KUDZ ZE KAYAH PROJECT

RESPONSE TO MINERAL RESOURCE BRANCH'S INFORMATION REQUEST

#1 ON BMC'S KZK QUARTZ MINING LICENSE APPLICATION

April 2024

BMC MINERALS LTD.

LIST OF ACRONYMS AND ABBREVIATIONS

BC	British Columbia
BMC	BMC Minerals Ltd.
CSM	Conceptual site model
DSHA	Deterministic Seismic Hazard Assessment
EDGM	Earthquake Design Ground Motion
GSC	Geological Survey of Canada
IDF	Intensity-duration-frequency
IR	Information Request
KZK	Kudz Ze Kayah
MECCS	Ministry of Environment and Climate Change Strategy
MRB	Mineral Resource Branch
PGA	Peak Ground Acceleration
PSHA	Probabilistic Seismic Hazard Assessment
SHA	Seismic Hazard Assessment
TSF	Tailings Storage Facility
UHS	Uniform Hazard Spectrum

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1 INTRODUCTION

BMC MINERALS LTD (BMC) submitted a Quartz Mining Licence Application for the proposed Kudz Ze Kayah (KZK) Project (the Project) to the Yukon Government's Mineral Resources Branch (MRB) on August 23, 2022. On April 11, 2023 BMC received Information Request #1 (IR1) from the MRB (MRB, 2023). This Response Report provides the additional information requested by the MRB. For clarity and ease of understanding, BMC has listed the information requests (IRs) from MRB's IR1 (in black text) followed by BMC's response (in blue text). The requests and responses follow the same order as IR1 (MRB, 2023).

As per communication with the MRB (December 21, 2023), once BMC's responses to all issued information requests (during the adequacy stage) are deemed adequate by the MRB, BMC will provide updated versions of all revised documents in accordance with the revisions detailed within this Response Report.

2 SITE CHARACTERIZATION

IR1-1 Develop and submit a conceptual site model as described by Appendix A of the Guidelines for Mine Waste Management Facilities (Yukon, 2023) and in the Guidelines for Developing Water Quality Objectives and Effluent Quality Standards for Quartz Mining Project (Yukon, 2021). This should include, but is not limited to, the consideration of:

a) Geology and geochemistry;
b) Atmospheric environment;
c) Hydrology;
d) Hydrogeology;
e) Aquatic ecosystem;
f) Climate change; and
g) Terrestrial ecosystem and resources.

Rationale: A conceptual site model provides a framework for identifying interactions between the environment and the proposed project and describing pathways for potential effects. The framework can be used to define the questions that baseline monitoring and site characterization programs need to address and identify what information is currently known or not known about the environment and the site. This will delineate any limiting factors and gaps in data for the proponent to address moving forward. It will also be useful to guide subsequent stages of design and to support the identification of potential risks in future risk assessments.

BMC Response: A conceptual site model (CSM) has been developed in accordance with Appendix A of the *Guidelines for Mine Waste Management Facilities* (Yukon, 2023) and the *Guidelines for Developing Water Quality Objectives and Effluent Quality Standards for Quartz Mining Projects* (Yukon, 2021), and generally following the more detailed guidance in British Columbia Ministry of Environment and Climate Change Strategy (BC MECCS) (2018). This CSM is presented in Chapter 2 of the updated Site Characterization Plan and forms the framework for baseline monitoring and characterization programs for the Project.

IR1-2 Update climate modelling in accordance with updated guidance including the guidelines for mine waste management facilities (Yukon, 2023) and Guide on Climate Change Adaptation for the Mining Sector (MAC, 2021).

Rationale: The climate modeling presented in the application is not in accordance with updated and acceptable guidance, which is required to inform mine planning and designs.

BMC Response: Climate modeling has been updated in accordance with applicable guidance, including the *Guidelines for Mine Waste Management Facilities* (Yukon, 2023) and the *Guide on Climate Change Adaptation for the Mining Sector* (MAC, 2021). Yukon (2023) provides guidance on quantifying baseline climate data, characterizing climate change, and assessing climate extremes. It also discusses the role and requirements of water balance modelling for a project. MAC (2021) provides guidance on the methodology for establishing a baseline climate period and developing future predictions of climate change.

The long-term precipitation and temperature estimates for the Project were updated to support updates to the *Baseline Watershed Model* (KP, 2024a) and the *Life of Mine Water Balance Model* (KP, 2024b). A discussion of the updated long-term climate is presented in the letter *Long-Term Climate Input for the Baseline Watershed Model* (KP, 2024c). These documents are provided as appendices to the Site Characterization Plan and the Water Management Plan.

The Project's climate change analysis was updated to support water balance modelling, and the methodology and results are presented in *Climate Change Forecasts Update* (KP, 2024d), provided as an appendix to the *Life of Mine Water Balance Model* (KP, 2024b). The development of the climate change predictions was conducted in accordance with Yukon (2023) and MAC (2021). The water balance modelling (KP, 2024b) meets the expectations for water balance modelling outlined in Yukon (2023) and includes a model scenario that considers climate change to assess mine water management. Predictions of extreme climate, such as intensity-duration-frequency (IDF) curves, consider an uplift for climate change as recommended in Yukon (2023).

IR1-3 Prepare and submit a geotechnical report for the mine site that includes the details of previous investigations, including detailed borehole logs, laboratory test results, and instrumentation installation details.

Rationale: The Site Characterization Plan contains baseline geotechnical information but does not provide details on the site investigation conducted, particularly methodology of data collection and how it has been interpreted.

BMC Response: Geotechnical site investigations and analyses have been performed in 1995/1996 and on multiple occasions since 2015. This information has been summarized in a site characterization report (KP, 2024e), developed in accordance with the *Site Characterization for Dam Foundations in BC guideline* (APEG BC, 2016), provided as Appendix O of the Site Characterization Plan. Individual geotechnical reports, providing details of investigations, including detailed borehole logs, laboratory testing results and instrumentation are provided as Appendix P of the Site Characterization Plan.

IR1-4 Provide a list of all geotechnical instrumentation on site (e.g., ground temperature cables, piezometers, inclinometers, etc.) including a plan showing their locations relative to the mine waste and overburden facilities.

Rationale: The information provided makes it challenging to determine the location of geotechnical instruments in relation to mine site infrastructure and should be delineated further to create a clearer picture of what is on site.

BMC Response: A list of all geotechnical instrumentation on site and plans showing their locations relative to mine facilities has been compiled and are provided as Appendix N of the Site Characterization Plan.

IR1-5 Prepare and submit a site geological model in accordance with EGBC 2016 guidance, *Site* Characterization *for Dam Foundations in BC*, to a level of detail appropriate to see the extent of different surficial geological, bedrock geological, geotechnical, hydrogeological and seismotechnic conditions within the foundations of the mine waste management facilities. This should include, at least, a soil stratigraphy plan and multiple sections for each mine waste management facility.

Rationale: A site geological model is to develop a clear 3-dimensional understanding of the foundation for engineered structures and general site conditions. The model should be done for the entire site but is of particular importance for the foundation areas of large engineered structures requiring dams that will remain in perpetuity such as the mine waste management facilities proposed by BMC.

BMC Response: A site-wide 3D geological model was developed using *Leapfrog Geo* software, in accordance with the *Site Characterization for Dam Foundations in BC* guideline (APEG BC, 2016). Results of this model were used in developing a site characterization report (KP, 2024e), provided as Appendix O of the Site Characterization Plan.

IR1-6 Prepare and submit a site-specific site characterization report for each mine waste facility in accordance with *EGBC* 2016 guidance, *Site Characterization for Dam Foundations in BC*. This should also include instrumentation reports for all geotechnical instruments showing all data collected to date.

Rationale: BMC has already compiled a lot of this information in their current site characterization report, but it should be updated to include all information recommended by the ECBG 2016 guidance. Specifically missing from the current site characterization report is how the site data was interpreted by the designer, representative geological and hydrogeological plans, and cross-sections showing the extent of site investigation data, geological and geotechnical units and groundwater conditions. The completion of the site-specific characterization reports will support the review of design information and assumption for the mine waste management facilities.

BMC Response: A site characterization report was developed, including site-specific foundation details for each mine waste facility, in accordance with the *Site Characterization for Dam Foundations in BC* guideline (APEG BC, 2016). This report is provided as Appendix O of the Site Characterization Plan.

BMC notes that APEG BC (2016) is intended to '*apply to site characterization for dam foundations during the various phases of development, from conceptual through to design, construction, design updates and closure*.' The proposed mine waste facilities at KZK include a filtered Tailing Storage Facility and waste rock storage facilities, none of which are impounded by a dam. The proposed KZK facilities have much lower potential consequences of failure than would a slurry TSF impounded by a dam, which is the type of facility that APEG BC (2016) is intended to apply to. Moreover, certain foundation characteristics have a high potential to induce a catastrophic failure of a slurry TSF impounded by a dam (such as the Mt. Polley TSF), but very little potential to induce a catastrophic failure of a filtered TSF or waste rock storage facility. These are important factors to consider when

assessing the risk of KZK's waste storage facilities, and when developing appropriate risk-based designs for the facilities.

3 PLANNING AND DESIGN OF MINE WASTE MANAGEMENT FACILITIES

IR1-7 Use the Guidelines for Mine Waste Management Facilities to:

a) Classify all mine waste management facilities;
b) Determine the level of design detail for each facility based on the guides hazard classification; and
c) Compare the requested design detail in the guide with the submitted design packages to identify gaps that may exist.

Rationale: In order to determine risk and classify facilities according to the GMWMF, site- specific data must be available to delineate input parameters for the engineers to manage performance risk and determine appropriate design levels for each facility.

BMC Response: All proposed mine waste management facilities were classified according to the *Guidelines for Mine Waste Management Facilities* (Yukon, 2023), summarized in the *KZK Waste Storage Facilities and Ponds Classification Review* (KP, 2024f), provided as Appendix A of the Tailings Management Plan. All facilities are classified as *Class II*, except for the Class A Collection Pond, which is classified as *Class III* as the result of water quality stored at certain times. All facilities are classified as *Low* consequence according to guidelines from Canadian Dam Association (2013) and the *Global Industry Standard for Tailings Management* (Global Tailings Review, 2020).

The engineering designs submitted by BMC for the proposed KZK mine waste management facilities were developed to meet or exceed requirements for feasibility level. They were developed by a highly experienced team of tailings, geotechnical, civil and environmental engineers and scientists, and have been reviewed on multiple occasions by other engineers and scientists experienced in mine waste management, in accordance with industry guidelines.

The level of design detail submitted by BMC meets the requirements of Table 2-3 of Yukon (2023), which states that feasibility design is '*required for obtaining regulatory approvals*'. Yukon (2023) also states that preliminary design '*may be required for obtaining regulatory approvals described above where more detailed information on designs of ancillary features and the mechanical and electrical equipment and the operations is required by regulators*'. Given the simplicity of the proposed facilities, and lack of complex or high risk ancillary features, increasing the level of design beyond feasibility would not materially increase confidence in the predicted performance of the facilities. Moreover, final engineering designs will be sealed by a Professional Engineer licensed by Engineers Yukon.

IR1-8 Following the collection and analysis of the required information, the engineered designs for all mine waste management facilities at the Kudz Ze Kayah mine should be updated as appropriate and resubmitted for review.

a) Updated designs must consider YG guidance and updated baseline and site characterization data, studies and reports (see IRs 1, 2, 3, 5, and 6).
b) Provide construction specifics for each facility considering updated designs.

Rationale: The engineered designs submitted by BMC Minerals for the mine waste management facilities are pre-feasibility or feasibility level. The level of design expected for licensing is generally based on the level of risk associated with each facility. Overall, it is expected that the level of confidence in the predicted performance of the facility will be increased for submission to the regulatory phase, but this is not clearly demonstrated in the application submitted.

BMC Response:

a) As discussed in the response to IR1-7 the engineering designs submitted by BMC for the proposed KZK mine waste management facilities were developed to meet or exceed requirements for feasibility level. They were developed by a highly experienced team of tailings, geotechnical, civil and environmental engineers and scientists, and have been reviewed on multiple occasions by other engineers and scientists experienced in mine waste management. As detailed in response to IR1-1, 2, 3, 5 and 7, these designs and the processes used to develop them align with guidance provided by Yukon (2021, 2023), EGBC (APEG BC, 2016) and federal and international organizations including Mining Association of Canada (MAC) (2021), Canadian Dam Association (CDA) (2013) and the Global Tailings Review (2020). Characterization of the Project site has been updated to incorporate additional baseline data and to utilize the analysis methods preferred by Yukon (2021, 2023), as summarized in the Site Characterization Plan. All relevant management plans have been updated, and multiple additional studies have been completed. Following the updated site characterization, completion of additional studies and detailed review of engineering designs, it has been concluded that no changes to the design of proposed mine waste management facilities are warranted at this time. Minor changes to the design of these facilities are expected as part of Detailed Design to optimize the designs while minimizing risk and/or cost, but these changes are not expected to change the design approach or intent, or related environmental risks.

BMC agrees that the level of design expected for licensing should be based on the risk profile of each facility. However, BMC respectfully disagrees with the expectation that the level of design must be increased for submission to the regulatory phase, in cases where the level of risk associated with each facility is relatively low and the level of design is adequate to characterize facility risks and required mitigations. BMC's opinion aligns with Yukon (2023) which states that feasibility design is '*required for obtaining regulatory approvals*', and that preliminary design '*may be required for obtaining regulatory approvals described above where more detailed information on designs of ancillary features and the mechanical and electrical equipment and the operations is required by regulators*'. Given the simplicity, and lack of complex or high-risk ancillary features, of the proposed facilities, increasing the level of design beyond feasibility would not materially increase confidence in predicted performance of the facilities, so is not warranted. It should be noted that it is common for these types of simpler and lower risk waste management facilities to advance directly from feasibility design to issued-for-construction drawings, without completion of an intermediate design stage, as this additional stage is typically not needed to characterize facility risks and costs.

b) Construction specifications for the Class A Storage Facility are provided in the Tailings Management Plan and appendices, at a level of detail appropriate and typical for feasibility design and licensing of a dry stack facility. Construction specifications for the Class B and C Storage Facilities

and the Overburden Storage Facility are provided in the Waste Rock and Overburden Management Plan and appendices, at a level of detail appropriate for feasibility design and licensing. More detailed construction specifications will be developed as part of Detailed Design, which will be completed after licensing is complete. These designs will be sealed by a Professional Engineer licensed by Engineers Yukon.

IR1-9 Discuss how artesian conditions and possible effects are being considered and mitigated in the design and placement of mine infrastructure.

Discussion: The information provided in the application does not discuss the potential effect of artesian pressure on mine infrastructure and the proposed mitigations even though artesian conditions are identified beneath the Class B and Class C mine waste facilities and elsewhere on site. This may also be of particular importance for the design of foundation drainage for the Class A facility where foundation drainage is routing groundwater towards an area of potentially artesian pressures.

BMC Response: Artesian conditions were encountered at depth (> 16 m) in two bedrock drillholes in the footprint of the Class B Storage Facility, which is well below the depth of overburden at these locations (depth to bedrock of 1.3 m and 7.4 m, respectively). Artesian conditions have not been identified in the footprint of the Class A Storage Facility or the Class C Storage Facility and are not expected to impact the construction or operation of any of the facilities.

Foundation preparation for the Class A Storage Facility and the Class B Storage Facility is limited to overburden materials, including removal of overburden in structurally important areas of the Class A Storage Facility and the foundation drain system of both facilities. If artesian conditions are encountered during foundation preparation, these flows will be managed using the foundation drainage system and the measures described in the Sediment and Erosion Control Plan. The alignment of the foundation drain systems may be changed during construction to manage observed conditions, as determined by the site Engineer. Artesian conditions identified in bedrock downstream of these facilities is not expected to impact construction or operation of the facilities or of the associated collection ponds.

All monitoring wells located in the footprints of proposed facilities, including those with artesian conditions, will be sealed as part of the well decommissioning process prior to facility construction. Well decommissioning will follow the guidance provided in Protocol 7 Groundwater Monitoring Well Installation, Sampling, and Decommissioning (Yukon, 2019).

IR1-10 Re-evaluate the foundation drainage system design for applicable mine waste management facilities and advance the design to account for site-specific topography. Including both natural gully and slope features, but also the areas where anticipated excavations of frozen soils are anticipated.

Rationale: The proposed drainage system for the Class A facility consists of two herring- bone pipe arrays to drain an area nearly 1,000 m wide. Successful drainage of the foundation relies upon only two down-slope pipes. Should either of these fail (due to blockage, construction damage) there

may be water pressure on the underside of the foundation liner, and leakage into the Strongly Potentially Acid Generating (SPAG).

BMC Response: The Class A and Class B Storage Facilities include foundation drainage systems, as described in the feasibility design report (KP, 2019). The wording of this IR indicates that the reviewer may have misunderstood the design and intent of the drainage system. These underliner drains are intended to capture groundwater that may flow through the shallow foundation and convey it away from the site, to facilitate construction of the storage facilities. These drains are not intended to drain the overlying waste materials and are not necessary for geotechnical stability of the facilities, or to mitigate their potential environmental impacts. The Class C and Overburden Storage Facilities do not have a need for foundation drainage systems, as detailed in the Waste Rock and Overburden Management Plan, as a result of local foundation conditions and facility designs.

During foundation preparation, the subgrade of the Class A and Class B Storage Facilities will be stripped and exposed and any unsuitable materials within the preferred drain alignments will be removed, including any areas of ice-rich permafrost. The drain alignments shown in the Tailings Management Plan and the Waste Rock and Overburden Management Plan are indicative only, and final alignments will be selected during construction based on stripped topography, the locations of observed groundwater seepage pathways and other factors. The drains will be arranged in herringbone patterns and the mainline drains connecting to the downstream sumps will be aligned in topographic lows. Additional sumps and/or drains may be specified as part of foundation preparation, based on observed conditions at the time of construction.

The drains are proposed to be excavated drain rock channels, and do not include pipelines within the drain, as implied in this IR. The foundation drain profiles will be evaluated and revised as needed based on actual conditions encountered during foundation preparation. Additional material zones around the base of the drain may be required to establish appropriate material filter relationships between the surrounding subgrade materials and the drain rock. These decisions will be made by the supervising site engineer and Project engineering team upon inspection of the exposed ground during construction. This filter relationship will prevent migration of fines into the drain rock. In the unlikely scenario that drains fail to provide adequate transmissivity and there is water pressure on the underside of the foundation liner, the only impact would be minor seepage through flaws in the liner into the facility. This would have no negative geotechnical or environmental impacts, and would act to decrease the potential for impacted water to flow out of the facility into the foundation, thus decreasing the already low risk of groundwater contamination related to the facilities.

Flows from the foundation drains will be monitored in the downstream sumps to confirm water quality criteria are met prior to discharging to the natural environment, as discussed in the Environmental Monitoring, Surveillance and Reporting Plan.

IR1-11 Revise the geotechnical parameters after updated baseline and site characterization studies are complete (IRs 1, 2, 3, 5, and 6).

a) Determine geotechnical parameters for permafrost conditions suggested in GMWMF.
b) Determine geotechnical and seismic parameters for soils and bedrock based on field-

collected data for the foundation of all engineered mine facilities.

Rationale: At this stage, the design parameters should be developed from targeted specific geotechnical and hydrotechnical field investigations. Furthermore, if permafrost exists beneath the mine waste management facilities, and is not removed to bedrock, then the permafrost must be understood to a significant degree to determine how it will behave under loading. There are several methods that can be use to approximate the strength of permafrost, to determine which method is best in each situation it is necessary to review details of the permafrost such as, the texture of the frozen soil, temperature of the permafrost, lateral and depth of frozen soils, ice-content and type of ice in the frozen soils. This requires more robust, site-specific data and analysis, as suggested by the site characterization studies recommended.

Permafrost mapping and analysis for the Project was undertaken in 2017 to support the feasibility study, and was updated in October 2023 (Palmer, 2023) (Appendix Q of the Site Characterization Plan). This mapping and analysis identified areas of confirmed permafrost at the northeast toe of the Class A Storage Facility, the north part of the Class C Storage Facility and the west part of the Overburden Stockpile including the site of the proposed collection pond. Probable permafrost areas are mapped throughout approximately half the area of the Class B Storage Facility and collection pond, at the south parts of the Class A Storage Facility and collection pond, at the north and east parts of the Class C Storage Facility and the northwest part in the vicinity of the drainage line and at the upslope area of the Overburden Stockpile. Considerations for permafrost conditions were included in the feasibility design. Shallow flow slope failure and slope creep caused by permafrost are not anticipated beneath the facilities based on the available data. Frozen soil strength parameters were based on published geotechnical parameters for slope stability assessments in frozen soils (Nater et. al., 2008), as discussed in the Waste Rock and Overburden Management Plan. Unsuitable (fine grained or ice-rich permafrost) foundation materials will be removed during construction as required for physical stability.

Geotechnical parameters for soils and bedrock have been developed based on multiple site investigations, laboratory investigations and analyses, as detailed the Site Characterization Plan, and Appendix M through Appendix S in particular. Ground motion parameters (peak ground acceleration and spectral accelerations) have been produced for the Class A, Class B, and Class C Storage Facilities and the Overburden Stockpile, as described in the KZK Project Seismic Hazard Assessment (SHA) (KP, 2024g) as discussed further in response to IR1-17. The SHA included Probabilistic Seismic Hazard Analysis (PSHA) and a Deterministic Seismic Hazard Analysis (DSHA) for the project site. It was confirmed that the design of waste management facilities is appropriate given these updated seismic parameters.

Additional geotechnical and hydrogeological investigations and analyses are planned for 2024 and 2025, and the parameters used for feasibility design of the waste management facilities will be reassessed using this information in support of Detailed Design. While it is expected that some geotechnical parameters may be refined using this information, it is also expected that final designs will include only minor changes for optimization. These changes are not expected to change the design approach or intent, or the related environmental risks. More detailed construction

specifications will be developed as part of Detailed Design, which will be completed after licensing is complete. Final designs will be sealed by a Professional Engineer licensed by Engineers Yukon.

IR1-12 Conduct stability analyses on a series of cross-sections for each mine waste management facility. This analysis should include both operations and closure scenarios.

Rationale: The slope stability designs appear to have generalized cross-sections and foundation conditions. It is not evident that the sections analyzed are cross-sections at a specific location or of they are determined to be the critical section and if so, how that section was determined. In general, the analysis of all mine waste management facility slopes is conducted at a Feasibility Design level and needs to be advanced to a Preliminary Design level to provide confidence that the design is mitigating all risks.

BMC Response: Stability analyses were conducted on the critical section for each of the mine waste storage facilities, corresponding to the highest section of the facility in its ultimate configuration during operations, and for closure, as detailed in KP (2018), provided as an appendix to the Tailings Management Plan. This is standard practice in Canada and internationally for analyzing the stability of tailings and waste rock storage facilities.

BMC respectfully disagrees with the comment that the analysis of mine waste storage facility slopes should be advanced to Preliminary Design level to provide confidence that the design is mitigating all risks. Given the fact that the proposed facilities include only relatively simple and low-risk facilities, it is clear from an engineering and risk management perspective that the existing Feasibility Design is adequate to characterize and mitigate risks. This is also supported by and aligns with Table 2-3 of the Guidelines for Mine Waste Management Facilities (Yukon, 2023) which states that Feasibility Design Level is '*required for obtaining regulatory approvals*.'

Regarding the recommended advancement to Preliminary Design Level, the Guidelines for Mine Waste Management Facilities (Yukon, 2023) state that this design level '*may be required for obtaining regulatory approvals described above where more detailed information on designs of ancillary features and the mechanical and electrical equipment and the operations is required by regulators*.' The proposed facilities at KZK, including a filtered TSF and waste rock storage facilities, do not have dams or any complex or high-risk ancillary features, mechanical or electrical equipment, or other features that would warrant advancement to a Preliminary Design Level prior to commencement of Detailed Design.

IR1-13 Revise the Tailings Management Plan to include dedicated compaction equipment to ensure that the tailings and waste rock mixture is adequately compacted.

Rationale: The tailings management plan envisions co-disposal of filter tailings and Class A waste rock. There is little detail provided at this stage on how the co-disposal will function in practice, but is conceptually understood. Since there is a lack of details, BMCs assumed the lower strength parameters of the tailings to represent the entire co- disposed pile.

However, the tailings disposal plan does rely on the tailings being placed in a compacted state and relies on compaction from haul truck traffic and bulldozers to achieve the compaction. In general, compaction specific equipment, like vibratory rollers, should be employed to ensure that the entire footprint of the tailings and waste rock life is adequately compacted.

BMC Response: BMC agrees that dedicated compaction equipment will be required to meet specifications. As detailed in the Tailings Management Plan, tailings and waste rock will be placed in lifts and compacted using a vibratory roller and equipment traffic to ensure that minimum compaction specifications (% of Standard Proctor maximum density) are met. These minimum compaction specifications will be established during Detailed Design to ensure that settlement does not exceed an acceptable range, and that the void ratio of potentially liquefiable materials is less than their critical void ratio. The co-disposal strategy and compaction specifications will be further assessed and refined during Detailed Design and compaction performance will be evaluated during Operations. BMC will also be reviewing the conservative assumption that the co-disposal of waste rock with the tailings does not provide any additional strength.

IR1-14 Provide detail as to how off-specification tailings (both too wet and too dry) will be managed in both sub-freezing and above-freezing conditions.

Rationale: The tailings management plan indicates that moisture conditioning will be used to adjust the tailings moisture content when off-specification tailings are disposed of in the Class A facility. Addition of moisture is relatively easy to ensure that the tailings are within +/- 2% of the optimum moisture content and can be achieved in freezing conditions with some care. However, drying of material that is over the optimum moisture content by 2% will be more difficult. Typically, in this situation the surface of the material is scarified and allowed to dry before compaction, or the material is blended with a drier material to reduce the overall moisture content. Even in above-freezing temperatures this may be difficult to achieve if the haul path is over the off-specification tailings. In sub- freezing temperatures it not likely that enough time will be available to sufficiently dry and compact the tailings before they freeze in place.

BMC Response: Filtered tailings will be placed in the Class A Storage Facility and co-disposed with waste rock. BMC recognizes that off-specification tailings may produce operational challenges, especially tailings that are wet-of-optimum moisture content. These are challenges common to all filtered tailings facilities, including facilities in cold climates (Bellekeno, Pogo, Raglan and others) and are generally managed through one or more methods developed and implemented by the Engineer of Record and site personnel.

At KZK, the moisture content of filtered tailings will be tested at least daily, and excess filter capacity will be available as needed in the short term. If off-specification tailings are produced, wet-of-optimum tailings can be selectively blended with waste rock, a drier material, to facilitate compaction. It's unlikely that significant amounts of tailings will be dry-of-optimum, but these tailings could be temporarily stored towards the back of the TSF and moved once wetter, or they could be deposited permanently in an area of the TSF that is not structurally significant.

If the filtration plant regularly produces off-specification tailings for extended periods, tailings dewatering practices will be assessed and revised as appropriate. This may include changes to tailings thickening and/or filtration processes such as changes to flocculant dosing, the addition of filter plates in the filtration units and/or increasing filter cycle time or other parameters. These types of adjustments are considered relatively routine and can typically be made within hours.

BMC personnel and BMC's consultants have extensive experience with the design and management of filtered tailings, including travel to Pogo Mine, Greens Creek and other filtered tailings operations. Multiple options exist to rapidly change operating procedures if off-specification tailings are produced at KZK, and there is clear precedent for the appropriate management of off specification filtered tailings in all weather conditions.

IR1-15 Provide a dust monitoring, management and mitigation plan for the mine waste management facilities which demonstrates measures to control fugitive dust from the facilities. This plan should include.

a) Monitoring plans for fugitive dust from all facilities, including Class A, B, C, and overburden.
b) Mitigations to control dust from all facilities (Class A, B, C, and overburden) that can be employed if monitoring shows fugitive dust is escaping the facilities.

Rationale: The application is unclear on dust management practices for the mine waste facilities. Considerations for dust management are necessary for filtered tailings and waste rock piles. The tailings management plan acknowledges that dust monitoring is necessary but does not provide any mitigations to help control dust. Dust management is not included in the Class B or Class C facilities planning and designs. Dust can also escape from these facilities during the winter, especially if the surface is windblown and snow free.

BMC Response: The Tailings Management Plan and the Waste Rock and Overburden Management Plan have been updated to include details of dust management to control fugitive dust from the facilities. The primary management practice will be dust suppression using water or other common environmentally acceptable dust suppressants. Progressive reclamation will decrease the area of exposed tailings or waste rock susceptible to dust generation. Air quality monitoring for the Project is discussed in the Environmental Monitoring, Surveillance and Reporting Plan, including multiple air quality sampling stations. The Adaptive Management Plan provides details of air quality trigger values and associated adaptive management responses in the event that these trigger values are reached or are predicted to be reached based on trend analysis.

4 DESIGN EVENTS

IR1-16 Design events should be updated in accordance with the GMWMF, current seismic modeling, current climate models, and industry best practices.

Rationale: It is possible that updates to design events will result in changes to design of mine waste management facilities and water management infrastructure.

The National Building Code of Canada has released their 6th generation seismic hazard model, which provide updated ground motions that are in the order of 20-30% higher than the previous generation model. The newer design values should be applied to all engineered design facilities. It is likely that the Class A and B facilities, in particular, will require higher seismic design events incorporated into their design.

BMC notes, in its Site Characterization Plan, that they used an envelop curve to estimate peak flow discharges for various return periods and compared to peak flows calculated from nearby Water Survey Canada station data. The calculated peaks were then increased by a 15% adjustment factor to account for climate change in accordance with Engineers and Geoscientists B.C. 2018 guidance. This likely underestimates the severity of 24h extreme events over the project life. It may also underestimate the rate of snowmelt in the future, and related changes in freshet timing and intensity. More detailed climate modeling guidance (GMWMF, 2023 and MAC, 2021) is now available and should be applied.

BMC Response: Ground motion parameters (peak ground acceleration and spectral accelerations) have been produced for the Class A, Class B, and Class C Storage Facilities and the Overburden Stockpile, as described in the SHA (KP, 2024g) and discussed further in response to IR1-17, and in the Tailings Management Plan and Waste Rock and Overburden Management Plan. The SHA included Probabilistic Seismic Hazard Analysis (PSHA) and a Deterministic Seismic Hazard Analysis (DSHA) for the Project site. It was confirmed that the design of waste management facilities is appropriate given these updated seismic parameters.

Climate predictions have been updated using all available data, as discussed in the response to IR1-2. Climate change modelling has been incorporated into the Life of Mine Water Balance Model as discussed in the *Life of Mine Water Balance Model Update* report (KP, 2024b) and the Water Management Plan. The modelling incorporates climate predictions extending beyond the predicted Mine life, for multiple emissions scenarios.

Given the observed and predicted rates of change in extreme rainfall events, any potential climate change effects during the Mine life are expected to be well within the uncertainty of the IDF values presented in the *2019 Hydrology and Climate Analysis* report (KP, 2019). Nonetheless, as stated in KP (2019), "*It is generally expected by regulators and the public that climate change is addressed in peak precipitation and flow analyses, and a 10% to 20% climate change factor has evolved in engineering practice as a somewhat "de facto" standard to address this concern (EGBC, 2018). Therefore, a 15% uplift was applied to the return period precipitation values.*"

To put this 15% value in the context of the IDF_CC tool, 100-year 24-hour precipitation values were generated with IDF_CC for future time periods of 2020-2050 and 2040-2070, then compared with a value based on historic conditions. The results of the IDF_CC analysis, presented in Table 4-1, are for an ensemble of global climate models recommended for Northern BC on the ClimateBC website (Mahony et al., 2022; Wang et al., 2016).

Table 4-1: Changes in the 100-year 24-hour Storm given Various Emissions Scenarios

Period	SSP1-2.6	SSP2-4.5	SSP5-8.5
2020-2050	13%	3%	-3%
2040-2070	12%	2%	17%

These results, which are for time frames that extend well beyond the anticipated KZK Mine life, indicate that the magnitude of extreme precipitation events is likely to increase for most emissions scenarios. However, as 15% is towards the upper end of the projected changes, no additional uplift to the Project values is considered appropriate.

Another point to consider is that Project closure will involve the draining and removal of all ponds and other hydrotechnical infrastructure, so there will be no need for closure spillways, ditches, or other "permanent" hydraulic structures that would require a design based on an extreme precipitation event for some future period. Furthermore, if the closure design is modified for some reason in the future, any potential climate change effects will be reassessed at that time based on the latest modelling developments and climate change predictions at that time.

IR1-17 A site designation or shear wave velocity of soils and bedrock should be determined for each mine waste management facility based on the specific foundation conditions of each footprint.

Rationale: Both the 6th and 5th generation seismic modeling from National Building Code of Canada require a site designation, based on the shear wave velocity of the site soils to be determined in order to adjust the seismic values for the site conditions. It is not clear which site designation that BMC used for the site, however, BMC states they have used a 1:2475 design event for all mine waste management facilities.

BMC Response: A Seismic Hazard Assessment has been completed for the KZK Project and includes both a Probabilistic Seismic Hazard Analysis (PSHA) and a Deterministic Seismic Hazard Analysis (DSHA) (KP, 2024g), provided as Appendix S of the Site Characterization Plan.

Seismic ground motion parameters have been determined from the PSHA using the computer program EZ-FRISK to develop a seismic hazard model for the region of western Canada and Alaska. The DSHA was carried out to predict maximum ground motions at the Project site from earthquakes located on the major fault systems in the regions of northwestern Canada and southeastern Alaska. Appropriate ground motion prediction models defining the relationship between earthquake magnitude, source to site distance and ground shaking, defined by Peak Ground Acceleration (PGA)

and spectral acceleration values, have been used in the seismic hazard analyses. The seismic sources and source parameters defined in the EZ-FRISK model are consistent with those used by the Geological Survey of Canada (GSC) for defining the seismic hazard in western Canada. However, the GSC model does not include the Tintina fault which was added to the seismic hazard model using fault characteristics developed using the available information and recorded seismicity data.

The PSHA was used to predict PGA and spectral accelerations defining uniform hazard spectra, for return periods ranging from 100 to 10,000 years, corresponding to Annual Exceedance Probabilities ranging from 1/100 to 1/10,000. PGA and spectral accelerations were initially calculated for a Vs30 value of 450 m/sec (representing very dense soil or soft rock) for comparison with values provided by the seismic hazard database of Natural Resources Canada. The predicted PGA values for return periods of 475 years and 2,475 years are 0.05 g and 0.14 g respectively, indicating the seismic hazard at the Project site is relatively low.

Ground motion parameters (PGA and spectral accelerations defining the Uniform Hazard Spectrum (UHS)) are provided for each facility based on their site-specific foundation conditions, defined by a Vs30 value representing the average shear wave velocity in the top 30 metres of the ground profile. The corresponding basin effect term, Z1.0, representing the depth to a shear wave horizon of 1,000 m/sec was also determined. The Vs30 and Z1.0 values were calculated using available information and data provided by geotechnical and geophysical investigations conducted at the site.

The Vs30 and corresponding Z1.0 values assigned to each facility are summarised in Table 4-2. Calculated Vs30 values account for the removal of unsuitable (ice-rich/loose) soils where appropriate during foundation preparation.

Table 4-2: Summary of Seismic Foundation Parameters for Key Facilities

Facility	Seismic Foundation Parameter	
	Vs30 (m/sec)	Z1.0 (m)
Class A Storage Facility	1,000	0
Class B Storage Facility	600/1,000	6/0
Class C Storage Facility	300/600	20/6
Overburden Stockpile	600	6
Process Plant	760	5

NOTE: The representative Vs30 varies across the foundation footprint for the Class B and Class C Storage Facilities.

Ground motion parameters have been calculated for Vs30 values of 300 m/sec, 600 m/sec, 760 m/sec, and 1,000 m/sec, for a range of return periods (100 to 10,000 years).

A site-specific Vs30 of 1,000 m/sec was determined for the Class A Storage Facility and the corresponding PGA for return periods of 2,475 and 10,000 years are 0.1 g and 0.2 g respectively. A

design earthquake Magnitude of 7.0 is recommended for the Class A Storage Facility, based on the review of historical seismicity and the results of deaggregation of the probabilistic seismic hazard for return periods of 2,475 years and longer.

For the Class B and C Storage Facilities and the Overburden Stockpile, the predicted PGA values for a return period of 475 years are 0.03 g, 0.04 g and 0.06 g for Vs30 values of 1,000 m/sec, 600 m/sec and 300 m/sec respectively. According to Yukon (2023), the maximum required earthquake design ground motion (EDGM) for waste rock facilities has an Annual Exceedance Probability of 1/1000, corresponding to a return period of 1,000 years. A design earthquake Magnitude of 7.0 is recommended, based on the review of historical seismicity and the results of deaggregation of the seismic hazard for return periods up to 1,000 years. For return periods up to 1,000 years larger Magnitude (M7 to M8+) earthquakes associated with the Fairweather fault are also identified as contributing significantly to the seismic hazard for long period ground motions. Consequently, a design earthquake magnitude of 8.1 should also be considered for periods of motion of about 1 second and longer.

5 COVERS FOR CLOSURE

IR1-18 Develop sequencing for progressive reclamation of the Class A and B facilities to determine if progressive reclamation is in fact possible or practical for the facilities.

Rationale: Progressive reclamation is planned to be conducted at the Class A and B facilities. In areas where progressive reclamation is going to be conducted, it is important to ensure that the facility is constructed or easily regraded to meet its closure geometry during operations. Progressive reclamation of both the Class A and Class B facilities is encouraged, but early design work is necessary in order to ensure the progressive reclamation achieves the closure objectives. One of the key pieces of information that will be necessary to facilitate progressive reclamation is the final closure geometry, including both average and maximum slope as well as frequency and size of benches. This will allow the Class A and Class B facilities to be shaped during operations to their final geometry so that placement of the glacial till soil cover can commence early.

BMC Response: Additional details of progressive reclamation of the Class A and Class B Storage Facilities have been provided in the Tailings Management Plan and the Waste Rock and Overburden Management Plan, and general details of progressive reclamation are provided in the Reclamation and Closure Plan. Detailed Design of the progressive reclamation of these facilities will be developed prior to Construction and will be revised as appropriate during Operations. Detailed Design will develop details of the factors discussed in this IR, including final closure geometry, overall and interbench slopes, and bench frequency, size and grade.

BMC expects that progressive reclamation of these facilities may present some challenges, and some trial and error is to be expected while optimal construction and vegetation techniques are determined, as is the case at most mines undertaking progressive reclamation. BMC management has routinely applied the principles of progressive reclamation at mine sites and is not aware of any reasons that progressive reclamation would not be possible for the proposed KZK facilities. Progressive reclamation is common for waste rock storage facilities and for dry stack tailings storage facilities and this is one of the reasons that dry stack tailings are considered a best practice (Oberle et al., 2020; MEND, 2012).

IR1-19 Develop design parameters for closure in accordance with closure objectives and the GMWMF.

a) Review design and performance details from 2010 to 2016 for the Grum sulphide cell at the Faro mine and incorporate any lessons learned in to the design of this facility.

Rationale: The final covered slopes on both the Class A and B facilities are steeper than the completed, and very similar, cover on the Grum sulphide cell at Faro. At the Grum sulphide cell, there were both construction and post-construction issues with the slope and stability of the cover. There are a number of publicly available reports at the EMR library from BGC Engineering that will support this review, including cover control measure from 2011, cover upgrades in 2012, and annual reviews of cover performance from 2013-2016.

BMC Response: BMC has reviewed the documentation on the Faro Mine Complex (Faro) closure cover installed in 2010. The Faro cover system experienced significant erosion following initial construction during spring runoff (BGC, 2013; 2016). Remedial measures were identified and implemented in 2011, and annual inspections, recommendations and maintenance were undertaken in subsequent years to confirm performance.

The closure cover design for the Class A and B facilities will include considerations for erosion protection, slope breaks/catch benches, collection ditches, etc. and will conform with the *Guidelines for Mine Waste Management Facilities* (Yukon, 2023) to avoid similar problems to those encountered at Faro. Features will be specified to allow surface water to be collected and directed away from the facility (sloped collection ditches) and at specified slope length intervals along the closure cover. Collection ditches will be sized to convey peak flows from the closure design storm event and will include appropriate erosion control measures (geotextiles, rip rap, etc).

Construction of the closure covers will be completed as per QA/QC specifications that will be developed prior to construction. Surface erosion of the cover materials during spring freshet and/or significant precipitation events may occur prior to the vegetation cover being established. Ongoing monitoring, performance reviews, and required maintenance and repairs of the closure covers will be completed as detailed in the Operations, Maintenance, and Surveillance manual, which will be prepared prior to construction, in conformance with industry standards such as MAC (2021).

Detailed specifications for the proposed KZK closure covers will be developed during Detailed Design and will be reviewed and updated as required during operations. The primary objective of the closure and reclamation initiatives is to return the mine to a self-sustaining condition consistent with pre-mining conditions, and for the stored tailings and waste rock to remain physically and chemically stable.

IR1-20 Review the constructability of the cover system to ensure that the cover can be safely placed over the geomembrane and remain stable.

Rationale: Placement of Class C material over the geomembrane may pose to be difficult since the slopes are long and there may not be enough mid-slope benches. This should be considered in overall design of both the Class A and B facilities.

BMC Response: The Class A and B Storage Facility closure covers are proposed to be constructed using similar materials and methodologies, described in detail in the Reclamation and Closure Plan. The proposed design uses a common approach to tailings and waste rock closure covers, and is a recommended practice in semi-arid regions with limited evapotranspiration, like the Project site (Hawley and Cunning, 2017; INAP, 2018).

The Class A cover will be constructed to a minimum overall slope of 4H:1V, and the Class B cover will be constructed to a minimum overall slope of 3H:1V. The overall slope will be achieved by progressive placement of the cover materials in controlled lifts, with placement and compaction controls for each material and lift. Appropriate lift thicknesses, placement and compaction requirements, and testing for each material will be specified in the final design and QA/QC

documents. Final slopes will be regraded as required to achieve overall slope specifications including catch benches, collection ditches, and erosion control features. Ongoing monitoring and performance reviews of the closure covers will be completed as outlined in the Operations, Maintenance, and Surveillance manual, which will be prepared prior to construction. Stability analysis of the cover layers is presented in KP (2018, 2019) as discussed in the Tailings Management Plan and the Waste Rock and Overburden Management Plan and will be updated during Detailed Design and during Operations, as more information becomes available.

The IR notes that '*Placement of Class C material over the geomembrane may pose to be difficult since the slopes are long and there may not be enough mid-slope benches*'. It should be noted that the figures submitted by BMC do not show the planned individual benches. BMC understands that multiple benches will be required on the final slopes to mitigate erosion and stability risk of the cover system, and these benches will be included in Detailed Design drawings. Slopes will be monitored as discussed in the Environmental Monitoring, Surveillance and Reporting Plan, and mitigations and changes to reclamation procedures will be implemented as appropriate.

6 RISK ASSESSMENT AND EMERGENCY MANAGEMENT

IR1-21 Update the FMEA to include input received during assessment and additional information from any new site characterization and design advancement and include interested parties in the workshop for all structures. The FMEA should concentrate on the failure modes associated with the infrastructure that will used during operation and exist in perpetuity, beyond closure. The FMEA should be conducted with active participation and deliberation from regulators and affect First Nations as recommended in the GMWMF.

Items of note from elsewhere in this intervention to note for an updated FMEA:

a) Include failure or blockage of foundation drainage pipes for the mine waste management facilities and design appropriate mitigations for the scenario.
b) Include downslope movement in the piles on the mine waste management facilities and include suggested actions of defensive measures that are in place to mitigate the risk.
c) Include updated climate projections.

Rationale: BMC conducted a qualitative failure modes and effects assessment (FMEA) as a part of their submission. The FMEA was conducted prior to the assessment phase. The FMEA for the Class A facility was updated in 2020 but was based on the 2016 design.

The FMEA and updates included only members of BMC and their design consultants and did not involve local First Nation groups, regulators or other stakeholders.

The FMEA should be undertaken to improve design with respect to improving design robustness, improved performance of long-term infrastructure and minimization of long- term operational maintenance and surveillance. The FMEA should also consider the constructability and long-term performance challenges of the Class A, B and C facilities associated with working in such a steep and narrow valley.

BMC Response: The FMEA conducted in 2020 for the Class A Storage Facility was completed with the participation of Ross River Dena Cho, including two RRDC Elders. BMC is now in the process of updating this FMEA for the Class A Storage Facility, and conducting FMEAs for other proposed waste management facilities, in collaboration with Yukon Government and Yukon Conservation Society. Ross River Dena Council and Liard First Nation have also been invited to participate, but have chosen not to respond to the invitations. FMEA summary reports are expected to be complete by May 2024, and will be provided as standalone documents upon completion, and will be provided as appendices to subsequent versions of the Tailings Management Plan and the Waste Rock and Overburden Management Plan.

With regards to the three items of note listed in this IR:

a) The mine waste management facilities do not include drainage pipes, because they have no need for such features to maintain adequate drainage and stability. Nevertheless, the potential for inadequate drainage to create stability risks will be further evaluated as part of the FMEA;

b) Stability of the mine waste management facilities has already been evaluated using multiple methods and a range of loadings and sensitivities, and the planned designs include a range of measures to mitigate instability risks. Nevertheless, inadequate stability is a potential risk that will be evaluated as part of the FMEA; and

c) Climate change was considered under the YESAB assessment. Updated climate predictions have been considered in the current design, and will be further considered as the design is optimized during Detailed Design, and related uncertainty in climate and storm events will be further considered in the FMEA.

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