability is cited as a potential driver for select simulated heads within the MacLellan pit being more than 7 m lower than observed. As seasonal variability at MWM-09A/b and GBHM-06A appears to be on the order of 2 m it is not clear how this seasonal variability may relate to calibrated differences greater than 7 m. While these differences may predominately effect the drawdown at the open pit (as stated in the response to IAAC-73), the related uncertainty extends to the forecasted hydraulic gradients, and groundwater inflows to the open pit.	Provide further discussion, beyond seasonal variability, of the different settings at these wells relative to those with lower calibration residuals. Discuss efforts made to improve the calibration at these wells and the resulting effect on other calibration points within the pit area.
IAAC-74	NRCan	Section 6.1.5 Groundwater and Surface Water	EIS Volume 5, Appendix F, Gordon Lake Hydrogeology Assessment, Section 4.4.2, and Appendix G, MacLellan	The EIS Guidelines state that an appropriate hydrogeological model should be included in the assessment. Such a model should have the ability to replicate the observed seasonal variability in groundwater elevations. IAAC-74 requested the rationale for the inability of the MacLellan Site model to replicate the seasonal variability in groundwater elevations.	Reevaluate the transient calibration for the MacLellan site given the simulated consistent decline in groundwater elevations over the 2-year simulation period. Discuss the impact of these simulations on the results of the groundwater assessment, and provide updated modelling results as required.

			Hydrogeology Assessment, Section 4.4.2	The response to IAAC-74 states that the poor fit to the observed seasonal variation is due to the constant elevation assigned to the model boundaries at the lakes and streams. Seasonal variation of the boundary conditions at the lakes and streams would not be expected to improve the performance of the model based on the following: • The magnitude of the seasonal variation appears to have limited dependence on proximity to surface water features. For example, groundwater elevations at GBHM-10 (approximately 1 km from the Keewatin River) rise by 3 m during the spring freshet. This magnitude of fluctuation is unlikely to be caused by river level variability alone. • None of the simulated water levels show any seasonal variation, rather model results show a consistent decline throughout the 2-year transient simulation period. The magnitude of this decline (e.g. 10 m at GBHM-06A) suggests that the initial condition used in the transient simulation was not a steady-state condition. Based on these results the rationale provided in response to IAAC-74 does not appear to be valid.	
IAAC-78(2)	NRCan	Section 4.3 Study Strategy and Methodology	EIS Volume 5, Appendix F, Gordon Lake Hydrogeology Assessment, Section 5.2.1.1, and Appendix G, MacLellan Hydrogeology Assessment, Section 5.2.1.1	The EIS Guidelines state that all models will be documented such that analyses are transparent and reproducible. IAAC-78 requested details on the FTM integration into the groundwater model and its effect on groundwater inflow into the open pit. The memo provided in response to IAAC-78 provides detail on the parameterization of the FTM plugin, and states that the FTM module was run separately from the flow model. Results from the FTM model were used to assign hydraulic conductivities of zero where frozen ground is present. It is unclear from the reporting the extent to which the subsurface and pit face are frozen. It is also unclear whether the FTM module, run separately from the flow model, accounts for the advective flux of heat related to the groundwater inflow to the open pit.	Provide cross sections showing the seasonal variation in ground temperature and hydraulic conductivity for both the MacLellan and Gordon Pits at the intermediate and ultimate depths, including model mesh overlay. Discuss how groundwater flow and the associated advective heat flow were represented in the FTM module simulations. Discuss any limitations of the modelling approach, and the potential impact on assessment results.

				These two factors affect the timing and overall quantity of groundwater inflow to the open pit, impacting the assessment of groundwater and groundwater-surface water interactions.	
IAAC-79(2)	NRCan	Section 6.2.2 Changes to Groundwater and Surface Water	EIS Volume 5, Appendix F, Gordon Lake Hydrogeology Assessment, Section 5.2.1.1, Map 15 and Table 5-1, and Section 5.3.2.1, Map 18 and Table 5-5	The EIS guidelines state that the assessment of groundwater should include the assessment of changes to groundwater fluxes. Changes in the quantity of groundwater discharging to surface water, or the quantity of surface water recharging the groundwater system can influence linked valued components such as surface water and wetland environments, and fish and fish habitat. IAAC-79 requested a discussion of the increase in groundwater flow to Susan Lake (on the order of 37%) and decrease in surface water flow to groundwater at Marnie Lake (on the order of 30%) under operations conditions relative to baseline conditions given that there are no reported changes in groundwater elevations on Map 15. The response provided addresses why there would be no change to groundwater elevations at these lakes, and thus no change in flux. The response does not address the unexpected yet simulated change in flux in the absence of a simulated change in head. Changes in groundwater-surface water interaction should be linked to changes in groundwater elevation and groundwater flow. This is not apparent from the response to IAAC-79.	Provide the rationale for the change in flux at Susan and Marine lakes as it relates to simulated changes (or the absence of changes) in groundwater elevation.
IAAC-81(2)	NRCan	Section 6.2.2 Changes to Groundwater and Surface Water	EIS Volume 5, Appendix F, Gordon Lake Hydrogeology Assessment, Section 5.3.1.2	The EIS guidelines state that the assessment of groundwater should include the assessment of changes to groundwater fluxes. Groundwater interceptor wells screened through the faulted shallow bedrock at the Gordon are used to capture a portion of the flux of groundwater from Gordon and Farley Lakes prior to reaching the open pit. By applying the water pumped from these wells to the lakes within the water balance model, impacts to the lakes are mitigated.	Provide the simulated pressure heads at the base of the well screens at the end of the operations period. Discuss the implications of the saturated simulation on the evaluation of the pumping volumes from the interceptor used in the water balance model. Provide details for the design of the interceptor well system that ensure that the pumping volumes required to mitigate impacts to the lakes can be produced. Discuss contingency

				The response to IAAC-81 states that the simulated groundwater interceptor wells continue to pump at the same rate throughout the operations period despite water table drawdowns greater than 100 m, and complete dewatering of the well screen. These simulation results indicate that the groundwater model was run under saturated conditions, allowing the wells to continue pumping despite being at negative pressure. Under saturated modelling mode the groundwater flow model can simulate larger pumping volumes than would be feasible given the well depth and simulated drawdown. As the surface water assessment is based on a constant volume of water pumped from the interceptor wells throughout the operations period, the feasibility of providing that quantity of water should be assessed given the expected drawdown through the operations period.	options and the potential effects to the lakes under sub-optimal pumping performance.
IAAC-83(2)	NRCan	Section 6.2.2 Changes to Groundwater and Surface Water	EIS Volume 5, Appendix F, Gordon Lake Hydrogeology Assessment, Section 5.3.2.3, and Appendix G, MacLellan Hydrogeology Assessment, Section 5.3.2.3	The EIS guidelines state that the assessment of groundwater should include the assessment of changes to groundwater fluxes including fluxes from mine facilities to the groundwater flow system. As stated in response to IAAC-83(b) the applied recharge rates for the MRSA represents the infiltrated water that does not flow laterally to the MRSA collection system. As such, particle tracking results in Appendix F and G are inherently representative of particle tracks under an operating seepage collection system. Wording in Section 5.3.2.3 should be updated to be consistent with the recharge applied. The response to IAAC-83(c) appears to indicate that the porosity applied to the bedrock at the Gordon site is a factor of 2000 higher than the MacLellan site. This difference is not expected, and if reported in error should be corrected. IAAC-83(e) requests a rationale for the assumption that 50% of the infiltration to the MRSA will reach the base of the pile during the "wetting up" period, with the remainder stored within the micropore system. The response to IAAC-83 (e) states that this	Update the discussion of the particle tracking results to reflect the fact that the boundary conditions for the MRSA represent the operation of a seepage collection system. Update the bedrock porosity values for the Gordon site to reflect those modeled. If a value of 0.2 was applied within the Gordon groundwater flow model, provide a rationale for this value. Provide information to support the assumption that 50% of the infiltration to the MRSA will be stored within the micropore system during the "wetting up" period.

				50% value is an assumption applied within the water balance model. Information to support this assumption should be provided to support the assessment of groundwater seepage. Review of IAAC-83(f) not completed by NRCan as it relates to loading rates and water quality. NRCan defers to ECCC's review of this information request.	
IAAC-91(2)	NRCan	Section 6.2.2 Changes to Groundwater and Surface Water	Appendix G, MacLellan Hydrogeology Assessment, Section 5.3.2.1, Table 5-5	The EIS guidelines state that the assessment of groundwater should include the assessment of changes to groundwater fluxes. The change in fluxes between groundwater and surface water can affect other valued components such as surface water and wetland environments, and fish and fish habitat. IAAC-91 requested a discussion of the simulated model boundaries for East Pond and KEE3-B2-A1 as they relate to the potential for these waterbodies to drain during operations. The response states that while the East Pond will likely drain, KEE3-B2-A1 will likely continue to flow. Within the groundwater assessment (as stated in the response IAAC-91(a)) boundary conditions for these features were not changed in operations, such that both features were able to contribute to the groundwater flow system. For the assessment of fish and fish habitat it appears that the assessment was based on both waterbodies being dry, and not contributing to the groundwater flow system (IAAC-91(b) and (c)). The rationale for the representation of these waterbodies within the groundwater flow model should be provided as it differs from the expected conditions, and the assessment of fish and fish habitat. Groundwater model results in Appendix G, Table 5-5 indicate that the flux from surface water to groundwater at KEE3-B2-A1 increases by a factor of 4 at the end of operations. Map 20 shows drawdown at this feature ranging from more than 10 m to less than 1 m. If this stream were to drain during operations, groundwater drawdown associated with the open pit would propagate further than simulated, and other surface water bodies may experience changes in groundwater-surface water interaction that are not captured by the model.	Provide the total flow and any low flow data for KEE3-B2-A1. Discuss these values in comparison to the flux to groundwater from this waterbody during operations. Complete a sensitivity analysis showing the effect of the representation of this boundary on groundwater flow patterns and groundwater-surface water interaction. If, as stated in IACC-91(a), the boundaries for the East Pond are unchanged from baseline to operations conditions, report the fluxes between groundwater and surface water for the East Pond under baseline, end of operations, and post-closure conditions.

IAAC-108(2)	NRCan	Section 6.1.5 Groundwater and Surface Water Section 8.0 Follow-up and Monitoring Programs	Section 8.4.3 Assessment of Change in Groundwater Quality, Section 8.9 Follow-up and Monitoring, Section 9.9 Follow-up and Monitoring, Section 22.5.2.3 Environmental Effects Assessment, Section 23.5.4 Groundwater Monitoring Plan, Section 23.5.5 Surface Water Monitoring and Management Plan	IAAC-108 requests additional details on the seepage pathways from the MRSA and TMF, the travel times from these facilities to surface water receptors, and the proposed monitoring programs for groundwater and surface water. As stated in IAAC-108(b) the groundwater flow model results will be used to delineate the groundwater monitoring network to confirm groundwater quality and contaminant attenuation. Given the simulated travel time for the particle tracking relative to the operations period, changes in groundwater elevation may be the primary observation used to validate the groundwater model results. To support adaptive management, the groundwater monitoring network should be initiated during the construction phase of the project to monitor the development of vertical and horizontal hydraulic gradients for comparison to model results. As stated in IAAC—57 (2) the groundwater monitoring program should continue until the results of the groundwater seepage assessment, and the attenuation of the associated chemical load can be confirmed. As stated in IAAC-108(d(i)) the groundwater model will be updated throughout the operations period should observations show statistically significant differences from model results. Further details should be provided on the triggers for groundwater model updates as no stochastic assessment has been completed.	Provide the following details on the Groundwater Monitoring and Management Plan: • The planned timing of the installation of the groundwater monitoring network • The anticipated criteria for updates to the groundwater model used to guide adaptive management
Geochemistry					
IAAC-95	NRCan	6.1.2 Geology and geochemistry 6.2.2 Changes to groundwater and surface water	Volume 4, Appendix F Geochemistry Baseline Technical Data Report 3.4.2 Characterization of Composite Samples 3.4.3 Kinetic Tests	NRCan agrees that the composite samples presented in Tables IAAC-95-1 to IAAC-95-6 sufficiently represent the average chemical composition of each lithology based on samples collected to date. However, worst-case conditions were not analyzed as recommended in MEND (2009). Specifically material with high sulphur content and low neutralization potential (NP) that can produce problematic drainage chemistry in terms of acid rock drainage (ARD) and metal leaching (ML), which can negatively impact site water drainage. This information is critical for decision making regarding waste segregation, management of waste rock,	Provide a detailed plan to test potentially acid generating samples from MacLellan Site and argillite from Gordon Site, including static, mineralogy, and kinetic tests as recommended by MEND (2009).

			Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. MEND Report 1.20.1. Mining Environment Neutral Drainage Program, Natural Resources Canada; MEND (2009)	low grade ore, exposed pit walls, as well as water management and treatment. It is also required to develop appropriate inputs for the water and sediment quality predictions model, specifically determining acidic loading rates and evaluating potential impacts should potentially acid generating (PAG) waste be insufficiently blended or placed on the edge or top of the storage facility. For the Gordon Site argillite unit, 8 of the 11 tested samples are interpreted to be PAG with the average total sulphur and NP values skewed by the remaining three samples. The argillite composite sample (FLS2C) represents average total sulphur and NP and has an uncertain ARD potential (NPR 1.1), and thus does not capture the potential risk associated with ARD/ML. For the MacLellan Site, the two composite waste rock samples "ML WR S>1%" and "ML WR Avg" both report similar sulphide mineralogy, average NP and uncertain ARD potential based on NPR values between 1 and 2. With 19% of the 160 mine rock samples classified as PAG, consideration should be given to testing more material with higher sulphide content and lower NP. MEND, 2009. Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. MEND Report 1.20.1. Mining Environment Neutral Drainage Program, Natural Resources Canada. December 2009.	
IAAC-97	NRCan	6.1.2 Geology and Geochemistry	Volume 4, Appendix F Geochemistry Baseline Technical Data Report 3.0 Methods, 4.6 ARD Block modelling results Geochemical Baseline Technical Data Validation Report 2.0 Existing Data	In Section 5.2.1, the Proponent states that the breakdown of potentially acid generating (PAG) mine rock from the MacLellan Site is predicted to be lower based on the block model results, specifically the block model predicts 14% PAG rock and 15% uncertain rock, while the geochemistry baseline testing program predicts that 28% of samples are PAG and 13% are uncertain. The difference between the two predictions is 12% of the total tonnage of waste rock, which could result in PAG material being managed as non-PAG. The more robust sampling program for the block model (20,782 samples) assesses ARD potential using neutralization potential derived from statistical analysis as described in Section 3.5.1.2. Thus, a detailed evaluation comparing the measured NP from the geochemical baseline program and the statistically derived NP should be completed by the Proponent to verify the predicted lower quantity of PAG rock is valid.	a. Provide the referenced conceptual level Acid rock Drainage and Metal Leaching (ARD/ML) Management and Monitoring Plan. The plan should include methods for sampling and testing of mine rock, including how the Proponent intends to integrate this information into the ARD/ML block model and validate predictions for PAG mine rock. Include a comparison of the statistically derived NP from exploration assay data and NP results from the geochemistry baseline program for each lithology considering the spatial distribution of results from both data sets, as well as the requested evaluation of the feasibility of physical segregation of mine rock should PAG and non-PAG rock be highly interlayered.

				The multi-element scan includes parameters of concern identified in Volume 4 Appendix F and observed in during monitoring of the historical mine features, which are reported to have been impacted based on elevated sulphate, arsenic, and other metal concentrations (MacLellan Site) as well as ammonia and selenium (Gordon Site). Additionally, per IAAC –98, the future mine rock from Gordon Site reports various trace metals at higher concentrations than observed in the historic mine rock. NRCan maintains its recommendation to include metal(loid)s of concern in the block model, should metal(loid) leaching be correlated with total metal(loid) content, to ensure that rock with elevated neutral mine drainage potential is managed appropriately during operations to minimize impacts to the receiving environment in post-closure.	b. NRCan recommends that the ARD/ML Management and Monitoring Plan include strategies to manage, monitor, and mitigate neutral mine drainage and metal leaching from waste rock stockpiles, and that consideration be given to including metal(loids) of concern in the block model for the identification of mine rock with higher metal leaching potential.
IAAC-99	NRCan	2.2 Alternative means of carrying out the project 6.1.2 Geology and geochemistry 6.2.2 Changes to groundwater and surface water	Volume 4, Appendix F Geochemistry Baseline Technical Data Report Geochemical Baseline Technical Data Validation Report 4.0 Closure Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. MEND Report 1.20.1. Mining Environment Neutral Drainage Program, Natural	Per IAAC-95, and as originally requested in IAAC-99, NRCan maintains that the Proponent did not evaluate the worst-case conditions that could be present in the argillite mine rock at Gordon Site, or for high sulphur content mine rock at MacLellan Site. This has implications for the estimated time to onset of acid rock drainage (ARD) and assumptions in the water quality model that the mine rock will not produce ARD, which could occur if potentially acid generating (PAG) waste rock is not sufficiently blended with non-PAG waste rock and/or stored on the edges or top of the waste rock pile. NRCan cannot locate in Volume 4 Appendix F the predicted 3 years until acid rock drainage (ARD) is generated from the argillite unit. A conservative estimate of the lag time until PAG material could generate ARD is critical for mine waste and water management planning. Standard practice is to calculate the lag time from laboratory kinetic test results on PAG samples by applying various assumptions; this approach is theoretical and does not consider the increasing rate of acid production once ARD has commenced. Calculations should be updated when acidic leachate is observed from PAG samples. Consideration should be given to the results reported by Sexsmith et al. (2015): when comparing calculated and observed lag times for 30 PAG kinetic test samples, it was noted	As the project progresses, the ARD/ML Management and Monitoring Plan should be updated to account for changes in predicted ARD onset time based on observed acidic leachate in the kinetic test samples. Additionally, the water quality model should be updated with a sensitivity analysis that considers ARD through imperfect segregation or blending of PAG waste rock.

			Resources Canada; MEND (2009)	that actual lag times are shorter than calculated times for the same sample. Lastly, the metal leaching potential under acidic conditions has not been captured in the humidity cell tests completed to date. It is therefore not possible to confirm that PAG samples would maintain leachate concentrations below Metal and Diamond Mining Effluent Regulations limits in the long-term. NRCan appreciates that waste management is being designed to minimize the development of ARD, and thus PAG loading rates were not considered in the water quality model. However, a complete understanding of the risk and extent of ARD and metal loading is required to appropriately manage PAG waste and exposed PAG rock in the pit walls, as well as water management and treatment planning. Further, a sensitivity analysis to assess the effects of imperfect segregation of waste rock is required per the FIES guidelines. Sexsmith, K., D. MacGregor, and A. Barnes. 2015. Comparison of Actual and Calculated Lag Times in Humidity Cell Tests. 10th International Conference on Acid Rock Drainage & IMWA Annual Conference. Santiago, Chile.	
IAAC-101	NRCan	6.1.2 Geology and Geochemistry	Volume 4 Appendix F Geochemistry Baseline TDR and Geochemical Baseline Technical Data Validation Report	In both maps IAAC-101-1 and IAAC-101-02, NRCan observes that all overburden samples were collected from the perimeter of the pit outline at both Gordon and MacLellan sites. Overburden above the mineralized zone can contain elevated concentrations of sulphide minerals and metals if it was developed through weathering of the underlying bedrock. This could limit use of this material for construction purposes or require special management.	The ARD/ML Management and Monitoring Plan should include sampling and testing of overburden within the pit footprint prior to or during construction to confirm the ARD/ML potential of this material and thus appropriate use and/or management.
IAAC-105	NRCan	2.2 Alternative means of carrying out the project	2.9 Alternative Means for Carrying Out the Project Table 20A-1 Volume 5, Appendix D Lynn	The preferred option for mine rock disposal at the **Gordon** site is the use of a soil cover placed over the proposed mine rock storage area (MRSA) as described in the Project Conceptual Closure Plan provided in Environmental Impact Statement (EIS) Appendix 23B. This cover will be the primary use for overburden stockpiled at both sites during construction and operation. The disposal of mine rock in the open pit is not considered economically feasible due to the high costs of recovering the mine waste due to double	The Proponent did not provide contaminant of potential concern predictions in the receiving aquatic environment as a result of cover deterioration over the long-term as requested. The Proponent justifies this by citing the prohibitive cost of backfilling the open pit (i.e. double handling) with problematic waste rock as well as additional greenhouse gas emissions from rock transportation. With changing climate, engineered covers may erode at faster

			Lake Gold Project, Hydrology Water Balance and Water Quality Impact Assessment: Gordon site Technical Modelling Report Appendix I The Minerals and Metals Policy of the Government of Canada; Natural Resources Canada (1996)	handling and transporting the relatively long haul distance from the far end of the MRSA to the open pit. This distance is upwards of 1.5 km at the Gordon site. This additional transportation would also result in the generation of additional greenhouse gases (GHG) resulting in adverse effects to air quality. See Table IAAC-105-1 attached to this response for further detail on the alternative means assessment. (i) The assessment of alternative means was completed in accordance with the Canadian Environmental Assessment Agency's Operational Policy Statement "Addressing 'Purpose of' and 'Alternative Means' under the Canadian Environmental Assessment Act, 2012". The alternative means assessment included the following methods: • Describing each identified alternative to the extent needed to identify and compare potential environmental effects. • Considering the environmental (including socio-economic) effects of the identified technically and economically feasible alternative means of carrying out the Project. • Selecting the preferred alternative means of carrying out the Project, based on the relative consideration of effects.	rate. Hence, cover maintenance need be considered in the calculation of post-closure financial assurance.
IAAC-106	NRCan	2.2 Alternative means of carrying out the project	2.9 Alternative Means for Carrying Out the Project Table 20A-1 Volume 5, Appendix D Lynn Lake Gold Project, Hydrology Water Balance and Water Quality Impact Assessment: Gordon site	The preferred option for mine rock and tailings disposal at the **MacLellan Site** is the use of a soil cover placed over the proposed mine rock storage area (MRSA) and tailings management facility (TMF) as described in the Project Conceptual Closure Plan provided in Appendix 23B of the Environmental Impact Statement (EIS). This cover will be the primary use for overburden stockpiled at both sites during construction and operation. The disposal of mine rock and tailings in the open pit is not considered economically feasible due to the high costs of recovering related to double handling the mine waste and transporting the relatively long haul distance from the far end of the MRSA to the open pit. This distance is upwards of 4.5 km at the MacLellan site. This additional transportation would also result in the generation of additional greenhouse gases (GHG), resulting in adverse effects to	The Proponent did not provide contaminant of potential concern predictions in the receiving aquatic environment as a result of cover deterioration over the long-term as requested. The Proponent justifies this by citing the prohibitive cost of backfilling the open pit (i.e. double handling) with problematic waste rock as well as additional greenhouse gas emissions from rock transportation. With changing climate, engineered covers may erode at faster rate. Hence, cover maintenance need to be considered in the calculation of post-closure financial assurance.

			Technical Modelling Report Appendix I The Minerals and Metals Policy of the Government of Canada; Natural Resources Canada (1996)	air quality. See Table IAAC-106-1 below for further detail on the alternative means assessment. (i) As no feasible alternatives were identified, the conclusions of the EIS related to water quality parameters are unchanged. (ii) The assessment of alternative means was completed in accordance with the Canadian Environmental Assessment Agency's Operational Policy Statement "Addressing 'Purpose of' and 'Alternative Means' under the Canadian Environmental Assessment Act, 2012". The alternative means assessment included the following methods: • Describing each identified alternative to the extent needed to identify and compare potential environmental effects. • Considering the environmental (including socio-economic) effects of the identified technically and economically feasible alternative means of carrying out the Project. • Selecting the preferred alternative means of carrying out the Project, based on the relative consideration of effects.	
IAAC-110	NRCan 48	6.4 Mitigation measures	5.2.6 Geochemistry 8.4 Assessment of Residual Environmental Effects on Groundwater 20.1 Summary of Changes to the Environment, Potential Effects, Mitigation and Residual Effects Table 20A-1	The Proponent responded that for both the Expected and the Upper Case scenarios, contact water quality (including collection pond water quality) was predicted to remain below Metal and Diamond Mining Effluent Regulations limits and short-term water quality guidelines with the exception of ammonia. The Proponent indicates that modelling contaminants of potential concern in the receiving aquatic environment would result in unexpected predictions as it would be above the upper case. Regarding sediment modelling, this medium is not typically modelled for environmental assessments because there is no widely used or established approach to predict changes to sediment quality. Due to the lack of robust sediment modelling approaches and the lack of precedence in environmental assessments, The Proponent states that they do not believe sediment modelling is required for the assessment of potential effects.	The water quality predictions in the receiving aquatic environment provided by the Proponent are based on a base and upper cases. NRCan is not convinced that the upper case is a reasonable scenario (IAAC-97; IAAC-99). The water quality predictions are linked to adsorption of contaminant to suspended particles and their settling to sediments. This load of contaminant to the sediment can be subtracted and result in lower water quality predictions. Without a sediment modelling component, it is not possible to verify if the base and upper cases water quality predictions are reasonable. While the Proponent is correct that sediment modelling is not typically presented, it has been provided by other projects in the past (See response to IRs on Palladium PGM projects, Valentine Gold). Consulting firms have routinely provided sediment modelling predictions along with information about the removal of metals from the water to the sediment. NRCan maintains its recommendation that the Proponent provide the sediment modelling predictions to verify if the upper (as result IAAC-97 and 99) and base case water quality

					predictions remain reasonable or in other words, the removal of metal from water to sediments is not overestimated to limit the spatial extent of water and sediment contamination. The accuracy of these predictions is useful for both the regulator and Proponent as these predictions should become compliance verification values within environmental effects monitoring that can act as trigger for adaptive management of mining effluent during operations and seepage during post-closure.
IAAC-111	NRCan	6.4 Mitigation measures	5.2.6 Geochemistry 8.4 Assessment of Residual Environmental Effects on Groundwater 20.1 Summary of Changes to the Environment, Potential Effects, Mitigation and Residual Effects Table 20A-1	The Proponent provided trigger criteria for phosphorus, fluoride and selenium and examples of best available treatment technology to be implemented if these triggers were exceeded.	Response is acceptable. NRCan recommends that these triggers and best available treatment technologies be included as a mitigation measure.