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SECTION 9

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9.0 MALFUNCTIONS AND ACCIDENTS

9.1 Introduction and Approach

All aspects of the Springpole Gold Project (Project) have been designed to meet or exceed applicable safety and environmental regulations. While professional engineering designs and mitigation controls have been integrated in the Project from the earliest planning stages, the federal Environmental Impact Statement (EIS) Guidelines (Appendix B-1) require that the environmental effects of malfunctions or accidents, even if improbable, be considered in the final Environmental Impact Statement / Environmental Assessment (EIS/EA). Malfunctions and accidents can include structural and operational failures and/or accidents caused by human error, and their consideration is important to validate the engineering designs and mitigation controls. Project design and operational performance monitoring are key to safeguarding against the risk of a malfunction or accident.

The consideration of malfunctions and accidents occurs in a stepwise manner:

1. Proposed design mitigation measures and operational safeguards are described, as well as proposed contingency measures and emergency response procedures, to eliminate or reduce potential effects.
2. Potential residual effects are assessed after mitigation.
3. Residual risk for each malfunction and accident is determined, considering likelihood and severity.

For identified malfunction and accident scenarios, the effects were assessed based on a reasonable worst-case. Occurrences where environmental effects are only likely to arise through situations that are practically impossible to attain have not been considered. Medical and similar emergencies, while important, are unlikely to have an environmental impact. These emergencies will be addressed through routine health and safety planning, as applicable.

9.2 Influence of Consultation with Indigenous Communities, Government and the Public

Consultation has been ongoing prior to and throughout the environmental assessment (EA) process, and will continue with Indigenous communities, government agencies and the public through the life of the Project. Section 2 provides more detail on the consultation process. The Record of Consultation (Appendix D) includes detailed comments received during the development of the final EIS/EA.

Feedback received through consultation has been addressed through direct responses (in writing and follow up meetings) and incorporated into the final EIS/EA. An overview of the key comments that influenced the identification and analysis of malfunctions and accidents between the draft and final EIS/EA is provided below:

9.2.1 Location of Co-disposal Facility

Comments were received from the Impact Assessment Agency of Canada (IAAC) and the Ministry of Natural Resources related to the proximity of the Project features such as the co-disposal facility (CDF) and the ore stockpiles to adjacent waterbodies. In response, additional engineering details have been advanced since the draft EA providing additional setback for the CDF where possible with the setbacks being between 120 and 300 metres (m) from Birch Lake and Springpole Lake, which provides for the application of contingency engineering measures during life of mine. And the entire perimeter contact water collection system has been designed to demonstrate its feasibility and effectiveness.

These additional design considerations and information regarding potential failures of the open pit, the CDF and the stockpiles have been added to Sections 9.5, 9.7 and 9.9. Additionally, it is noted that many mines across Canada have infrastructure located in equal proximity to waterbodies without issue, and further design measures have been advanced to demonstrate the safeguards associated with the Project.

Cat Lake First Nation (CLFN) and Lac Seul First Nation (LSFN) requested further information concerning foundation conditions and stability of the CDF. Additional information was added to Section 9.7 providing further details on geotechnical investigations that were carried out (numbers and locations of test pits and boreholes), and the general nature of foundation conditions.

9.2.2 Potential Spills of Hazardous and Non-hazardous Materials

Comments received from CLFN and Slate Falls Nation requested additional information on the potential for spills of hazardous materials at the mine site and along the transportation routes, and the associated mitigation measures and emergency response plans. Additional information on the spill mitigation and emergency response has been included in Section 9.12 and Section 9.13.

Northwestern Ontario Métis Community (NWOMC) requested information on the notification of an emergency and the involvement of NWOMC in the potential clean-up or remediation afterwards. Wabauskang First Nation also questioned how they or other Indigenous communities would be notified in the event of a spill or accidental release. IAAC and the Ojibway Nation of Saugeen requested confirmation that liquid cyanide would only be used in the event that solid cyanide is temporarily unavailable, and with the inclusion of appropriate additional safeguards as needed. In response, it is clarified in Section 9.13 of the final EIS/EA that the transportation of cyanide will follow all applicable regulatory requirements for transportation of dangerous goods, and the Project will also consider the cyanide transportation recommendations by the International Cyanide Management Institute.

9.2.3 Water Management System Malfunction

CLFN and LSFN requested further information concerning the effectiveness of water treatment technologies and the effects of treatment system malfunction. Slate Falls Nation also requested additional information on the water storage capacity of the management system and effluent treatment limits. Comments received from IAAC and the Ministry of the Environment, Conservation and Parks requested additional information and assurance that contact water could be collected and managed to appropriate design storms and that sufficient space was available to contain the required volumes. IAAC requested additional discussion of the resiliency of the overall water management system to extreme rainfall events and the consequences of discharge of untreated contact water, particularly from the perimeter ditches and water management ponds.

Additional analysis was completed in 2024 for the design of seepage and runoff collection systems. As a result, the design criteria for the ditches and collection ponds have been modified. Section 9.9 has been updated to clarify that although the short-term construction phase water management will use more frequent design events (i.e., 1:10-year), the operations phase water management facilities will be designed to accommodate and contain a 1:100-year, 24-hour storm event. A summary of the additional analyses to support the design criteria has been added to Section 9.10. The assessment of the effects of the environment on the Project (Section 8.6) has also been updated to include additional information that describe the resiliency of the overall water management system to extreme rainfall events, including the ability to use the open pit for additional storage in the event of an extreme precipitation event.

9.2.4 Potential Effects of Effluent Seepage from the Co-disposal Facility on Birch and Springpole Lakes

CLFN and LSFN requested further information concerning the potential effects of undue residual seepage release from the CDF on Birch and Springpole Lake water quality. Additional discussion is presented in Section 9.6 demonstrating that the effectiveness of CDF seepage capture such that Birch and Springpole lakes will not see increased concentrations of contaminants of concern beyond preventive action limit (or background) concentrations.

9.2.5 Dike Stability

CLFN and LSFN requested clarification on the dam (i.e., dike) design and safety factors. The dikes are designed to meet the factors of safety required by guidelines and regulations such as the Canadian Dam Association (CDA) *Dam Safety Guidelines* (CDA 2013, 2019) and supporting technical bulletins, Ministry of Natural Resources (MNR 2011a) guidelines and the *Lakes and Rivers Improvement Act* (R.S.O. 1990, c. L.3). Additional design information on dike stability and safety is included in Section 9.5.

9.2.6 Potential for Interactions between Wildlife and Water Management System

IAAC requested additional information as to why wildlife, including birds, are not considered likely to be adversely affected by interacting with the water management system. Additional consideration has been added to Section 9.10 of the final EIS/EA that discusses the intermittent and limited interactions anticipated, if any between wildlife and the water management system, and includes discussion of cyanide destruction within the ore processing plant using the sulphur dioxide / oxygen treatment facility, to ensure that cyanide and metal concentrations within the CDF tailings pond will be maintained at concentrations that are below thresholds that could potentially pose a hazard to wildlife. The use of deterrents to minimize the potential for interactions between wildlife and birds with the water management treatment system as been included in Section 9.10.

9.2.7 Effects on Traditional Land and Resource Use

CLFN and LSFN requested that First Mining Gold Corp. (FMG) assess how accidental events or spills could affect the conservation and continued use of traditional sites near the mine site, harvesting practices, members' ability to practice their way of life and to transfer knowledge and teachings specific to the area; and community socioeconomics. NWOMC also requested that FMG include information on how the accidents described could impact the health and safety of the NWOMC citizens, and the ability of NWOMC citizens to harvest.

FMG recognizes that an accident or malfunction could result in an environmental effect that subsequently could impact traditional land and resource use. Engineering design features and mitigation measures will be implemented for the Project to eliminate or reduce the risk a potential accident or malfunction from occurring, and its potential for effects on the environment. Although not explicitly stated in the following sections, these engineering design features and mitigation measures are intended to be protective of the environment and traditional land and resource use in the area can continue.

9.3 Identification of Malfunctions and Accidents

Malfunctions and accidents for the Project were identified from a variety of sources, including experience with other similar mining projects and internal risk assessment discussions. The following potential malfunctions and accidents were identified for effects assessment:

- **Structural integrity of facilities or process disruption:** open pit slope stability, dike stability, CDF dam stability, stockpile stability, water management system (physical or treatment) disruption;
- **Accidents:** explosives accident, chemical spill; and
- **Other malfunctions:** Project-related fires.

Identified malfunctions and accidents are primarily associated with the construction and operations phases of the Project. The closure phase has also been assessed where applicable in Section 9.16.

9.4 Safety Measures

The Project is designed by qualified persons including professional engineers. A qualified person, in this context, is defined as a person who (a) holds a licence, limited licence or temporary licence under the *Professional Engineers Act* (R.S.O. 1990, c. P.28), or (b) holds a certificate of registration under the *Professional Geoscientists Act, 2000* (S.O. 2000, c. 13) and is a practising member, temporary member, or limited member of the Association of Professional Geoscientists of Ontario, or (c) has a degree in environmental science with specialization in hydrology, aquatic ecology, limnology, biology, physical geography and/or water resource management, as appropriate, and has demonstrated relevant knowledge and experience.

Accordingly, the Project will be constructed and operated along best practices to meet or exceed regulations and standards for engineering, safety and environmental management, which directly address the risk for malfunctions or accidents and any corresponding potential Project-related environmental effects. Multiple levels of safety measures to reduce the potential for malfunctions or accidents are achieved by following key principles:

- Incorporate safety and reliability into the design of Project components.
- Develop and apply procedures and training aimed at safe operation of the Project and that prevent or avoid the upset conditions that might lead to a malfunction or accident.
- Provide expert review and advice on key Project infrastructure including tailings and mine rock management and associated water management including dikes..
- Provide training in operational procedures and environmental emergency response procedures, including safety measures to prevent malfunctions or accidents.
- Implement robust monitoring related to geotechnical performance of key infrastructure and water balance through all phases of the Project.

An emergency response plan will be developed prior to construction and informed by detailed engineering. The purpose of the emergency response plan will be to facilitate prompt and efficient response actions for addressing emergencies; identify responsibilities, communication and reporting procedures; provide protocols to follow should an emergency occur; and provide information on available equipment, resources, facilities and trained personal in the event of an emergency.

The priorities of the emergency response plan will be the following:

- Protection of human life;
- Protection of the environment; and
- Protection of property.

The emergency response plan will include further details on the appropriate notifications to Indigenous communities and regulatory agencies. Indigenous communities will be able to review and comment on the emergency response plan prior to implementation.

9.5 Open Pit Slope Stability

The open pit will be excavated through existing overburden and into the native bedrock where the ore is located. The stability of the rock and overburden in the open pit area has been assessed by geotechnical drilling investigations, and this information has been used to develop safe and stable open pit slopes to industry safety standards by qualified geotechnical engineers. Additional information on the pit development and pit geometry is provided in Section 5.6.

9.5.1 Design and Operations Safeguards

Overburden slopes around the perimeter of the open pit are designed for stability and are in the range of 30 degrees (°), depending on overburden depth. Steeper slopes may be used temporarily during the initial development of the open pit. The majority of the open pit will be developed in rock that is characterized as being of good to very good rock mass quality, and the geotechnical conditions are well understood. Follow-up routine analysis will occur during operations as the pit development advances to monitor slope performance.

The design of the open pit will be continuously refined by qualified geotechnical and mine engineers during operations to confirm the pit design continues to meet or exceed industry standards for stability. The open pit design is based on:

- Maintaining open pit stability (meeting or exceeding safety requirements);
- Bench heights of typically 12 m (can vary depending on rock type); and
- Safety berms developed typically every 24 m (can vary depending on rock type).

Ramp widths will be maintained at approximately 27 to 35 m with an approximate design grade of 10 percent (%). Inter-ramp design slope angles in rock will be maintained at 22° to 52° and bench face angles will range from 34° to 75°. Mining widths of 35 to 40 m are proposed with preferred bench widths of 60 m or more. Based on the known geotechnical conditions and pit design, only minor sloughing / erosion is expected to occur.

Geotechnical monitoring of the open pit wall stability will be directed by qualified geotechnical engineers. Survey prisms / survey monuments and inclinometers or similar will be set up in the open pit and monitored for changes in position to identify potential areas of instability and ground movement. If appropriate during final design, instrumentation will also be provided to record pore pressures and ground deformation in pit perimeter overburden areas, to provide an early warning of potential overburden slope instability. Should substantial slope movements occur, a review will be conducted by qualified engineers to assess whether design changes are needed for continued safe mining operations. The long-term stability of the open pit overburden slopes is sensitive to the groundwater phreatic surface. Piezometers can be installed along the south and west sections of the open pit during operations to assist with slope monitoring. Regular visual inspections will be carried out for all pit slope faces. Drone facilitated surveys are also becoming useful inspection tools in the industry.

During decommissioning and closure, the open pit basin will be refilled with water, and slope stability monitoring in the open pit will cease.

9.5.2 Potential Environmental Concerns

During the operations, two primary slope failures of the open pit walls were considered for the malfunctions and accidents assessment:

- Overburden slopes caused by pre-shearing or uncontrolled erosion; and
- Bedrock slopes caused by anomalous geologic conditions and/or improper operational procedures.

During construction and operations, open pit slope instability can pose a safety hazard to workers. During these phases (i.e., prior to filling the open pit basin with water at closure), a failure of the open pit wall could affect the open pit footprint only if it occurs at the upper bench. If a large-scale pit slope failure were to occur (bedrock triggering overburden failure, or overburden failure alone), it could enlarge the open pit footprint on surface at the location of the failure. The overburden slopes over the bedrock are designed to maintain a safe setback from the crest of the bedrock face so that the overburden surface will not be impacted in the event of a small bedrock slope failure. A small bedrock slope failure within the open pit will not have an environmental effect.

A large failure at the bedrock face of the open pit could increase the open pit diameter at the top of the bedrock in a localized area. A slope failure may require subsequent recontouring outward (i.e., expanding the at surface perimeter of the open pit) to maintain overburden slope stability and/or open pit access. A similar outward expansion could result from erosion of the overburden slopes, particularly water-related erosion, from surface runoff and flows or from groundwater seepage into the open pit.

An overburden slope failure that extends beyond the open pit boundary would slightly increase the pit footprint by causing the adjacent ground to slump into the open pit. Depending on where along the open pit perimeter a slump occurred, haul roads and other onsite access roads could be temporarily disrupted.

A pit slope failure of the northwest portion of the open pit closest to Birch Lake has been considered, including associated overburden pit slope failure and potential for outward migration of the pit boundary. The open pit is comparatively much shallower in this area, with only a few gently sloping benches present in competent rock. Failure of this section of the open pit is therefore unlikely.

An open pit failure resulting in a stability concern for the CDF is also considered unlikely due to a minimum setback of approximately 120 m between the open pit and the CDF.

9.5.3 Contingency and Emergency Response

Geotechnical monitoring will be able to identify potential instabilities at the open pit and measures will put in place before an issue arises. In the unlikely event of an open pit slope failure, work will cease and workers will be evacuated from the open pit per emergency response procedures. Depending on the scale of the issue, once the area is secured, recontouring and other support measures will be employed as needed to allow stability measures to be implemented and monitoring and mining to continue safely. Should large, localized areas of erosion of the pit overburden slopes occur, additional measures will be taken, such as armouring of the slope with mine rock and slope recontouring as needed.

The bedrock pit wall angles have been established based on geotechnical drilling investigations and designs by qualified geotechnical engineers. For the bedrock walls, shotcrete, bolting or other methods can be used to stabilize areas, if monitoring indicates an area of concern. Follow-up analysis will take place during operations to monitor slope performance.

Falling rocks are typically captured by the in-pit safety berms that form part of the benches and would be removed from the pit. The emergency response procedures will be developed prior to operations based on detailed engineering and sequencing of the open pit.

9.6 Dike Stability

During the pre-production phase of the Project, two dikes (west and east) will be constructed to isolate a portion of the north basin of Springpole Lake to safely develop the open pit. Water-containing dikes in Ontario are highly regulated in order to ensure safety. The dikes will be designed to meet or exceed the CDA guidelines (2013, 2019) and the MNR *Lakes and Rivers Improvement Act* requirements (MNR 2011a,b). Design requirements of the Global Industry Standard on Tailings Management, being the global technical standard have also been considered in developing the design criteria. Dike cross sections are illustrated in Section 5.7.1.1. These dikes are essential for the safe and controlled dewatering of the open pit basin in advance of mining operations. Very similar dikes, although much larger and more complex in comparison to the Project, have been successfully implemented at several other Canadian mining projects, including the Meadowbank Mine, Gahcho Kué Mine and Diavik Mine.

9.6.1 Design and Operations Safeguards

Fundamental engineering considerations were evaluated for the dikes, such as the constructability, deformation compatibility with the surrounding soil, acceptable strain, effectiveness in maintaining continuity (with treated bedrock and between panels), and performance on seepage control. Dike slopes are constructed of materials (rockfill / riprap) that are resistant to erosion from precipitation and/or wave action. The dike design includes a grout curtain and seepage cut-off wall that will be developed into the underlying foundation to facilitate hydraulic cut-off / isolation and minimize seepage from Springpole Lake (Appendix V); this grout curtain also increases the stability of the dikes.

The design includes dikes with a crest width of about 28 m and combined length of approximately 940 m (Appendix V). Dike height (height from dike crest to lake bottom) will vary due to the natural undulations in the lake bed (water depth), with a maximum height of about 11 m for the west dike and approximately 17 m for the east dike. The dikes include sufficient freeboard above the elevation of Springpole Lake to prevent flooding during storm events (i.e., 5 m above the average lake level elevation of approximately 391 m above mean sea level [amsl]). In situ monitoring has shown that water levels in Springpole Lake vary by approximately 2.1 m, with a peak water elevation of approximately 392.8 m amsl and a minimum water level of approximately 390.7 m amsl. This information was used to predict the average lake level and the dike freeboard height in accordance with the CDA (2013, 2019) *Dam Safety Guidelines*. The overall side slopes of the dikes will be approximately 1.3 horizontal to 1 vertical (1.3H:1V).

The design is supported by geotechnical investigations of subsurface conditions and presented in Knight Piésold (2021) and will be constructed to withstand the inflow design flow of a probable maximum flood and maximum credible earthquake (1:10,000-year event) per the CDA (2019) and *Lakes and Rivers Improvement Act* (MNR 2011a,b) requirements. Loose lake sediments from the dike footprints will be removed prior to dike rockfill placement. The dikes will maintain stability during the life of mine, meeting or exceeding all safety requirements for long-term, static loadings conditions and pseudo-static loading conditions.

Operational safeguards will include daily visual inspections of the dikes. Geotechnical instrumentation will be installed to monitor geotechnical performance of the dikes, and include (Knight Piésold 2021):

- Vibrating wire piezometers to assess pore pressure build-up and dissipation in the underlying lake bed sediments and embankment rockfill; and
- Slope inclinometers and survey monuments to monitor slope movement or deformation.

Geotechnical and dike safety inspections will be conducted at regular intervals by a qualified geotechnical engineer, meeting or exceeding all regulatory requirements.

9.6.2 Potential Environmental Concerns

The two dikes will be built to isolate the open pit at the very north end of Springpole Lake. These dikes are essential for the safe access to the ore body so mining can occur in the dry. A major breach would bring water from Springpole Lake back into the open pit basin. The breach could erode lake sediment on the floor of the basin along the flow path between the dikes and open pit. Aquatic species near the breach location could be temporarily affected by the suspended sediments from the open pit basin. Springpole Lake water would come into contact with the open pit walls and any equipment present in the open pit at the time, potentially having a short-term effect on water quality within the pit, primarily related to suspended solids. In addition, suspended solids in the water column would settle in a matter of days and the system would be expected to recover quickly.

A breach in the dikes, though unlikely, could also result in a temporary drop in the level of Springpole Lake, depending on the size of the breach, the length of time until the breach could be closed off and the time of year when the theoretical scenario occurred. This lake level lowering could result in a temporary impact to the littoral zone and temporary reduction of aquatic habitat. Once Springpole Lake returns to its natural water level, which would be expected to occur in the short term, water levels and habitats would be re-established naturally and quickly.

9.6.3 Contingency and Emergency Response

The initial response of any malfunction or imminent malfunction will be to protect worker health and safety. The emergency response plan will be implemented, which could include emergency repairs including using material available immediately adjacent to dike sections given the freeboard allowance on the dikes. In such an event, it is expected that water in the open pit basin would be fully contained and would not be allowed to mix with Springpole Lake or otherwise released to the environment unless water quality requirements are met.

9.7 Co-disposal Facility Dam Stability

Perimeter dams will be constructed from mine rock and overburden, primarily excavated during open pit development and from onsite borrow sources such as the fish habitat development area and the CDF quarry. The preliminary CDF design includes perimeter dams constructed primarily from the non-acid generating mine rock. It is estimated that approximately 81 million cubic metres (Mm^3) of material will be required to construct the CDF dams.

9.7.1 Design and Operations Safeguards

Extensive geotechnical investigations have been undertaken in connection with the proposed CDF foundation conditions inclusive of:

- FracFlow Consultants Inc. (Fracflow 2020) – 6 boreholes and 13 test pits;
- Ausenco (2022) - 4 boreholes and 17 test pits;

- Knight Piésold (2022) – 11 boreholes and 39 test pits; and
- Appendix L-1 – 7 boreholes and 4 monitoring wells.

Results of these investigations show that the major portion of CDF dams will be constructed on a robust bedrock foundation, with remaining portions being constructed mainly on areas of shallow overburden amenable to construction preparation. In addition to highly favourable geotechnical characteristics, the bedrock foundation uniformity across the CDF footprint provides highly effective mitigation for seepage management and capture. Details are provided in the *Pre-feasibility Design Update Co-disposal Facility* (Appendix V-2*)*. Since the draft EIS/EA was submitted, further design optimizations have been completed for the CDF.

The CDF will be designed to meet the factors of safety required by regulatory agencies for long-term, static loading conditions, as well as pseudo-static loading conditions and will be designed in stages with early construction and placement of material focused on the south cell of the CDF. By using predominantly mine rock to construct the dams, the overall stability of the facility is not affected by the strength of the thickened and slurry tailings. The dams will be constructed with 3H:1V upstream slopes and 2H:1V downstream slopes for both the north and south cells. Reflecting the stability characteristics of the different types of materials being stored, the north cell will have a centreline construction, while the south cell will have a robust downstream construction. The south cell perimeter dam will also be lined with a low permeability material, such as a geomembrane, for additional seepage control.

Subject to final design considerations, the dam height is expected to be approximately 77 m above grade (Appendix V-2).

Based on the dam classification under the CDA (2019) guidelines, the recommended inflow design flood during operations is defined as two-thirds between the 1:1,000-year return period flood and the probable maximum flood. As such a 72-hour probable maximum precipitation (400 mm) is used as the dam design factor and a minimum freeboard of 2 m above the maximum inflow design flood value is included for the south cell dam to prevent risk of dams overtopping during a severe storm event. A minimum freeboard of 2 m is also provided for the north cell dam. As such, the CDF has been designed to manage flood waters over a very wide range of possible precipitation conditions, Including a condition between the 1:1,000-year return period flood and the probable maximum flood.

The minimum design offset of the CDF from waterways and waterbodies is 120 m. Collection Ponds will be accommodated within the 60 m allowance and/or other available areas outside the waterways and water bodies offset.

Earthquake design ground motion parameters have been determined for the dams using estimates from the Natural Resources Canada seismic hazard calculator. Considering the close proximity to water bodies and overall size, the CDF will be designed applying design criteria for the highest hazard classification with a design earthquake of 1:10,000-year event. Stability analyses of the CDF dams were performed for long-term and 1:10,000-year design earthquake loading conditions. The stability analyses determined that the required factors of safety criteria are met or exceeded as required by CDA (2013) (Appendix V-2*)*.

The Project includes having a qualified geotechnical engineer dedicated to the design, supervision and safe construction and operation of the CDF. In addition, an Independent Geotechnical and Tailings Review Board (IGTRB) has pro-actively been established for the Project and is composed of three external experts. The purpose of the IGTRB is to provide independent oversight on the design, construction, operation, performance and closure planning for the CDF, with the objective of long-term safety and environmental protection. The IGTRB was established early in the planning phase, well in advance of construction, to provide review and advice from the detailed design stage through to closure. The IGTRB has reviewed the updated CDF design and provided advice on the design, construction and operational performance of the dams. In the IGTRB report (Appendix V-3.4), the IGTRB has indicated that the FMG has positively advanced the design concepts. The report states with the CDF dams founded on competent bedrock, there is ample foundation stability. In addition, with a negative water balance and no external runoff catchment, there would be no risk of overtopping the dikes (Appendix V-1).

In-plant cyanide destruction, using the sulphur dioxide / oxygen cyanide destruction process, will reduce cyanide and metals concentrations in the CDF south cell pond and in deposited tailings pore water, which will limit adverse environmental impacts in the unlikely event of a dam breach.

Instrumentation and monitoring will be required to confirm the performance of the CDF. Slope inclinometers and survey monuments will be installed to monitor the CDF perimeter dam deformations. Vibrating wire piezometers will be installed to monitor pore pressure conditions within the CDF dams foundation confirm conditions are stable within the dams.

9.7.2 Potential Environmental Concerns

Under the unlikely circumstance of a breach of a CDF perimeter dam, tailings solids, liquid and potentially mine rock could be released to the surrounding environment, which could pose a safety hazard to workers and facilities in the immediate vicinity. As the CDF is composed of two cells containing thickened tailings and mine rock (north cell), and slurry tailings (south cell), the potential effect would vary depending on the scale, nature and location of the breach (including the type of material stored at the breach), as well as the time of year. Therefore, a potential breach in either of the two areas is discussed separately below.

9.7.2.1 Breach of the Co-disposal Facility North Cell Dam

A breach of the CDF north cell dam could result in the release of thickened tailings, mine rock and potentially tailings contact water. In such an instance, tailings solids could extend into the surrounding environment, including entry into the nearshore area of Birch Lake near a breach location. Any release of such materials including contact water, would be limited as there are no plans to maintain a water pond within the CDF north cell. The tailings solids are composed of fine crushed rock expected to have parameters consistent with natural rock geochemistry, and very low amounts of cyanide and ammonia following the cyanide destruction process. A north cell breach would likely affect the immediately adjacent land more so than adjacent waterbody depending on the amount of material released. Given the design of north cell dams, and with the potentially acid generating mine rock encircled by thickened non-acid generating tailings, a hypothetical breach and associated tailings loss would be minimized. However, a north cell breach could also temporarily affect the seepage collection ditches and perimeter service road, all requiring repairs along with the dam.

A CDF perimeter dam breach during the winter, under frozen ground conditions, would be expected to have a lesser effect as a portion of the deposited tailings would be in a frozen state and cleanup efforts would be easier. Under such conditions, a substantial portion of the tailings, mine rock and affected ice, snow and frozen ground could potentially be removed prior to snowmelt and deposited back into a restored CDF, limiting potential environmental effects.

9.7.2.2 Breach of the Co-disposal Facility South Cell Dam

In the event of a breach of the smaller south cell, while a portion of the tailings would be released and contained within the 120 m setback, additional tailings and pond water could extend to the receiving environment with temporary effects on the receiving water quality. A breach would require substantial clean up and repairs of the dams and seepage control system.

Large breaches typically occur with liquefaction of dikes; however, this is unlikely to occur in this situation as the downstream dike raise will be constructed of mine rock founded on bedrock or competent ground. Additionally, the CDF detailed design will meet all relevant requirements of the CDA, as well as provincial requirements under the *Lakes and Rivers Improvement Act*. In addition, the Project will have a qualified geotechnical engineer dedicated to the safe design, construction and operation of the CDF, and an Independent CDF Review Board, which will be composed of an independent three-person panel of experts, to review both the detailed permitting designs, construction, ongoing operations and closure design of the CDF.

A CDF perimeter dam breach during the winter, under frozen ground conditions, would be expected to have a lesser effect, as some tailings solids and water effluent may remain on top of the lake ice, where there would be some potential to recover a portion of this material and redeposit it into the CDF. limiting potential environmental effects.

9.7.3 Contingency and Emergency Response

The initial response in the event of a CDF failure will be to ensure worker safety and environmental protection following the emergency response plan. The deposition of new materials in the CDF will cease immediately, and once deemed safe to do so containment measures will be deployed, including temporary earthworks and sediment barriers both on land and in water if necessary. The CDF layout provides a minimum setback of 120 m from waterways providing additional allowance for environmental contingency measures. Spilled tailings on land would be excavated and hauled back to the repaired CDF. The affected area would be restored and associated land surfaces would be revegetated.

The emergency response includes completion of appropriate notifications to government and Indigenous communities, as well as emergency repairs. The spill containment and repair will be facilitated and expedited by having the equipment needed already on site. An event specific remedial action plan would be developed in the event of a breach with regulators and Indigenous communities. The remedial action plan would include a surface water, groundwater and aquatic monitoring plan to be implemented to monitor the success of rehabilitation measures.

9.8 Ore, Overburden and Surficial Soil Stockpile Slope Stability

During operations, ore stockpiles will be required to store excess ore excavated from the open pit for later processing. There will be two discrete ore stockpiles, with the low grade ore stockpile located north of the process plant and a mid to high grade stockpile located within the area allocated to the fish habitat development area southeast of the process plant (Figure 5.1-1). The ore stockpiles will be processed and depleted prior to decommissioning and closure. Given the relatively coarse and dry nature of ore, slope failures of the ore stockpiles are considered to comprise small-scale sloughing or slumping and would be limited to the immediate vicinity of the piles within the Project Development Area (PDA). The material would require excavation and the stockpile recontoured.

During the construction phase, where practicable, overburden materials and organics will be collected and stored in the surficial soil stockpile and surficial soil stockpile. These materials will be stockpiled east of the open pit and will be used at decommissioning and closure to support rehabilitation and revegetation of the Project, as needed. The overburden and surficial soil stockpile will be more susceptible to erosion than the ore stockpiles given soils finer nature. In addition to gentle slopes, mitigations such as progressive reclamation, seeding the surficial soil and ore stockpiles as they are developed, and staged development of the surficial soil stockpiles will help to minimize wind and water erosion.

During operations, the disturbance of an ore or surficial soil stockpile slope could result in the release of rock and overburden posing a safety hazard to workers and facilities in the immediate vicinity of the affected stockpile. Stockpiles will be developed with suitable slope safety factors for short-term and appropriate longer-term stability. Designs take into account safe distances from nearby infrastructure and watercourses / waterbodies. As an operational safeguard, all stockpiles will be visually monitored during operations to examine for any signs or indications of instability.

The following design safeguards address the potential for a stockpile slope failure:

- Instrumentation will be installed to monitor stability.
- Slopes and interior roads will be designed to help ensure stability within stockpiles.
- Runoff will be collected in ditches to protect against infiltration and erosion.

As a result, there is no reasonable potential for failure of the ore or overburden and surficial soil stockpile that would results in a release to the environment during normal operations, and therefore this scenario is not considered further.

9.9 Passive Water Management System (ponds and ditching)

A robust site-wide water balance has been developed for the Project. During operations, the water management system will involve both passive features (a series of ponds and ditches) and active features that include pumps and piping (see Section 9.9).

The water management system includes the following passive features:

- CDF drainage ditch (contact water);
- CDF internal pond (contact water);
- Open pit drainage ditch (diversion of clean water away from pit);
- Ore stockpile ditch (contact water);
- Surficial soils stockpile and organics stockpile diversion ditch (contact water);
- Plant site ditch (contact water);
- Central water storage pond (CWSP) (contact water);
- Stockpile contact water management ponds; and
- Plant site runoff pond (contact water).

This strategy will reduce risk by minimizing the volume of water released from a potential breach and maintain available storage space for precipitation events.

9.9.1 Design and Operations Safeguards

The water management system design uses standard engineering criteria for ditches, water storage ponds, and any necessary emergency spillway. Storage ponds and water management structures have enough capacity to withstand the both the environmental design flood and the inflow design flood without discharge of untreated water to the environment. For the Project, the environmental design flood has been defined as a flood event with a 1:100-year return period, at a minimum, which is a typical requirement for mines in Ontario. This provides a large reservoir capacity that accommodates year to year variations in precipitation and runoff to alleviate the potential for major precipitation events. Should a breach occur, contact water can remain temporarily in the open pit if there is insufficient capacity remaining in the CWSP. Contact water ponds will also be drawn down prior to winter to maintain pond capacity during the spring freshet. The water storage and collection ponds and ditches will be visually inspected regularly and also be inspected by a qualified professional engineer and comply with all regulatory requirements.

Designs and locations for perimeter ditching and ponds consider distances from nearby infrastructure and natural waterbodies and maintain setbacks from these features. For example, perimeter collection ponds will be strategically located in the topographic low points surrounding the CDF. The water collected in these ponds will be considered contact water and pumped back into the CDF. Runoff from the outside slopes of the perimeter dikes, as well as interflow and seepage through and beneath the dikes will also be captured by perimeter collection system and ponds, and pumped back to the CDF. Water collected in the south cell pond will be reclaimed to the plant / mill, reducing the need for freshwater demands from Birch Lake. Excess water will be pumped to the CWSP for monitoring, treatment, and discharge to environment as needed.

The south cell upstream slope will be lined with low permeability liner (e.g., reinforced geosynthetic clay liner; GCL) and anchored to low permeability bedrock and/or overburden to prevent seepage loss. The liner will be extended into north cell to limit seepage losses from the south cell pond. The surficial fractured bedrock will be grouted as required to control the seepage through the dam foundation, which also increases the stability of the dams.

9.9.2 Potential Environmental Concerns

The environmental concerns related to any potential water management system passive features will depend on the quality and quantity of the stored water and on the berm height (potential energy of the stored water). Depending on the water quantity released and discharge velocity, the downgradient environment of the pond failure or overtopping of a ditch could be damaged by localized erosion of the affected area within the PDA.

The CWSP will receive and store contact water from site wide water management infrastructure for re-use in the process plant or treatment in the effluent treatment plant. A breach of the CWSP could potentially release contact water to the surrounding environment; however, this is extremely unlikely given that the pond watershed is less than 1 square kilometre (km^2), and as the haul road located to the north and west of the CWSP will help retain contact water within the PDA and directing it overland towards the open pit.

Failure of an upstream pond or blockage of a ditch(es) during a storm event could result in overtopping of a gravity draining ditch and a release of contact water to the adjacent land. The overtopping of a ditch could result in localized erosion at the affected area within the PDA. Runoff would have to travel considerable distance overland and not likely to enter a waterbody.

9.9.3 Contingency and Emergency Response

In the event of a disruption of a ditch or bermed pond, an emergency repair will occur immediately. Appropriate spill control equipment will be kept at the Project at all times. Silt fences, temporary earth or snow dams, and other erosion and sediment control measures will be deployed as needed to prevent contact water and sediments from entering a natural waterbody.

9.10 Active Water Management System (pipelines)

During operations, fresh water, contact water and tailings slurry will be transferred within the site via a series of pumps and pipelines. The following system pipelines are anticipated:

- Birch Lake to process plant / water holding tank (fresh water);
- CDF seepage collection system (contact water);
- CDF to process plant (contact water);
- Thickened tailings and slurry tailings to CDF (tailings);
- Open pit to CWSP (contact water);
- Ore and surficial soils stockpiles to CWSP (contact water);
- Haul road to CWSP (contact water);
- CWSP to process plant (contact water);
- CWSP to water treatment plant (contact water);
- Plant site runoff pond to CWSP (contact water); and
- Water treatment plant to Springpole Lake (treated effluent).

9.10.1 Design and Operations Safeguards

The tailings will be hydraulically conveyed through a high-density polyethylene tailings pipeline for final deposition in the north and south cell of the CDF. FMG will develop a safety and surveillance plan that includes active pipelines being inspected each shift during the operations phase, as well as incidentally. Automatic shutdown provisions will be built into the system. The tailings piping system is designed for immediate automatic shutdown to protect against leaks and pipeline breaks. Detection in flow rate variation between the beginning and end of the pipeline will stop the pumping system. Additional alarm or equivalent systems will also be employed as engineering designs are finalized. The pipeline will be double walled and placed within ditching which drains to a lined safety pond. The tailings slurry from the pipeline would be recovered and sent back to the process plant or CDF. Gradients will be sloped such that leaks are adequately contained within the PDA and do not enter the surrounding environment.

A spill prevention and response plan will also be developed to address onsite spill scenarios, including prevention, contingency planning and reporting practices for the timely and effective response to potential pipeline spills.

9.10.2 Potential Environmental Concerns

A major leak or rupture from any water-bearing pipeline (contact, treated effluent and/or fresh water) could result in localized pooling of water at the area of the leak and minor erosion depending on the volume of water being released. This could result in a short-term sediment release on land within the PDA that would be unlikely to enter a waterbody.

A worst-case scenario considers a rupture of the tailings pipeline during operation, resulting in the spill of tailings until pumping ceases and the loss of any remaining pipeline content. As pumping will cease within a few seconds of the breach, the tailings solids are expected to settle out within the pipeline while the liquid fraction of the slurry may exit the pipeline depending on the slope within the pipeline itself and retained pressure. For a spill from the tailings pipeline or breach, the pipeline contents will be contained within the ditching and a lined safety pond. The majority of the solids in the slurry will be retained within the pipeline and/or in close proximity to the breach location in the ditch. Spilled tailings will be recovered and sent to the process plant or the CDF.

9.10.3 Contingency and Emergency Response

The environmental effects of any potential spill will be limited as it would be captured within the PDA and recovered. In the event of a water pipeline leak or malfunction, pumps will be shut down and the pipeline will be repaired. If possible, erosion and sediment control measures such as straw bales or silt fences or other structures such as temporary earth berms, will be used to protect against overland runoff containing sediments from directly entering nearby waterbodies. Ditching already in place within the Project will help to capture and manage any waters released.

A combination of excavating equipment to build temporary earth / snow berms and spill containment materials will be used as needed to contain spills. Spilled tailings will be excavated from the ditching and transported to the CDF.

9.11 Water Management System Malfunction (cyanide)

During operations, the water management system at the Project will involve a series of ponds, ditches, pumps and pipelines including those described in Sections 9.8 and 9.9. The system is designed to manage and treat contact water at the Project site to allow the discharge of treated effluent to the environment that meets all regulatory requirements.

As part of the process plant operations, tailings from ore processing containing cyanide will be directed to an in-plant sulphur dioxide / oxygen treatment facility for cyanide destruction to reduce cyanide and heavy metal concentrations in the tailings and effluent, with a target weak acid dissociable cyanide value of 5 milligrams per litre (mg/L). Weak acid dissociable cyanide concentrations of less than 50 mg/L are considered to be safe for wildlife exposure (Donato et al. 2007). This same threshold has been adopted as being protective of birds, other wildlife and livestock by the International Cyanide Management Institute (2018) as part of the International Cyanide Management Code (Standard of Practice 4.4).

The proposed cyanide destruction method is technically proven, well established and unlikely to fail during normal operations. In the event of a cyanide destruction process malfunction, effluent with higher concentrations of cyanide and metals could enter the CDF. A meaningful impact to CDF water quality would only be expected to occur if the sulphur dioxide / oxygen treatment plant were not operational for several days. While this is highly unlikely, the process plant would be shut down until treatment is restored. Some improvement of the water quality would also occur within the system by natural processes on exposure to sunlight. There is no potential for effects on the environment as the water would be contained within the system. Additional freshwater may also be introduced into the CDF system if needed. As a result, there is no reasonable potential for cyanide to be released to the environment during normal operations, and therefore this scenario is not considered further.

9.12 Explosives Accidents

Explosives needed for mine development will be prepared in a dedicated explosives plant on site and stored in an approved magazine, currently located west of the low grade ore stockpile. If a local commercial operation can reliably transport explosives to site, this alternative may replace onsite storage. Emulsion explosives are expected to be predominantly used at the Project site due to anticipated wet conditions and because emulsion explosives typically generate reduced ammonia residuals compared with conventional ammonium nitrate fuel oil explosives. Explosives at the Project site will be stored, handled, transported and manufactured in accordance with the Explosives Regulations, 2013 (SOR/2013-211).

9.12.1 Design and Operations Safeguards

Explosives handling and storage is highly regulated in Canada and compliance is mandatory. Any onsite explosives manufacturing area or explosives storage magazines will be located in accordance with the guidelines (Standard CAN/BNQ 2910-510 Explosives – Quantity Distances) issued by the Bureau de Normalisation du Québec (BNQ 2015). This guide dictates locations of facilities, in part to ensure public safety.

The transportation of explosives is controlled by the Explosives Regulatory Division of Natural Resources Canada and the Transportation of Dangerous Goods Directorate (Transport Canada). All companies that transport explosives materials for the Project will be required to comply with the requirements of these agencies.

The Project will use an explosives company that is well versed in the Canadian requirements, as dictated by the federal *Explosives Act* (RSC 1985, c. E-17) and associated regulatory instruments, and as enforced by Natural Resources Canada. The company is expected to manage all aspects of explosives shipment, storage and use.

A blasting plan will be developed for the Project prior to construction that will consider such aspects as:

- Personnel responsibilities;
- Type of equipment and materials to be used;
- Safety requirements including pre- and post-blast notification and/or notices for site personnel, pre- and post-blast pit inspections;
- Periphery signs;
- Dust suppression;
- Spillage control and clean-up; and
- Transport and safe handling of explosives.

All personnel who handle explosives will have appropriate training; all other individuals will be restricted from access to all explosive storage magazine and manufacturing areas. Destruction of explosives (such as those unfit for use) and misfire procedures will be according to applicable regulatory instruments and completed by qualified personnel.

Explosives will be well managed at the Project site with minimal likelihood of inadvertent detonation or other accidents, including by contracting an experienced explosives firm, adhering to the regulatory requirements and following good housekeeping practices.

9.12.2 Potential Environmental Concerns

Explosives require an external detonation device and cannot be inadvertently detonated. Blasting will be a regular occurrence required within the open pit to access ore during operation. It may also be used during the construction phase where rock removal is required.

The environmental concerns associated with potential malfunctions or accidents during explosives storage and usage at the Project are:

- Worker safety and health;
- Excessive disturbance of nearby human and wildlife receptors due to associated effects (primarily sound and vibration); and
- Damage to infrastructure or facilities.

An uncontrolled explosion, although highly unlikely, could occur as result of an improperly managed or inadvertent detonation. An uncontrolled explosion could potentially create a larger blast and more noise and vibration than the regular controlled blasting (performed by drilling and blasting successive benches with appropriate controls in place). Noise and vibration effects from an uncontrolled explosion would be short in duration. No ongoing adverse effects are anticipated unless the uncontrolled explosion results in another form of malfunction or accident.

9.12.3 Contingency and Emergency Response

Improper handling of explosives can cause significant injury or worse. Damage to facilities and infrastructure may be possible but would generally only occur in association with use at the open pit during mining. Part of the safety prevention protocols includes evacuation of workers and equipment from areas that could be potentially impacted by blasting activities (fly rock, blast gases and dust). The mine site emergency response team will be trained in response measures associated with the use of explosives.

9.13 Vehicular Accident (hazardous or non-hazardous materials release)

All materials required to construct, operate and close the Project are expected to be transported to the site by the main access road. This will include fuel, process chemicals and other non-hazardous and hazardous substances. Certain waste products may also be shipped off site. Once on site, vehicles transporting materials will remain on designated site roads and generally will not travel on haul roads established for moving overburden and rock between the open pit and the stockpiles and CDF.

9.13.1 Design and Operations Safeguards

All shipments will follow regulatory requirements, including the *Transportation of Dangerous Goods Act, 1992* (SC 1992, c. 34) and associated regulations. The need for compliance with this act and associated regulations will be reinforced in all applicable contracts and vendor agreements.

The potential for environmental effects associated with malfunctions and accidents on the trucking route will be minimized by the following operational procedures, which will be incorporated into trucking / supply contracts, where practicable:

- Regular maintenance of fuel trucks;

- Strict adherence to speed limits, including on site;
- Strict adherence to national trucking hour limits and other applicable requirements;
- Requirement for drivers to meet all applicable regulatory training requirements, be trained in spill response procedures for the materials they transport, and carry the appropriate safety data sheets;
- Requirement for all vehicles transporting materials to site to maintain a supply of emergency response equipment, including communication equipment, first aid materials and a fire extinguisher; and
- Penalties for infractions.

The emergency response plan will address the primary hazardous materials on site, including procedures for spill response on the trucking route to the Project. Materials to be maintained in vehicles will be identified in the emergency response plan but are likely to include absorbent materials and equipment to contain spilled material.

9.13.2 Potential Environmental Concerns

All dangerous goods will be shipped in sealed containers with secondary containment as appropriate, but as a minimum, in compliance with regulatory requirements, including the *Transportation of Dangerous Goods Act* and associated regulations. Reasonable safeguards have been considered for the design of the Project, but a small potential for spills along transport routes still exists due to possible accidents related to poor weather conditions, collisions and other factors. A spill due to a collision or equipment malfunction could potentially contaminate the soil or snow at the incident site. The consequences of any spill are expected to be localized and recoverable, and will depend on the type and quantity of the material spilled, as well as the location and time of the spill.

A vehicular accident could happen at any time of the year. Offsite accidents could include construction materials and other non-hazardous materials needed for the Project. Onsite accidents are most likely to involve personnel vehicles or haul trucks transporting coarse materials (ore, mine rock or overburden).

A spill on land, even of hazardous materials, presents the lowest environmental effect as it could be readily contained and cleaned up. Spills of non-hazardous materials are unlikely to have an environmental effect beyond the immediate footprint of the incident. Any effects will be temporary in nature and readily remediated as needed.

A worst-case scenario would be the spilling of a considerable amount of diesel fuel. However, given the limited water crossings and distance from the site roads form waterbodies it is unlikely that spilled fuel would enter water.

9.13.3 Contingency and Emergency Response

Emergency and spill response procedures will be established and are expected to include the following: medical response, notification, containment of spill, removal of spill, treatment of affected environment, monitoring of environment and learning from the accident.

The primary goal in any collision resulting in a fuel spill will be to ensure public and worker health and safety. Potential ignition sources will be removed in the event of a spill of flammable or combustible materials, if possible, and the spill will be stopped or slowed using available equipment. Appropriate corporate and external personnel will be notified, and an assessment will be conducted to determine the best means to prevent immediate environmental effects. Spill countermeasures may include the use of absorbent materials, establishment of a collection trench and setting containment booms on ponded water. After fuel is contained, it will be pumped, skimmed or mopped with absorbent materials, excavated and disposed of in an approved facility.

The affected environment will be rehabilitated as needed. Clean-up and remediation will ensure restoration of the affected area. After any major spill or accident, a review will be conducted to confirm that the required design changes, procedures and appropriate monitoring measures are in place so that the incident will not be repeated.

9.14 Cyanide Spill during Transportation

Transport of cyanide material has been considered separately in this section, as it is typically an area of public interest.

9.14.1 Design and Operations Safeguards

Cyanide required for ore processing will be delivered by truck. Cyanide will be delivered as sodium cyanide pellets or solid briquettes, in sealed containers, and that liquid cyanide would only be used in the event that solid cyanide is temporarily unavailable. Transportation of cyanide will follow all applicable regulatory requirements for transportation of dangerous goods. The Project will also adopt cyanide transportation recommendations by the International Cyanide Management Institute, as defined by the International Cyanide Management Code.

Administrative and operational controls will follow similar procedures as those listed for the transport of other chemicals (Section 9.14.1) and will include:

- Complying with all applicable regulatory requirements for the transportation of dangerous goods;
- Confirming vehicles and drivers are licensed and trained in the transportation of dangerous goods;
- Confirming appropriate transportation containers are used by transport companies;
- Regularly reviewing local shipment operations and reporting all incidents, including near misses; and
- Establishing communication with drivers, which could include tracking during transportation of cyanide and/or check-ins, particularly if travel is required during poorer weather conditions.

9.14.2 Potential Environmental Concerns

The primary risk during transportation of cyanide would be a significant vehicular accident where containment was breached and the accident occurred in close proximity to a watercourse / waterbody. However, given the limited water crossings a spill affecting water is unlikely. Cyanide can still be harmful to humans and wildlife. While the risk of a vehicle accident cannot be reduced, the effect on the environment is reduces through the safety and operational measures that will be put in place.

9.14.3 Contingency and Emergency Response

Companies contracted to transport these materials will be required to have an emergency response plan or equivalent and a protocol for managing spills in the unlikely event of a vehicular accident resulting in a cyanide spill. In the event of a cyanide spill from a vehicular accident, the Project team will support the transport company as needed with the implementation of their recovery plan. All relevant corporate and appropriate external notifications will be made by the Project.

Solid cyanide spilled on land will be cleaned up and disposed of in compliance with the *Transportation of Dangerous Goods Act*, along with any potentially contaminated soil. After any spill or accident, a review will be conducted to confirm that the required design changes, procedures and mitigation measures are in place so that the incident will not be repeated.

9.15 Release from Containment or Dispensing Facilities

The primary chemicals that will be used and stored at the Project site are typical of those used in other gold mines in Ontario. All chemicals such as liquid, gas and solid reagents required for processing and other purposes will be stored and handled in accordance with industry standard and applicable safety data sheets. The safety data sheets provide relevant regulatory standards for the safe use and storage of these materials.

Chemical reagents that pose a potential risk to the environment will be stored and used within contained areas and buildings, with sealed floors and sumps or drains reporting to facilities that will provide retrieval of the spilled materials. Reagent mixing systems will be located indoors in the process plant within containment areas, to contain any spills and prevent incompatible reagents from mixing. These measures greatly reduce the release of such materials directly to the environment. Storage tanks will be equipped with level indicators, instrumentation and alarms to ensure spills do not occur during operation.

Only trained personnel will handle chemicals and reagents, and a program for regular inspections of tanks and operational procedures will be put in place. As a result, there is no reasonable potential for reagents or chemicals to be released to the environment at the process plant during normal operations, and therefore this scenario is not considered further.

Cyanidation is the only technically and cost-effective means of gold recovery from gold-bearing ore at a commercial scale for the ore type. The use of cyanide as a reagent to leach gold from ore is the standard practice throughout the industry, including at most other active gold mines in Ontario. Industry best practices are well established and will be used during the mixing and in-plant cyanide leaching process, and in the destruction and recycling of cyanide components in tailings prior to transport to the CDF for permanent storage. The Project will follow the International Cyanide Management Code for the Manufacture, Transport, and Use of Cyanide in the Production of Gold (International Cyanide Management Institute 2024).

9.16 Project-Related Fires

Fires can result from either natural (lightning) or human causes (e.g., operator error, equipment malfunctions or accidents). Natural fires are considered in Section 8.6.

Fire prevention and suppression systems will be maintained on site, including water supplies, sprinklers, fire extinguishers and other firefighting equipment to mitigate fires related to human causes. Emergency response measures will also be in place for a timely and effective response to fires. Fire related to human causes is not considered further.

9.17 Risk Assessment

Each credible potential malfunction and accident discussed above was assessed according to likelihood of occurrence and consequence of occurrence and given a residual risk ranking for likelihood of occurrence and consequence of failure. Each risk ranking refers to a row or column to identify a cell within a risk matrix shown in Table 9.17-1. As shown in the risk matrix, increased risk is associated with malfunctions and accidents having a greater likelihood of occurrence and increased level of consequence. An outline of potential approaches to mitigation is provided in Table 9.17-2.

A qualitative approach has been applied to this environmental risk assessment to be intuitive for the reader. The likelihood of occurrence has been defined as follows:

- **Very low:** not expected to occur over the life of the mine (1/100 to 1/10,000 events per year);
- **Low:** limited potential to occur over the life of the mine (1/100 to 1/1,000 events per year;
- **Moderate:** might occur over the life of the mine (1/10 to 1/100 events per year);
- **High:** expected to occur over the life of the mine (less than 1/10 events per year), with frequent occurrence in similar projects; and
- **Very high:** almost certain to occur over the life of the mine (1 to 1/10 events per year).

The consequences of the occurrence are important from an environmental perspective. The range of malfunctions or accidents considered and the varied sensitivity of the environments involved do not lend themselves to typical environment-related criteria (such as level of toxicity, surface area affected and duration of impact). As a result, a surrogate measure of environmental consequence has been used, which includes a combination of duration and extent of potential effects, as a measure of severity:

- **Very low:** localized effect (on site and immediate vicinity), readily remediated, recovery within days or weeks, with negligible physical or biological effects (i.e., within natural variation of the environment);
- **Low:** localized effect (on site and immediate vicinity), predictably remediated, recovery within the life of the Project, with short-term (less than 2 years) physical or biological effects;
- **Moderate:** regional effect, predictably remediated, recovery within the life of the Project, with medium-term (2 to 20 years) physical or biological effects;
- **High:** regional effect, not recoverable within the life of the Project, with long-term (more than 20 years) physical or biological effects; and
- **Very high:** regional effect, unlikely to be completely remediated with long-term (more than 20 years) ecosystem effects.

Where a range of risk ratings could be quite variable, a conservative approach whereby the highest risk ranking associated with a credible occurrence is used. The results of the risk assessment are provided in Table 9.17-3.

The Project is planned and designed to limit the potential for malfunctions and accidents through adherence to acceptable design codes and standards. Emergency response plans will be advanced prior to construction to effectively respond to malfunctions and accidents. Plans will include internal and external communications, roles and responsibilities, training requirements and response measures for an unplanned event.

The results of the risk analysis indicate that, as a result of Project design and response measures, the residual risk of a malfunction or accident is either low or very low.

Table 9.17-1: Risk Matrix

Index		Consequence				
		Very Low	**Low**	**Moderate**	**High**	**Very High**
Likelihood	**Very High**	Low	Moderate	High	Very High	Very High
	High	Low	Moderate	Moderate	High	Very High
	Moderate	Very Low	Low	Moderate	Moderate	High
	Low	Very Low	Low	Low	Moderate	Moderate
	Very Low	Very Low	Very Low	Low	Low	Low

Table 9.17-2: Response to Identified Residual Risks to the Environment by Assessment

Legend		Description
	Very Low	Risk to the environment is considered negligible (i.e., effect would be within the natural variation of the environment) and can be effectively managed through application of engineering standards and standard mitigation (e.g., best practices and management activities).
	Low	Risk to the environment is low and considered acceptable (e.g., below thresholds and guidelines). Risk can be effectively managed through application of engineering standard and standard mitigation (e.g., best practices and management activities).
	Moderate	Risk to the environment may be acceptable depending on the circumstances / nature of the risks. Additional appropriate risk mitigation may need to be implemented to reduce the risk.
	High	Risk to the environment is high and likely unacceptable. Appropriate risk mitigation will be implemented to reduce the risk.
	Very High	Risk to the environment is imminent and unacceptable. Mitigation needs to be applied and a long term risk reduction plan developed and implemented. .

Table 9.17-3: Summary of Malfunctions and Accidents Risks to the Environment

Mine Feature	Malfunction / Accident	Residual Risk Ranking		
		Likelihood	Consequence	Ranking
Open pit slope failure	An uncontrolled release of rock and/or overburden to the open pit floor resulting in an increase in the open pit footprint. Operational safeguards will include the following: engineering design for safe slopes and stability of the open pit, and geotechnical monitoring of the pit walls and overburden side slopes.	Very Low	Low	Very Low
Dike St	A significant breach of the dike creating a gradual or a catastrophic outflow of Springpole Lake back into the open pit basin that would result in the erosion of soils, water coming into contact with pit walls and equipment, degrading water quality in the open pit area. Lake bed disruption and mixing of the degraded water quality within Springpole Lake could have an effect on the aquatic life and habitat. Operation safeguards will be in place to mitigate the risk of a dike failure and will include the following: best practices for dam designs, compliance with regulatory requirements and geotechnical monitoring. Geotechnical and dike safety inspections will be completed annually to confirm the dikes are maintained in a safe condition.	Very Low	Moderate	Low
CDF north cell dam breach	A breach of the CDF slopes could result in the release of thickened tailings and mine rock to the surrounding environment. The released thickened tailings and mine rock could affect the surrounding terrestrial environment if not contained within the perimeter dams. Mitigation measures to prevent CDF slope failures will include the following: best practices in engineering designs, compliance with regulatory requirements and geotechnical monitoring. The mine rock dams will provide further stability to the facility, rather than solely relying on the strength of the co-disposed mine rock and thickened tailings.	Very Low	Moderate	Low
CDF south cell dam breach	A breach of the CDF south cell dam could result in the release of tailings solids, liquid or mine rock to the surrounding environment. The release of tailings, mine rock or contact water could affect the surrounding terrestrial environment. Should the materials migrate towards Springpole Lake, the water quality could deteriorate and affect aquatic life. Mitigation measures to prevent CDF slope failures will include the following: best practices and engineering designs, compliance with regulatory requirements and geotechnical monitoring.	Very Low	Moderate	Low

Table 9.17-3: Summary of Malfunctions and Accidents Risks to the Environment

Mine Feature	Malfunction / Accident	Residual Risk Ranking		
		Likelihood	Consequence	Ranking
Passive water management system failure	Failure of the passive water management system could result in overtopping of a pond or ditch resulting in flooding, localized erosion and the potential release of sediments or mine contact water that could affect the surrounding environment within the PDA. Mitigation measures to prevent passive water management system failure will include the following: best practices and engineering designs, and monitoring.	Low	Very Low	Very Low
Active water management system failure	The worst-case scenario for failure of the active water management system considers the rupture or failure of the tailings pipeline and a release of tailings to the environment. Tailings and/or mine liquid could flow and enter Springpole Lake and/or Birch Lake, but the release of tailings would be quickly controlled as the pipelines will be equipped with automatic shutdown in the event of a pipeline failure and alarm systems.	Low	Very Low	Very Low
Explosives Accident	Inadvertent detonation of explosives could result in disturbances to human and wildlife receptors and to workers. Explosives will be supported by a company that is well versed in the Canadian explosives regulatory framework. All staff will be appropriately trained prior to working around explosives.	Very Low	Low	Very Low
Vehicular accident (hazardous or non-hazardous materials release)	A vehicular accident involving transportation of fuel or chemicals that reports to a waterbody could result in effects to the aquatic environment. All shipments will be compliant with regulatory requirements and training, vehicles will be maintained regularly, speed limits will be posted on site and adhered to, and vehicles transporting materials will carry appropriate safety data sheets and emergency response equipment.	Low	Very Low	Very Low
Cyanide spill during transportation	During transportation of cyanide, a vehicular accident near a waterbody could result in the release of cyanide affecting the aquatic environment. All shipments to the Project will be compliant with regulatory requirements and training, vehicles will be maintained regularly, speed limits will be posted on site and adhered to, and vehicles transporting materials will carry appropriate safety data sheets and basic emergency response equipment.	Low	Low	Low

9.18 References

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