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cleared and access already exists. The Ministry of Natural Resources and Forestry (MNRF) and the Ontario Ministry of Environment and Climate Change (MOECC) indicated that the assumed camp location was too close to Sawbill Bay and that an assessment of alternative locations should be completed. In response, CMC provided a supplemental assessment of alternative camp locations and a new location, to the north of the access road and west of the Tailing Management Facility (TMF), was selected as the preferred location for the on-site accommodation camp. Relocation of the camp was considered to be a minor change to the Project description presented in the EIS/EA that did not result in new impacts or increase the impacts predicted in the EIS/EA.

3) Comprehensive Alternatives Assessment Tables for the Construction, Operations and Closures Phases

As part of the combined Federal and Provincial EIS/EA Report review process, the MOECC requested that additional information be provided with respect to various project alternatives methods for the construction, operation and closure / post-closure phases of the Project. In addition, the MNRF requested that the assessment include more comparison indicators and that it be provided following a tabular approach citing an alternatives assessment prepared for another mining project in Ontario as an example. In response, the alternatives assessment was expanded to include comprehensive comparison tables for the construction, operation and closure phases. The comprehensive tabular assessment was completed and submitted in April 2017. The result of this supplemental assessment do not change the selection of any of the preferred means on carrying out the project. Therefore, this assessment is provided as supplemental, supporting information.

4) Supplemental Assessment of Access Road and Transmission Line Routing Alternatives

As part of the combined Federal and Provincial EIS / EA Report review process, the MNRF indicated that the level of detail provided in the assessment of access road and transmission line routing alternatives was unlikely to be sufficient to meet the MNRF permitting information requirements, and requested that a stand-alone supplemental assessment of road and transmission line routing alternatives be prepared. In response, CMC provided the requested supplemental information April 2017. The supplemental stand-alone assessment of road and transmission line routing alternatives included the following additions:

- Further details on the transmission line steel tower placement and construction;
- A commitment to undertake further Species at Risk (SAR) baseline studies along the preferred routings prior to construction and an acknowledgment that Right-of-Way (ROW) refinements may be required at the permitting stage in response to SAR study findings;
- Details of construction access; and
- Improved quantification of habitat loss associated with access road and transmission line ROWs.

The results of the stand-alone assessment of road and transmission line routing alternatives do not change the selection of any of the preferred routing alternatives. Therefore, this assessment is provided as supplemental, supporting information.

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Assessment of Closure Alternatives

The Version 2 EIS/EA report included an assessment of alternatives for closure in Part B of the Version 2 Conceptual Closure and Rehabilitation Plan TSD. Subsequent to the submission of the Version 2 EIS/EA report, a supplemental assessment of closure alternatives was completed following a tabular approach at the request of the MNRF. This supplemental assessment is provided in Part 3, Appendix A, Tables 6-11 of the Version 3 Alternatives Assessment TSD. The MOECC and MNRF requested that a discussion on closure alternatives be brought forth into the main body of the EIS/EA. In response, a new section has been included at the end of this Chapter which provides a summary of the assessment of closure alternatives and the selection of the preferred closure methods.

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Version 3 Update: As requested by the GRT and as indicated in Part 3 of the Version 3 Alternatives Assessment TSD, the bounding scenario approach used for the initial assessment of alternatives has been expanded upon to further describe how each phase of the project was considered, for clarity. Alternatives have been assessed for each phase of the project as follows:

- *Construction (2.5 years): development of the project and construction in accordance with permits obtained and applicable regulatory requirements*
 - *Operation (11 years): following construction initiated with processing of ore*
- *Closure and post-closure (2 years and 10 years): final stages of the project following cessation of ore processing*

Construction and operation phases are often assessed together as they occur on a continuum, generally with the effect increasing during construction and early operation phases, peaking in during operations. When a specific phase is not relevant, it is not described (e.g., ore processing during closure and post closure does not occur so is not described). These situations are identified in the Version 3 Alternatives Assessment TSD, Part 3, Table 1.

Version 3 Alternatives Assessment TSD, Part 3, Section 2 provides additional details on specific methodology, performance objectives, evaluation criteria and indicators used in the Alternatives Assessment. Appendix A of the Version 3 Alternatives Assessment TSD, Part 3 provides comprehensive comparative alternatives analysis tables by project phase. A brief summary narrative based on these tables included in the applicable sections within this chapter.

An assessment of Project alternatives was carried out to fulfill the requirements of the ToR and EIS Guidelines.

The alternatives were selected through professional experience and consultation with Project stakeholders, including Regulatory Agencies, the public and Aboriginal communities (Chapter 7). The screening criteria considered potential environmental effects, social acceptability, engineering feasibility and cost. This EIS/EA Report includes but is not limited to the acceptable alternatives carried forward from the ToR. Alternatives further identified during the development of the Project are also assessed.

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This chapter provides an overview of the alternatives assessment process, the alternatives assessed, and the set of preferred alternatives that are carried into this EIS/EA Report. Section 4.1 identifies the Alternatives to the Project; Section 4.2 addresses the alternatives assessment of Project constituents that are not associated with the disposal of mine wastes; and Section 4.3 addresses the assessment of alternatives for the disposal of mine wastes (e.g., waste rock, tailings). The preferred alternatives are described in detail in Chapter 5, and further assessed for physical, biological and socio-economic effects in Chapter 6.

The detailed alternatives assessment is presented in the Alternatives Assessment Report and the Mine Waste Disposal Alternatives Assessment Report, including a description of the potential impacts of each alternative considered.

As described in Chapter 2, the alternatives assessment considers two categories of alternatives:

- **Alternatives to the Project**, which are the functionally different ways to meet the Project need and achieve the Project purpose.
- **Alternative Means**, which are the various technically and economically feasible ways the Project can be implemented.

4.1 Alternatives to the Project

As discussed in Chapter 1, the need for the Project derives from a strong global demand for gold, the opportunity presented by the Hammond Reef deposit and the need for local economic development. Historically high gold prices present an opportunity for OHRG to supply the gold found in the Hammond Reef deposit to world markets.

The assessment of alternatives to the Project compares the likely benefits of proceeding with the Project with the “Do Nothing” alternative where the decision would be made not to proceed with the Project.

4.1.1 Proceeding with the Project

Proceeding with the Project entails open pit mining and processing of gold ore and the production of gold by implementing the Project components described in Chapter 1. Mining, processing and overall conduct of the Project would use proven and effective technical methods of gold mining in Canada.

Proceeding with the Project would have both positive and negative effects on the biophysical and socio-economic environment. Most biophysical effects would be restricted to the Project Site, while socio-economic effects would likely extend to a regional level. The design of the Project and the assessment of alternatives are focused on ensuring that all significant adverse effects of the Project can be reduced or avoided entirely through good design, mitigation measures or compensation.

4.1.1.1 Advantages of the Project

The Project would have substantial economic benefits to OHRG in generating economic activity and wealth through the development of the Hammond Reef gold deposit. Further, the Project would also have substantial benefits on the socio-economic environment at a local, provincial and national level.

Positive effects of the Project would occur in the community-at-large and on Aboriginal communities. These positive effects would be evident on individuals, including: job creation, increased household and individual incomes, improved purchasing power, improved education and training. The Project would be expected to make a substantial contribution to the development of new business opportunities and economic growth in the

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Town of Atikokan and neighbouring Aboriginal communities, through the development of business activities as a result of Project purchases of goods and services during all phases of the Project. Finally, the Project would encourage a level of general optimism and growth in communities facing significant development challenges.

The Project would also lead to infrastructure enhancements beneficial to the community including upgrades to the access road and construction of a new landfill. The upgraded access road (Hardtack/Sawbill) would remain a public road during and after the Project's life cycle. The upgraded access road (Hardtack/Sawbill) would improve travel time and access to recreational areas in the vicinity of the Project Site. Collaborating and sharing responsibilities and funding associated with constructing a landfill will foster a mutually beneficial partnership between the municipality and Osisko.

The Project's purchase of electricity would result in increased revenue for Hydro One (i.e., the electricity provider), during the Project's phases.

The Project would also help collect valuable environmental data on the Project Site and surrounding area through its monitoring programs. Monitoring before, during and after the Project development would contribute to a more focussed understanding of the environment and identify areas where protection or enhancement is needed.

4.1.1.2 Disadvantages of the Project

A major purpose of the environmental assessment is to ensure that the Project can proceed without the creation of significant adverse effects. The preliminary screening of the potential Project effects identified some adverse effects on the biophysical environment. These included loss of fish-frequented habitat (i.e., Mitta Lake waterbodies located in the TMF and WRMF footprints), the loss of bat habitat, changes in water quality due to discharge of treated water from Project operations, nuisance effects such as increased noise and vibration from blasting, permanent landscape alteration, soil erosion and soil compacting in the Project footprint, and loss of vegetation, wetlands and streams in the Project footprint. The consequences of these effects would be considerably reduced once mitigation measures are applied.

A detailed description of the potential effects of the Project on the biophysical environment is provided in Chapter 6. Appropriate mitigation measures to address these potential effects are identified in Chapter 6.

Potential socio-economic effects would include increased risk of vehicular accidents in the access road, loss of fish habitat and of recreational fishing areas, and challenge to existing community services and infrastructure due to increase in population (i.e., introduction of Project workers from outside of the Atikokan community).

A detailed description of the potential effects of the Project on the socio-economic environment is provided in Chapter 6, including mitigation measures. Similar to the biophysical environment, no significant adverse effects are likely from the Project with implementation of mitigation measures.

4.1.2 “Do Nothing” Alternative

The “Do Nothing” alternative means that the Project would not proceed. The decision of not proceeding with the Project is the benchmark against which the consequences of implementing the Project can be measured. Comparison of the advantages and disadvantages of proceeding with the Project with the “Do Nothing” alternative provides the basis for selecting the preferred alternative. This comparison ensures that a decision to proceed with the Project would not result in substantial negative effects that could negate the obvious positive effects of economic development.

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4.1.3 Selection of Preferred Alternative

As noted, the selection of the preferred alternative involves the choice between proceeding or not proceeding with the Project. A decision not to proceed with the Project is identified as the “Do Nothing” alternative.

In the “Do Nothing” alternative none of the potential effects - positive or negative - of the Project would occur. No increase in economic activity would occur. The existing conditions of the biophysical and socio-economic environment would remain unchanged. Any adverse effects of the Project on the existing environment would be avoided. However, the gold resource would not be developed and the resulting socio-economic benefits to the local community, Ontario and Canada would not occur. The development of this resource by a private sector mining company provides opportunities for economic growth without public expense. A Canadian firm, OHRG, would not have the opportunity to grow and provide benefits to shareholders.

Specifically, the loss of socio-economic benefits arising from the Do Nothing alternative would result in a loss of employment, business and general economic activity for the Town of Atikokan and neighbouring communities. The scope of these benefits is identified in the socio-economic assessment in Chapter 6.

Proceeding with the Project is not expected to have significant negative effects on the biophysical and socio-economic environment due to the implementation of appropriate mitigation measures. The potential positive socio-economic effects of the Project make it an attractive opportunity for OHRG, the community of Atikokan, Aboriginal partners, neighbouring communities, the Province of Ontario and Canadians.

Based on the foregoing analysis, the preferred alternative is “Proceeding with the Project.” Subsequent sections of this chapter identify and evaluate alternative means of carrying out the Project so that the positive effects would be enhanced and negative effects reduced or eliminated entirely.

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4.2 Alternative Means of Carrying out the Project

The EIS Guidelines require the environmental assessment to identify and describe alternative means of carrying out the Project, and assess the environmental effects of any such means (CEA Agency 2011).

In the provincial environmental assessment context alternative means are referred to as “alternative methods”. Alternative means or methods can include consideration of alternative technologies, alternative methods of applying specific technologies, alternative sites for a proposed undertaking, alternative design methods, and alternative methods of operating any facilities associated with a proposed undertaking (MOE 2009).

It is neither practicable nor necessary to evaluate alternative means for every aspect of the Project. Accordingly, the identification, assessment and selection of alternative means focused on alternative means for those aspects of the Project that have the greatest potential for adverse environmental effects.

This section addresses the alternatives to all Project constituents with the exception of disposal of mine wastes. The assessment of alternatives for the disposal of mine wastes (e.g., waste rock and tailings) is addressed in Section 4.3.

4.2.1 Preliminary Screening

Version 3 Update: The fiber optic line and auxiliary power line were determined to be unnecessary through engineering work that was occurring in parallel with the development of the EA. As these components were deemed to be unnecessary, they no longer require consideration in the EIS/EA or the alternatives assessment. See response to EAB7-NEW (see Addendum Part B; Table B-1).

A preliminary screening of alternative means of carrying out the Project was included in the Project's ToR, approved by the Ontario Minister of the Environment (July 2012). Project aspects for which two or more feasible alternatives were identified in the ToR have been carried forward for assessment in this report.

The only substantive change to the Project, which is not reflected in the Project Description or the ToR, is the inclusion of an on-site accommodation camp for workers. This alternative was initially scoped out of the Project design, however as the Project planning advanced it was necessary to include it as an alternative to ensure the Project remained feasible. A fibre optic line and auxiliary power line were also added at the advanced planning stage, but are not considered substantive because they utilize existing rights-of-way or will utilize the same cable support structures as the proposed project transmission line resulting in no additional biophysical or socio-economic impacts.

The need to consider an on-site worker accommodation camp as an additional alternative method of carrying out the Project was determined based on detailed planning, consultation, and baseline studies. Detailed planning for the Project clarified the total anticipated workforce, length of the commute and duration of the Project. Consultation activities, including engagement with Aboriginal communities confirmed that employment is important and that many community members live two or more hours from the Project Site. Socio-economic baseline studies confirmed the demographics of the local population, including age distribution and education levels. The conclusion from the detailed planning, consultation and baseline studies was that an on-site worker accommodation camp would be required to ensure the Project remained feasible.

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Upon reaching the decision to include an on-site worker accommodation camp as an alternative means of carrying out the Project, the government, public and Aboriginal stakeholders were informed of this change.

For some components of the Project, a single feasible approach was identified (i.e., preferred alternative). These preferred alternatives have become part of the Project design and were, therefore, not assessed further. The constituents with a single feasible alternative are summarized below and described in detail in Chapter 5:

- **Mine development:** The only feasible mine development option is open pit development, including the draining of Mitta Lake. Once Mitta Lake is drained, the ore body will be accessed through open pit methods including two open pits (i.e., east pit and west pit).
- **Explosive storage siting:** The supply of explosives will be carried out under a contractor-provided service for delivery of explosives to each blast hole. The contractor will maintain an explosives factory on-site and will supply all infrastructure and vehicles required to deliver the explosive product to the hole. The explosives contractor will be required to supply the magazine(s) for storage of initiation and detonation consumables and to maintain the supply for operations. All temporary storage facilities will be constructed to meet Natural Resources Canada's requirements under the *Explosives Act*. A graded area for the explosives contractor to locate the magazine(s) will be located on-site as per requirements of the explosives licence, and the contractor will be responsible for the installation of the initiation system and detonating devices at the blast site and firing. Handling of explosives is legislated and methods will be required to meet regulations.
- **Chemical and fuel storage siting:** The mining and processing operation will consume cyanide, reagent chemicals, liquids and fuels including diesel, gasoline, lubricating and waste oil, antifreeze/glycol and propane, as required for heavy equipment operation, heating, back-up power generation and small vehicles. Chemicals and fuels will be brought to site by trucks. There will be a number of storage areas in the Project Site. Separate storage sites for petroleum and other chemical and reagents will be required for the Project and will be constructed according to the Technical Standards and Safety Act (2000).
- **Office and support facilities siting:** The main site will include administration offices, the processing plant and truck shop. Ancillary structures including administration, warehousing and storage buildings will be constructed adjacent to the processing plant. Communication links to site will be by satellite and fibre optic technology, with on-site communications by cell phone and radio as required. These infrastructure locations are selected to minimize the footprint and to be located close to the pit/processing plant.
- ~~**Auxiliary power line alignment:** An initial screening of alternatives for the auxiliary line route found that only one route is feasible. The selected route for the auxiliary power line follows an existing right of way. The purpose of the auxiliary line is to bring power from the existing provincial grid to the new substation, in order to allow the instrumentation within the substation to operate.~~
- ~~**Fibre optic line alignment:** The fibre optic line was not contemplated at the time of the ToR and has since been added to the Project. A fibre optic line will be required to provide telephone and internet services to Project administration offices. Satellite technology has been proven to be somewhat ineffective for communication at the exploration site. Although communication using cell phones and satellite technology will still be used to some extent, it has been determined that the bandwidth is not sufficient and a more reliable communication, such as a fibre optic line, needs to be in place during Project operations. The alignment will follow the auxiliary transmission line along Highway 622 to the proposed substation, and then use the same corridor and support structures as the selected alternative for the Project transmission line. As described in~~

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~~Section 4.2.8, the preferred project transmission line alignment will follow Hardtack/Sawbill Road and cross Sawbill Bay. By using the same cable support structures as the project transmission line, there are no additional biophysical or socio-economic impacts associated with the fibre optic line, and material and installation costs are minimized. Alternatives were therefore not considered. The total length of the fibre optic line is 29 km.~~

- **Hazardous waste management:** Hazardous waste will be stored on-site in sealed containers in lined, bermed areas for shipment off-site to licensed facilities. Hazardous waste storage facilities will comply with the MOE's Guidelines for Environmental Protection Measures at Chemical Waste Storage Facilities. Transporters of hazardous materials are required to be trained and registered according to the federal Transportation of Dangerous Goods Regulation.
- **Water sourcing:** Fresh water will be required for ore processing and domestic use. The processing plant will require an estimate of 34,000 m³/day of water. Fresh water requirements based on processing plant make-up needs are estimated to be 17,000 m³/day. Fresh water will also be needed for potable water uses, gland water and reagent make-up water. Upper Marmion Reservoir is adjacent to the Project and is technically and economically feasible as a water source.
- **Water recycling:** Recycled water will be used as much as possible. To the extent practicable, water required by the processing plant will be provided through recycling and re-use of process water, mine water and reclamation of tailings water. Use of fresh water will be required for certain applications in the processing plant, and this fresh water will be obtained from an intake from Upper Marmion Reservoir.
- **Tailings pipeline alignment:** Selection of pipeline alignment is directly linked to the selected TMF location as described in Appendix 4.I Mine Waste Disposal Alternatives Assessment of the Alternatives Assessment Report. Additionally, the pipeline alignment was designed as the shortest distance between the processing plant and the preferred TMF location without interfering with mine infrastructure, following the upgraded mine site road and avoiding fish habitat to the extent possible. The tailings pipeline will be constructed above ground with drainage points and spill containment areas located at topographical lows. The tailings pipeline will be protected on either side by berms that would direct any potential spillage to constructed containment areas.
- **Organic and solid waste management:** Non-hazardous waste will be generated at the worker accommodation camp and the Mine and will be disposed of in a regulated landfill. The results of the preliminary screening process described in the ToR identified off-site disposal as the only available alternative being considered for managing organic and solid waste. The current landfill servicing Atikokan will reach its maximum capacity in approximately 5 years. The Town is looking for an industry partner to assist with the construction of a new landfill. The process of obtaining permits for the landfill has already been initiated by the Town of Atikokan. Partnering with the Town of Atikokan to develop a new landfill is the most reasonable option to manage non-hazardous waste generated from the Project operations. This alternative is in the best interest for both the Town of Atikokan and OHRG. Collaborating and sharing responsibilities and funding associated with constructing a landfill fosters a mutually beneficial partnership between the municipality and corporation. The storage, handling, transportation and final disposal of waste are subject to Ontario Regulation 347 – General Waste Management.

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- **Low-grade ore stockpile siting:** Stockpiling of ore is necessary to allow for constant feed rates to the Ore Processing Facility. The Ore Processing Facility for the Project will require a temporary crushed low-grade ore stockpile. The low-grade ore stockpile will be temporary in nature, as the economic ore will be processed before the Project is decommissioned. There were no alternative ore stockpile locations reflected in the ToR. The results of the preliminary screening process indicated that the location of the low-grade ore stockpile would be dictated by the final location of the Ore Processing Facility. In OHRG's April 2011 Project Description there were two low-grade ore stockpiles shown and described, the locations of which were based on the processing plant and pit layout that was contemplated at that time. However, since then there have been revisions and modifications to the site layout. Given the final location of the Ore Processing Facility within the current site layout (Figure 3-1), there is only one available alternative for the location of the low-grade ore stockpile. The location chosen was based on the proximity to the open pits and processing plant to minimize haul distances, reduce fuel consumption, minimize effects on the environment and not interfere with other mine site infrastructure. Therefore, no additional alternative locations have been identified. The low-grade ore stockpile site is located approximately 715 m southwest of the east pit, and about 1.1 km southeast of the Ore Processing Facility. The storage capacity of this site over the life of mine is estimated at 21 Mt (million tonnes), with a footprint of 0.22 km². This stockpile location does not affect any waterbodies, and it is in the most economical location with regard to transporting ore from the open pits to the stockpile, and from the stockpile to the Ore Processing Facility.

Potentially available alternatives considered for assessment included approaches carried forward from the ToR preliminary screening process along with additional alternatives identified through subsequent site and mine planning.

The alternatives carried forward into the environmental assessment process are shown in Table 4-1, which shows the Project components and alternative means assessed.

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4.2.2 Assessment Criteria

Version 3 Update: The MOECC requested that additional information be provided with respect to various project alternatives for the construction, operation and closure / post-closure phases of the Project. In addition, the MNR requested that the assessment include more comparison indicators. In response, the alternatives assessment was expanded to include comprehensive comparison tables for the construction, operation and closure phases. Additional assessment criteria as summarized below were added and evaluated within the Version 3 Assessment Alternatives TSD, Part 3 – Section 2.2.2 (Evaluation Criteria and Indicators). Eight additional major criterion were evaluated, each having one or more associated sub-criteria and indicators. For each of these criteria, performance was ranked as Preferred, Acceptable, or Unacceptable based on performance indicators as defined for each main criteria category. At the request of the MNR, this supplemental approach followed an alternatives assessment approach used for another mining project in Ontario that was cited by the MNR as an example. This supplemental evaluation of additional criteria builds upon the initial alternatives assessment completed for the Project and confirms the selection of all preferred alternatives. A brief summary of the results of this supplemental assessment is provided for each project phase and component of the alternatives assessment at the beginning of each section within this chapter.

Additional major criteria and performance indicators are:

- **Technical and/or System Integrity/Reliability**
 - Preferred (predictably effective with contingencies if the alternative does not perform as expected)
 - Acceptable (Appears effective based on theoretical considerations; contingencies are available if the alternative fails to perform as expected)
 - Unacceptable (Effectiveness appears dubious or relies on unproven technologies)
- **Ability to Service the Site Effectively**
 - Preferred (Provides a guaranteed access / supply to the site with a low risk of interruption)
 - Acceptable (Provides the required access / supply to the site with contingencies in the event of disruptions)
 - Unacceptable (Cannot reliably provide sufficient access / supply, or involves an unacceptable level of risk without contingencies)
- **Effects to the Natural Environment**
 - Preferred (Requires least amount of mitigation to minimize adverse effects to the natural environment and is superior to acceptable alternatives)
 - Acceptable (Minimizes adverse effects to the natural environment with mitigation)
 - Unacceptable (Likely to cause significant adverse effects to the natural environment that cannot reasonably be mitigated)

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- *Effects to the Human Environment*
 - *Preferred (Requires least amount of mitigation to minimize adverse effects to the human environment, is superior to acceptable alternatives and provides positive effects)*
 - *Acceptable (Minimizes adverse effects to the human environment with mitigation)*
 - *Unacceptable (Likely to cause significant adverse human environment effects that cannot reasonably be mitigated)*
- *Amenability to Reclamation*
 - *Preferred (Causes disturbance to the natural environment that requires limited reclamation)*
 - *Acceptable (Causes disturbance to the natural environment that requires moderate to extensive reclamation)*
 - *Unacceptable (Mitigation of disturbance to the natural environment is not practical or feasible)*
- *Consideration of Effects from Climate Change*
 - *Preferred (Limited potential for infrastructure damage or service disruption due to climate change)*
 - *Acceptable (Some potential for infrastructure damage or service disruption due to climate change)*
 - *Unacceptable (Moderate to high potential for infrastructure damage or service disruption due to climate change)*
- *Cost effectiveness*
 - *Preferred (Facilitates a competitive return on investment)*
 - *Acceptable (Facilitates an acceptable return on investment)*
 - *Unacceptable (Cannot be financially supported by the HRGP)*

For each alternative and stage of project, a summary of performance by major criterion is provide in the applicable section.

The available alternatives in Table 4-1 were initially screened against criteria adapted from Ontario Ministry of the Environment's Code of Practice: Preparing and Reviewing Terms of Reference for Environmental Assessments in Ontario (MOE 2009). The screening assessment consisted of answering the following screening criteria:

- Does the alternative provide a viable solution to the problem or opportunity to be addressed?
- Does the alternative use proven technologies, and is it technically feasible?
- Is the alternative consistent with federal/provincial government priority initiatives?
- Can the alternative be carried out without significant effects to important environmental receptors?

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- Is the alternative practical, financially realistic and economically viable?
- Is the alternative within OHRG's ability to implement?
- Can the alternative be implemented within the Project Site?
- Is the alternative appropriate to the Proponent?
- Is the alternative able to meet the purpose of the *Canadian Environmental Assessment Act (CEAA)/ Environmental Assessment Act (EAA)*?

Each alternative was screened against the above criteria. The details of the screening are provided in the Alternatives Assessment Report. The result of the screening was either (1) the identification of one alternative (i.e., the preferred alternative), or (2) the identification of a number of alternatives that met the screening criteria. Each of the alternatives that met the screening criteria was advanced for a comparative evaluation using environmental and technical performance criteria. If only one alternative was considered feasible, it was identified as preferred alternative for that Project constituents and assessed as part of the Project.

The comparative evaluation of proposed alternatives was based on criteria and indicators developed for the assessment according to the following categories identified in Section 2.4, including:

Environmental Criteria

The following sub-indicators were considered in the evaluation of potential environmental effects:

- **Water Quality:** Potential effects on surface water quality.
- **Terrestrial Ecology:** Potential loss of wetlands, forest cover and terrestrial habitat for species at risk, furbearers, upland breeding birds, moose and wild rice.
- **Aquatic Biology:** Potential loss of aquatic habitat in Upper Marmion Reservoir, Lizard Lake and other fish-bearing water bodies. Species considered include Walleye, Smallmouth Bass, Northern Pike and small bodied forage fish.
- **Hydrology:** Potential changes in surface water flows and levels and effects on surface water navigability.
- **Hydrogeology:** Potential effects on groundwater levels and water quality.
- **Air quality:** Potential changes in ambient air quality due to emissions from stationary and mobile equipment and the ore processing facility.

Technical Criteria

The technical evaluation considered constructability, operability, construction risk and closure.

Economic Criteria

The economic evaluation considered total project costs including capital costs, operating cost and closure costs.

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Social Criteria

The social evaluation considered cultural heritage, services and infrastructure, land use, local resources and potential benefits to the local population and economy.

Selection of a preferred alternative was based on optimization of the defined criteria and indicators for each of the above categories. A description of specific criteria and indicators used in the evaluation of alternatives is provided for each alternative.

The alternative assessment process is depicted in Figure 4-1.

The following sections describe the assessment of each of the alternatives identified for the aspects associated with each of the Project constituents in Table 4-1.

4.2.3 Ore Processing Method

Version 3 Update: Ore will only be processed during operations, and cyanide will degrade within the TMF at closure and post-closure, therefore there are no influences of construction, closure or post closure conditions on the selection of the ore processing method. A supplemental evaluation of advantages and disadvantages is provided in Part 3, Appendix A, Table 1 of the Version 3 Alternatives Assessment TSD and the results summarized as follows:

Construction: Not applicable as there will be no ore processing during construction

Operations: There are two alternatives considered: **Alternative 1:** Processing using cyanide including a cyanide destruct circuit; and, **Alternative 2:** Processing using cyanide, including using natural degradation of cyanide.

- *Technical and/or System Integrity/Reliability – Alternative 1 Preferred (more effective/reliable)*
- *Ability to Service the Site Effectively – No preference*
- *Effects to the Natural Environment – Alternative 1 Preferred (Alternative 2 carries unnecessary risk and is considered Unacceptable)*
- *Effects to the Human Environment – Alternative 1 Preferred, Alternative 2 is Acceptable however carries additional perceived risk, although actual risk to human environment is considered low.*
- *Amenability to Reclamation – Alternative 1 is preferred, Alternative 2 is acceptable but carries disadvantage of higher risk of non-compliance and higher cyanide concentrations with the TMF.*
- *Consideration of Effects from Climate Change – No preference.*
- *Cost effectiveness – Alternative 1 is preferred (disadvantage of additional reagent cost if offset by potential additional costs for environmental compliance or additional dams and storage capacity required for Alternative 2)*

Overall: Alternative 1 (Processing using cyanide including a cyanide destruct circuit) is the preferred option. This technology is best industry practice with the lowest potential environmental risk.

Closure and Post Closure: Not applicable as there will be no ore processing during closure and cyanide will degrade naturally with time.

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The Project includes mining and processing of ore containing gold. Processing will be required to extract the gold from the mineral matrices, and refine the gold into gold bars (doré). Ore processing follows a defined method including crushing, grinding, flotation, carbon-in-pulp gold recovery, gold elution, gold electro-winning, smelting using an induction furnace, and tailings production. Cyanide has been used to leach gold from ore since the 1890s, although with some ore bodies it is possible to use a different chemical or even a biological process.

Processing the ore at an off-site processing facility has been discounted as it would be uneconomical to transport low-grade ore to another processing facility. Further, Town of Atikokan and surrounding Aboriginal communities have strongly petitioned for the job opportunities associated with local processing.

Non-cyanide processing methods were considered in the ToR but excluded from the alternatives assessment because these technologies do not produce adequate concentration grades and recovery, given the nature of the gold at this location. Accordingly, the alternatives considered for the Ore Processing Facility are associated with the cyanide degradation or destruction technology used.

4.2.3.1 Selection of Preferred Ore Processing Method

The natural degradation alternative results in a much higher concentration of cyanide (14 ppm) in the tailings slurry and ultimately in the TMF compared to the cyanide destruction circuit alternative (5 ppm). The higher cyanide concentrations resulting from natural degradation will have an increased potential to adversely affect the environment and biological receptors. In addition, natural degradation requires a significantly larger reclaim pond area, and natural degradation is reduced significantly in the winter under ice cover. The larger reclaim pond area will require a greater capital investment to construct and will increase the project footprint and associated terrestrial impact. For these reasons, the natural degradation alternative is considered to clearly be a worse alternative compared to the use of a cyanide destruction circuit and has not been carried forward for further evaluation.

A cyanide destruction circuit provides a more consistent and predictable solution to managing the cyanide concentrations in the slurry and is selected as the preferred alternative. A cyanide destruction circuit reduces cyanide concentrations to levels much lower than any natural degradation process and significantly reduces the potential for negative impacts on ecosystems affected by cyanide compounds. The proactive destruction of cyanide and the resulting reduced concentrations in the tailings slurry and reclaim water flows will present much less risk to the biophysical environment, and therefore is expected to be more readily acceptable to local stakeholders.

4.2.4 Sewage Treatment Technology

Version 3 Update: Construction and operations are considered together as there will be a steady ramp up to peak sewage treatment requirements. A supplemental evaluation of advantages and disadvantages is provided in Part 3, Appendix A, Table 2 of the Version 3 Alternatives Assessment TSD and the results are summarized as follows:

Construction and Operations: There are two alternatives considered: **Alternative 1:** Package Sewage Treatment Plant; and, **Alternative 2:** Septic Tank(s) and Tile Bed System(s).

- *Technical and/or System Integrity/Reliability – Alternative 1 is Preferred as it is more well suited to larger scale operations, however Alternative 2 is Acceptable.*
- *Ability to Service the Site Effectively – Alternative 1 is Preferred as it can better handle variable loads, however Alternative 2 is Acceptable.*

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- *Effects to the Natural Environment – Alternative 1 is Preferred as it has less risk of groundwater impact however Alternative 2 is Acceptable if properly designed and operated.*
- *Effects to the Human Environment – No preference (both Acceptable).*
- *Amenability to Reclamation – Alternative 1 is preferred, Alternative 2 is acceptable however may require more effort to decommission.*
- *Consideration of Effects from Climate Change – No preference (both Acceptable).*
- *Cost effectiveness – No preference (both Acceptable).*

Overall: Alternative 1 (Package Sewage Treatment Plan) is the preferred option. This technology is more flexible and best suited to larger scale operations.

Closure and Post Closure: For closure the selected technology will remain in use until it is decommissioned. No sewage treatment will be required in post-closure.

The worker accommodation camp and Mine site will generate sewage that must be treated on-site prior to discharge. The preliminary screening process in the ToR concluded that transporting sewage off-site to an established sewage treatment plant is not economically feasible and will not be considered for further evaluation. Two common technologies, a traditional septic tank and tile bed system and a package sewage treatment plant, are investigated as available alternatives for the Project.

The construction phase is selected as the bounding (*worst case*) scenario for the assessment of sewage treatment technology alternatives because Sewage generation is expected to be highest during the *construction* phase of the Project. During the operations, closure and post-closure phases, sewage generation is expected to be less and, therefore, the potential for environmental effect is considered to be reduced during these phases.

4.2.4.1 Selection of Preferred Sewage Treatment Alternative

Tile bed systems occupy a significant amount of land area and the site topography is such that significant grading would be required. Furthermore, the soil mantle in which the network of pipes would be embedded is considered to be inadequate. This type of system also poses greater environmental disturbance risks as a result of vegetation removal requirements and the potential for adverse ground and surface water impacts. Seepage to surface waters could result in organic enrichment and alter ecological conditions in adjacent waterbodies. Lastly, this method of sewage treatment would be much more onerous to remove and restore the affected land when the Project is decommissioned at closure. For these reasons, the septic tank and tile bed system is considered to be a worse alternative compared to a package sewage treatment plant and has not been carried forward for further evaluation.

The package sewage treatment plant alternative is selected as the preferred alternative for sewage treatment. A package sewage treatment plant is compact, easy to install, simple to operate and proven to be reliable. In a package plant, extended aeration processes are often better at handling organic loading and flow fluctuations as there is a greater detention time for the nutrients to be assimilated by microbes. The sewage treatment facility will be operated to attain regulated discharge limits; therefore, there will be no adverse effect on water quality or on aquatic life.

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4.2.5 Sewage Treatment Facility Location

Version 3 Update: Construction and Operations are considered together as there will be a steady ramp up to peak sewage treatment requirements. A supplemental evaluation of advantages and disadvantages is provided in Part 3, Appendix A, Table 2 of the Version 3 Alternatives Assessment TSD and the results summarized as follows:

Construction and Operations: There are two alternatives considered: **Alternative 1:** One centrally-located facility near accommodation camp; and, **Alternative 2:** Dedicated separate facilities for the camp and mine.

- *Technical and/or System Integrity/Reliability – No preference (both Preferred).*
- *Ability to Service the Site Effectively – No preference (both Preferred).*
- *Effects to the Natural Environment – Alternative 2 is Preferred as it has less risk since there will be less disturbance due to piping and associated infrastructure, however Alternative 1 is Acceptable if properly designed and operated.*
- *Effects to the Human Environment – No preference (both Acceptable).*
- *Amenability to Reclamation – Alternative 1 is preferred, Alternative 2 is acceptable however may require more effort to decommission.*
- *Consideration of Effects from Climate Change – No preference (both Preferred).*
- *Cost effectiveness – Alternative 2 is Preferred, with higher costs associated with required pumping for Alternative 1. Alternative 1 is Acceptable.*

Overall: Alternative 2 (dedicated separate facilities for the camp and mine) is the preferred option. Very similar but advantage due to lower risk and cost due to less pumping requirements.

Closure and Post Closure: Not applicable.

Two alternatives are considered for siting the sewage treatment facility: one centrally-located facility and dedicated facilities at the worker accommodation camp and the Mine site areas. The operations phase is considered as the bounding (*worst case*) scenario for the assessment of sewage treatment facility locations.

Alternative 1 involves a single treatment facility located near the worker accommodation camp that handles all sewage waste from the Project and discharges treated effluent directly south of the plant into Sawbill Bay. This alternative requires that domestic sewage from the process plant, truck shop administrative offices would be pumped via pipeline to the treatment facility.

Alternative 2 considers using multiple sewage treatment facilities distributed throughout the Project Site to accommodate specific areas. Four treatment facilities are proposed: a large facility located near the worker accommodation camp, and three smaller facilities designated for the process plant, truck shop, and emulsion plant respectively. The worker camp facility would discharge treated effluent directly south of the plant into Sawbill Bay, and the treated effluent from the three mine site systems would be discharged through the same discharge pipe as the effluent treatment plant which is to the south end of Sawbill Bay.

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4.2.5.1 Selection of Preferred Sewage Treatment Facility Location

A single central facility requires an extensive system of pumps and pipelines to transport untreated sewage to the facility. A pump and pipeline system introduces operational complexity, increases both capital and operating costs and introduces the risk of releasing untreated sewage to the environment if a pipeline failure or operational error were to occur. For these reasons, the single central facility alternative is considered to be a worse alternative compared to smaller localized facilities and has not been carried forward for further evaluation.

Construction and operation of multiple localized treatment facilities servicing the camp and the individual buildings at the Mine site has been selected as the preferred alternative for siting the sewage treatment facilities. Multiple smaller treatment facilities provide a simpler solution with lower operating costs and complexity, and reduced risk to the environment.

4.2.6 Water Discharge

Version 3 Update: Details of the discharge location selection and potential effects on spawning habitats are provided in responses to MNR-8 and MOE SW-1 (see Addendum Part B; Table B-1). As per response to MNRF-8 and MNRF-8B, it is acknowledged that the MNRF, MOECC and DFO were not the source of information regarding the location of spawning habitats.

For the water discharge location alternatives, a supplemental evaluation of advantages and disadvantages is provided in Part 3, Appendix A, Table 5 of the Version 3 Alternatives Assessment TSD and the results are summarized as follows:

Construction and Operations: There are four alternatives considered: **Alternative 1:** Underwater pipeline with discharge to Lynxhead Narrows; **Alternative 2:** Overland pipeline with discharge to Lynxhead Bay; **Alternative 3:** Overland pipeline to the northwest with discharge to the central portion of Sawbill Bay; **Alternative 4:** Overland pipeline to the south with discharge into south end of Sawbill Bay.

- *Technical and/or System Integrity/Reliability – Alternatives 2 and 4 are Preferred. There are technological limitations to any of the alternatives considered, however, the influence of winter operation of underwater pipelines result in an Acceptable rating for Alternatives 1 and 3.*
- *Ability to Service the Site Effectively – Alternatives 2 and 4 are Acceptable. Alternative 1 and 3 are considered Unacceptable due to increased risk of potential shutdown which may be required should receiving water quality not be acceptable.*
- *Effects to the Natural Environment – Alternative 4 is Preferred as it offers the best location to protect water quality while avoiding perceived Walleye spawning habitat.*
- *Effects to the Human Environment – Alternatives 2 and 4 are Preferred. Lack of mixing and perceived impact to spawning habitat result in Acceptable rating for Alternatives 1 and 3.*
- *Amenability to Reclamation – No preference (all Preferred).*
- *Consideration of Effects from Climate Change – Alternatives 1, 2 and 4 are Preferred. Climate change potential influence on mixing results in Acceptable rating for Alternative 3.*
- *Cost effectiveness – Alternative 4 is Preferred as it is a compromise between costs and maintaining appropriate mixing to achieve water quality objectives while reducing perceived permitting risk which may influence project cost.*

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Overall: Alternative 4 (Overland pipeline to the south with discharge into south end of Sawbill Bay) is the preferred option. Although slightly more costly it is a compromise between costs and maintaining appropriate mixing to achieve water quality objectives while reducing perceived permitting risk.

Closure and Post Closure: Infrastructure will be in place at closure until no longer required thus not applicable.

Water is required for domestic use and ore processing. Water will be sourced from the Upper Marmion Reservoir and intermittently discharged back into the basin which consists of several bays and catchments. Process water, as well as recycled water from the TMF and site runoff water, will be collected in the Process Plant Collection Pond (PPCP) from where it will either be reused in the processing plant, or will be discharged to the environment. Potential discharge locations include Sawbill Bay and Lynxhead Bay, the major bays surrounding the Project Site.

Sawbill Bay and the Sawbill Bay Watershed are located to the west – northwest of the Project Site. Sawbill Bay is somewhat isolated relative to the main flow paths through the Seine River system, and has a relatively small watershed. As such, this bay has a very low turnover rate (greater than 2 years). At some periods during the year, the flow direction moves back into Sawbill Bay rather than away from the bay due to management of the reservoir for flood control and water power generation requirements at downstream hydro-electric facilities on the Seine River.

Lynxhead Bay and Lynxhead Narrows are located to the south – southeast of the Project Site, and are separated from the main infrastructure areas by topography and the open pits. While Lynxhead Bay and Lynxhead Narrows are small in surface area they are located in the main flow channel of the Seine River and, therefore, convey flow from upstream locations within the Upper Seine River watershed including the Lac des Milles watershed. As such, the turnover rate is high (less than 10 days), and a very large volume of water flows through this small zone. Consultation with Aboriginal groups, the public and the government review team has identified Lynxhead Narrows as a walleye spawning area. Four alternatives have been identified for potential discharge locations and pipeline alignment, as described below and shown in Figure 4-2.

4.2.6.1 Selection of Water Discharge Alternative

The Project is expected to require water discharge periodically throughout the year. The selected water discharge location alternative is the South end of Sawbill Bay (Alternative 4). The use of Sawbill Bay will allow for a shorter pipeline that will require a lower capital cost relative to the Lynxhead Narrows alternative. In addition, the use of the south end of Sawbill Bay provides favourable mixing conditions with a reduced potential to affect identified fish spawning habitat and decreased potential to effect the local fishing resource.

Environmental Criteria

Discharge water quality is estimated to meet MMER criteria for all parameters. Copper and cyanide concentrations may exceed CCME and PWQO criteria under certain hydrologic conditions, therefore, ambient mixing conditions in the receiving water at the discharge location is an important consideration to ensure sufficient mixing occurs and the potential effects on aquatic habitat is minimized.

Given the high turnover rate and high volume of water flowing through the Lynxhead Bay zone, the amount of mixing through this location is substantial and will result in lower overall receiving water concentrations (likely similar to the upstream water quality). Poor mixing conditions exist in Sawbill Bay due to low inflow volumes

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and back flooding of the bay from the main flow channel. It is possible that the concentrations of some parameters in this bay will increase to concentrations similar to the discharge (i.e., in the case of Alternative 3); however, the concentrations downstream of the Project, at the Raft Lake Dam are expected to be similar to existing conditions.

In addition to flow and water quality, the potential effect on aquatic and terrestrial habitats was considered. Alternative 2 is an overland pipeline which could result in a small loss of terrestrial habitat. Alternatives 1, 3 and 4 have less overland piping and are not expected to result in any terrestrial habitat loss.

Aquatic habitat has the potential to be affected. Alternatives 1 and 2, located in Lynxhead Bay and Lynxhead Narrows are identified locations for walleye spawning habitat, which are important aquatic habitats. Alternatives 3 and 4 are not located near identified spawning habitat, therefore the potential to affect important aquatic habitat is less for these alternatives. However, because Alternative 3 does not offer adequate mixing, the discharge at this location could cause a change in water quality that may affect some sensitive species.

All four alternatives will result in a negligible increase in flows to Upper Marmion Reservoir and effects on groundwater quality or quantity are not expected.

Technical Criteria

The effluent treatment plant will be located northeast of the west pit and waste rock stockpile (as shown in Figure 3-1). The pipeline is planned to extend from the effluent treatment plant without interfering with mine operations or crossing over structures such as the open pits. Options for effluent conveyance include gravity-driven conveyance and pumping. The most reliable method is gravity-driven conveyance, which requires less operational maintenance and is simpler than a system that relies on pumping stations.

The length of pipeline must be considered as a shorter pipeline leads to less complicated construction and maintenance, and reduces the likelihood of pumping. Alternative 3 has the shortest pipeline and Alternative 1 has the longest pipeline. Underwater pipelines (Alternative 1) do not require freezing preventative measures, while overland pipelines do. Therefore, pipelines that are susceptible to freezing (Alternatives 2, 3 and 4) introduce operational and environmental risk if freezing and subsequent failure occurs.

Social Criteria

No effects on cultural heritage, services and infrastructure or land use are anticipated from water discharge. The selection of a water discharge alternative has the potential to affect local resources.

Alternatives 1 and 2 have been identified as a fish spawning habitat location. Selection of these alternatives has the potential to affect local fishing resources. Alternative 3 is not located near identified fish spawning habitat, but has poor mixing characteristics which also has the potential to affect local fishing. Alternative 4 is considered the best alternative for the protection of local resources.

Economic Criteria

Alternative 1 has the longest pipeline, incurring the greatest capital and maintenance costs, while Alternative 3 has the shortest pipeline, incurring the lowest capital and operating costs. Alternatives 2 and 4 are both feasible; however, they require freezing prevention measures and the risk of failure and the cost of maintenance are higher.

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4.2.7 Access Road

Version 3 Update: Response to MNR-3, MNRF 3 and MNRF 3B (see Addendum Part B; Table B-1) provides details on access road alternatives, rationale for selection, road widening and associated water crossings.

As part of the EIS/EA review process MNRF requested additional detail on the alternatives assessment for the access road and transmission line routing. In response CMC agreed to provide an updated assessment with additional detail which is provided in a standalone report included in Part 4 of the Version 3 Alternatives Assessment TSD, recognizing that some of the detail provided relates more to the environmental permitting and approvals stage rather than providing information necessary to select preferred alignments at the EIS/EA stage.

In addition, for the access road alternatives, a supplemental evaluation of advantages and disadvantages is provided in Part 4, Appendix B, Section 3 of the Version 3 Alternatives Assessment TSD and the results are summarized as follows:

Construction and Operations: There are two alternatives considered: **Alternative 1:** Upgrade the existing Hardtack/Sawbill Road; and **Alternative 2:** Development of a Raft Lake / Sawbill Road

- *Technical and/or System Integrity/Reliability – Alternatives 1 is Preferred since there are fewer water crossings, Alternative 2 is rated as Acceptable.*
- *Ability to Service the Site Effectively – No preference (both Preferred).*
- *Effects to the Natural Environment – Alternatives 1 is Preferred since it does not require substantial additional terrestrial disturbance and no new water crossings are required. Alternative 2 is rated as Acceptable.*
- *Effects to the Human Environment – No preference (both Preferred).*
- *Amenability to Reclamation – Both alternatives provide benefit, however Alternative 2 is preferred as it provides a new road to the public. Alternative 1 upgrades an existing road and is rated as Acceptable.*
- *Consideration of Effects from Climate Change – No preference (both Preferred).*
- *Cost effectiveness – Alternative 1 is Preferred as updating the existing road is most cost-effective. Alternative 2 has substantial cost risk due to possible bridge construction and is rated as Unacceptable.*

Overall: Alternative 1 (Upgrade the existing Hardtack / Sawbill Road) is the preferred option since there will be less terrestrial disturbance, fewer water crossings and less cost risk.

Closure and Post Closure: The road will have been constructed and will remain in place at closure.

The Project will require the upgrading of an existing gravel road to facilitate transport of equipment and supplies to the mine site. On-site access roads are also necessary to provide access routes connecting the site infrastructure. The option of widening Premier Lake Road was screened out in the ToR as this route would require significant upgrades and the route is much longer, resulting in commute times for workers and supplies from Atikokan to increase by an hour.

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Two alternatives are assessed for the main access road to the mine site; the Hardtack/Sawbill Road sequence (Alternative 1) and Raft Lake Road (Alternative 2). The two road alignments considered are shown in Figure 4-3.

Alternative 1 currently exists as a full-length route that would require widening and upgrading to support heavy equipment and haul truck loads.

Alternative 2 would require construction of a new section of road of approximately 2 km in length north of the Raft Lake Cut, construction of bridging across the Cut and widening and upgrading to support heavy equipment and haul truckloads of the existing sections of road.

4.2.7.1 Selection of Preferred Access Road Alignment

Hardtack/Sawbill Road (Alternative 1) is the selected alternative and will be upgraded to accommodate the increased traffic volume and heavy vehicles. The road will remain public and it is anticipated that the majority of the road will continue to be functional once the Mine is decommissioned. The Raft Lake Road alignment is not considered a viable option due to the higher costs and loss of terrestrial and aquatic habitat associated with constructing a new roadway and bridge.

Several factors were considered when selecting the best access route for the Project. These factors include the number of water crossings, construction time, potential habitat loss, total length, overall cost and value to the community.

Environmental Criteria

Hardtack/Sawbill Road (Alternative 1) already exists and only requires upgrades and widening the road. Due to the already existing corridor, there will be little terrestrial habitat disturbance, and minor additional effects on water quality as stream crossings are already in place.

Raft Lake Road (Alternative 2) requires considerable upgrades including construction of new sections of roadway and new water crossings. Construction of the new road will result in some terrestrial habitat loss and new stream crossings will cause result in some loss of stream habitat. The construction of new stream crossings may also affect water quality by increasing levels of total suspended solids (TSS) during in-stream construction.

Both alternatives will result in temporary alteration to stream flows during in-stream works. No effects to groundwater quality, quantity or air quality are anticipated from access road construction.

Technical Criteria

Both alternatives are technically feasible. Hardtack/Sawbill Road is the best alternative in terms of technical criteria as it entails widening and upgrading an existing road, with no new water crossings or culverts. The Raft Lake Road alternative requires considerable upgrades including construction of new sections of roadway, including new water crossings and culverts and the potential need to construct a new bridge.

Economic Criteria

Hardtack/Sawbill Road would be a lower cost as it entails improvements to an existing roadway. Raft Lake Road would be a higher cost since it requires considerable upgrades including constructing new sections of roadway with the potential need for construction of a bridge.

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Social Criteria

Neither road alternative is anticipated to effect cultural heritage. The change to services and infrastructure would be positive in both cases, as both an improved road and a new road would allow for improved access to recreational areas. Local resources could be affected, especially due to the selection of Alternative 2 and the construction of a new road. A new road could result in increased pressure on hunting and fishing resources that were previously not easily accessible.

Potential benefits to the local population and economy would be similar for both selected alternatives and could include use of local contractors for road construction. The plan is for the road to remain public throughout all phases of the Project, including mine decommissioning. This would result in positive socio-economic effects of increased access for the public to local recreation areas.

4.2.8 Power Supply

Version 3 Update: Additional detail on transmission line water crossings is provided in MNR-1B. Details of the potential impacts from the transmission lines and power corridor alternatives are provided in response to MNR-1, MNR-2, MNR-1, MNR-2, MNR-2B (see Addendum Part B; Table B-1), T-2 and T-61 (see Addendum Part A; Table A-1).

As part of the EIS/EA review process MNR-1 requested additional detail on the alternatives assessment for the access road and transmission line routing. In response CMC agreed to provide an updated assessment with additional detail which is provided in a standalone report included in Part 4 of the Version 3 Alternatives Assessment TSD, recognizing that some of the detail provided relates more to the environmental permitting and approvals stage rather than providing information necessary to select preferred alignments at the EIS/EA stage.

In addition, for the transmission alternatives, a supplemental evaluation of advantages and disadvantages are provided in Part 4, Appendix C, Section 4 of the Version 3 Alternatives Assessment TSD and the results are summarized as follows:

Construction and Operations: There are four alternatives considered (see Figures 7 and 8 in Part 4 of the Version 3 Alternative Assessment TSD): **Alternative 1:** construct along the Hardtack / Sawbill Road ROW, paralleling the northwest side of Finlayson Lake, and continuing around the north side of Sawbill Bay to the Project site; **Alternative 2:** construct along the height of land separating Finlayson Lake and the Lower Marmion Reservoir, along the Raft Lake Road and connecting into the Alternative 1 route north of Sawbill Bay; **Alternative 3:** construct along the Alternative 1 route to the north end of Finlayson Lake and from there eastward across Sawbill Bay to the Project site; and **Alternative 4:** construct along the Alternative 2 route to the north end of Finlayson Lake and from there eastward across Sawbill Bay to the Project site.

- *Technical and/or System Integrity/Reliability – No preference (all Preferred).*
- *Ability to Service the Site Effectively – Alternative 3 is Preferred as it involves the least use of land with mining claims held by others. Alternative 2 has the longest length passing through crown lands with mining claims held by others and thus is most susceptible to disturbance therefore is rated as Unacceptable.*
- *Effects to the Natural Environment – Alternative 3 is Preferred as it follows primarily along the access road and will involve the least amount of habitat disturbance. Alternative 2 is the longest of the options considered, resulting in additional disturbance with no other advantages thus is rated Unacceptable.*

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- *Effects to the Human Environment – Alternatives 1 and 2 would provide improved access for Hunters thus are rated Preferred, Alternatives 2 and 3 are rated Acceptable.*
- *Amenability to Reclamation – No preference (all Preferred).*
- *Consideration of Effects from Climate Change – Alternatives 1 and 2 would use smaller towers and are rated Preferred, Alternatives 2 and 3 use larger towers which are subject to higher wind-loads and need to be designed to handle such loads thus are rated Acceptable.*
- *Cost effectiveness – Alternative 3 is Preferred with the advantage of lowest cost, and follows the existing road. Alternative 2 is rated as Unacceptable to increased cost, disturbance due to construction of a new corridor.*

Overall: Alternative 3 (construct along the Alternative 1 route to the north end of Finlayson Lake and from there eastward across Sawbill Bay to the Project site) is the preferred option since there will be less terrestrial disturbance, and no new access corridor requirements, recognizing that the open water crossing may be less attractive to local members of the public or outfitters.

Closure and Post Closure: The infrastructure may remain in place at closure if there is need or a potential buyer, or will be remediated, thus alignment options for closure are not applicable.

The mine and processing plant will require approximately 100 MW of power. Power for the Project Site will be supplied via a new 230 kV project transmission line, feeding a main on-site substation. The line would connect to an existing 230 kV transmission line just off Highway 622.

On-site diesel generators were considered in the Project ToR, but excluded due to the high carbon footprint from the use of non-renewable fossil fuels and because the option is not cost-effective. Diesel generation will be used for back-up power supply only. On-site renewable power generation was also considered in the ToR but not carried forward for further assessment as renewable energy cannot consistently and reliably provide power during mine operations.

There are three transmission line alignment alternatives considered. Alternatives 1 and 2 were carried forward from the preliminary screening process described in the ToR. A third alternative (Alternative 3) was subsequently developed as a result of further consideration and conceptual design discussions with the electrical power utility. The alternative transmission line alignments are shown in Figure 4-4.

The selection between these three alternatives will not affect the potential effects during operations, but have the potential to affect terrestrial habitat during construction. Therefore, the construction phase has been selected as the bounding scenario for the selection of transmission line alignment.

A 10 km auxiliary transmission line will be constructed adjacent to Highway 622. The purpose of the auxiliary transmission line is to provide electricity required to operate the substation that connects the project transmission line to the provincial electricity grid. The new substation will be constructed near the intersection of Highway 622 and Hardtack Road.

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There are no additional alternatives identified for the auxiliary power line. The only available alternative is to source the power from Atikokan Generating Station and align the power line with Highway 622. This alternative utilizes existing rights-of-way resulting in no additional biophysical or socio-economic impacts.

4.2.8.1 Selection of Preferred Power Supply Alternative

The preferred project transmission line alignment is Alternative 3 – Hardtack/Sawbill Road across Sawbill Bay. The selected alignment for the access road to the mine site is via Hardtack Road and Sawbill Road, and as this alignment will already undergo road construction and upgrading it is advantageous that the Project transmission line be implemented along this corridor.

The option of the transmission line crossing Sawbill Bay significantly reduces the length of the line, and in turn, the overall cost of installing the transmission line. As the project transmission line will be strung across the bay, the potential effects to water quality and aquatic habitats will be minimized. The change to the visual landscape is expected to be a concern that will be addressed through ongoing work with the community. The changes to visual landscape will be fully reversible during mine closure because the infrastructure will be decommissioned.

All three proposed alignments are viable routes for implementing a transmission line. The proposed alignments follow existing roadways, however, each alignment involves varying degrees of environmental and socio-economic impacts, and encompass different technical and economic obligations.

Environmental Criteria

Three alternatives were compared against the environmental criteria, with a focus on terrestrial ecology. Terrestrial ecology would be the most potentially affected component of the environment due to transmission line construction. Any vegetation clearance required for construction would disturb and potentially destroy terrestrial habitat. The alignment along the Hardtack/Sawbill road and crossing Sawbill Bay is the shortest route and therefore requires the least vegetation clearance, and less habitat loss.

None of the three transmission line alignments are anticipated to affect water quality, air quality, stream flows, or groundwater quality and quantity. Aquatic life will also be unaffected as construction will avoid aquatic habitats.

Technical Criteria

In all three cases, construction of the transmission line is simplified due to the presence of an existing roadway. Vegetation clearing would be minimized as excavators and other equipment already have unobstructed access to install transmission lines and poles. Sections of Raft Lake Road (Alternative 2) require construction of new roadway, while Sawbill Road is continuous along the length of road. Sections of Alternative 3 are not along a roadway and would require clearing of new areas.

Alternative 3, in which the transmission line is strung across Sawbill Bay, presents the easiest option in terms of constructability. The total span across the water is short enough that placement of footings directly in the water can be avoided. Alternative 3 is the shortest route, minimizing overall construction time.

Economic Criteria

Alternative 2 is the longest route, and thus requires a larger budget for material and installation. Additionally, Raft Lake Road requires construction of new roadway which would have to be completed preceding transmission line installation. Since Raft Lake Road (Alternative 2) was not selected as the Access Road alternative, it makes less economic sense to select it as the transmission line alternative. Alternative 3 will incur the lowest costs as it is the shortest route.

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Social Criteria

The transmission line construction is not anticipated to affect cultural heritage or services and infrastructure.

Local resources could be affected through the change to the visual landscape. The local area is known as a wilderness destination, and the presence of a transmission line could affect this perception. Alternative 3 has the largest potential to affect the visual landscape, as it would be located over the water in an area that is frequented by tourists in boats and canoes.

4.2.9 Worker Accommodation

Version 3 Update: Details on the worker's camp alternatives description, location and assessment methodology are provided in response to MNR-11, MNDM 8, MNRF 5 and MNRF 5B (see Addendum Part B; Table B-1). Details on the consultation that took place regarding the worker's camp location is provided in EAB6 (see Addendum Part B; Table B-1). Worker accommodation alternatives was assessed in two phases:

Phase 1: On-site vs. Off-site Accommodation

The assessment of on-site vs. off-site accommodation was initially completed as part of the Version 2 Alternatives Assessment TSD and the results are summarized below in Section 4.2.9.1. A supplemental evaluation of advantages and disadvantages is provided in Part 3, Appendix A, Table 4A of the Version 3 Alternatives Assessment TSD and the results are summarized as follows:

Construction and Operations: There are two alternatives considered: **Alternative 1:** Dedicated on-site accommodation; and, **Alternative 2:** Use of existing off-site accommodations

- *Technical and/or System Integrity/Reliability – No preference (both Preferred).*
- *Ability to Service the Site Effectively – Alternative 1 Preferred, Alternative 2 had the disadvantage of posing difficulty in attracting a qualified workforce.*
- *Effects to the Natural Environment – Alternative 1 is Preferred as it has the advantage of reducing traffic related noise.*
- *Effects to the Human Environment – No preference (both Preferred). Alternative 1 may provide greater opportunities for Aboriginal workers, whereas Alternative 2 may provide more benefit to the Town of Atikokan.*
- *Amenability to Reclamation – Alternative 2 is Preferred, as there will be less to reclaim, however Alternative 1 is acceptable given the small amount of reclamation required for the accommodation complex.*
- *Consideration of Effects from Climate Change – Alternative 1 is Preferred due to less travel and associated potential for weather delays.*
- *Cost effectiveness – Alternative 1 is Preferred, while there may be additional costs for the accommodation itself, security of supply and workforce availability results in higher potential cost risk for Alternative 2.*

Overall: Alternative 1 (dedicated on-site accommodation) is the preferred option due to more certainty with respect to workforce and reduction in weather related risk.

Closure and Post Closure: The closure alternatives assessment is the same as that of the Construction and Operations project phase during period of active closure after which time on-site accommodation will not be required.

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Phase 2: Location of On-site Accommodation

The Version 2 Alternatives Assessment TSD only considered on-site and off-site alternatives for worker accommodation. Alternative locations for on-site worker accommodation were not assessed because the site of the current exploration camp was initially assumed to be preferred because the site has been largely cleared and access already exists. The MNRF and MOECC indicated that the assumed camp location was too close to Sawbill Bay and that an assessment of alternative locations should be completed. In response, CMC provided a supplemental assessment of alternative camp locations and a new location, to the north of the access road and west of the Tailing Management Facility (TMF), was selected as the preferred location for the on-site accommodation camp. Relocation of the camp was considered to be a minor change to the Project description presented in the EIS/EA that did not result in new impacts or increase the impacts predicted in the EIS/EA. The results of this standalone assessment are provided in Part 2 of the Version 3 Alternatives Assessment TSD.

In addition, a supplemental evaluation of advantages and disadvantages is provided in Part 3, Appendix A, Table 4B of the Version 3 Alternatives Assessment TSD and results are summarized as follows:

Construction and Operations: There are five alternatives considered: **Alternative 1:** West Shore of Sawbill Bay; **Alternative 2:** West of Sawbill Bay (North of Access Road); **Alternative 3:** East of Sawbill Bay (Below TMF); **Alternative 4:** East of Sawbill Bay (Mine Site Access Road) and, **Alternative 5:** East of Sawbill Bay (west of TMF)

- **Technical and/or System Integrity/Reliability** – Alternatives 1, 4 and 5 are Preferred. Alternative 3 poses increased risk due to proximity of tailings and is considered Unacceptable.
- **Ability to Service the Site Effectively** – Alternative 5 is Preferred due to proximity, Alternatives 1, 2 and 4 are Acceptable. Alternative 3 poses increased risk of service disruption due to proximity of tailings and is considered Unacceptable.
- **Effects to the Natural Environment** – Alternatives 1, 2, 4 and 5 are Preferred. Alternative 3 is considered Unacceptable due to increased habitat disruption as it is located in a wetland.
- **Effects to the Human Environment** – Alternatives 2, 3 and 5 are Preferred. Alternative 1 is Acceptable but does not comply with resource objectives. Alternative 4 increases health risk due to a shared haul road.
- **Amenability to Reclamation** – Alternatives 1, 2, 3 and 5 are Preferred. Alternative 4 is considered Acceptable however has less potential for re-use at closure since it is located farther from the shoreline.
- **Consideration of Effects from Climate Change** – No preference (all are Preferred).
- **Cost effectiveness** – Alternatives 1, 4, and 5 are Preferred, Alternative 2 is Acceptable with additional road construction costs, whereas Alternative 3 is Unacceptable due to increased risk of cost associated with proximity to TMF.

Overall: Alternative 5 (East of Sawbill Bay (west of TMF)) is the preferred option due to proximity to site, lower cost, and no increased risk.

Closure and Post Closure: Not applicable.

An on-site worker accommodation camp alternative with a capacity of up to 1,200 persons was evaluated against off-site accommodations in the Town of Atikokan.

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The environmental assessment process was used as a planning tool that enabled OHRG to make informed decisions, identify potential risks to the Project and choose alternative methods of carrying out the Project that would bring the greatest benefits and lowest potential effects. The issuance of a federal Project Description Document and provincial ToR were completed early in the planning process and minor changes to Project details have occurred throughout the planning process.

The only substantive change to the Project, which is not reflected in the Project Description Document or ToR, is the inclusion of an on-site worker accommodation camp. This alternative was initially scoped out of the Project design, however as the Project planning advanced it was evident that it should be included as an alternative to ensure the Project remained feasible.

An on-site worker accommodation camp was included in the detailed environmental assessment for the Project. The location for the on-site worker accommodation camp is within the Project Site and did not require additional baseline data collection.

The need to consider an onsite worker accommodation camp as an additional alternative method of carrying out the Project was determined based on detailed planning, consultation, and baseline studies. Detailed planning for the Project clarified the total anticipated workforce, length of the commute and duration of the Project. Consultation activities, including engagement with Aboriginal communities confirmed that employment is important and that many community members live two or more hours from the site making a daily commute from those communities impossible. An on-site worker accommodation camp offers the opportunity for Aboriginal community members to maintain a permanent resident in their community while being provided accommodation while on-shift at the on-site camp. Socio-economic baseline studies confirmed the demographics of the local population, including age distribution and education levels. The conclusion from the detailed planning, consultation and baseline studies was that an on-site worker accommodation camp would be required to ensure the Project remained feasible.

Upon reaching the decision to include an on-site worker accommodation camp as an alternative means of carrying out the Project, the government, public and Aboriginal stakeholders were informed of this change.

The following provides a summary of consultation activities that included information about the on-site worker accommodation camp:

- Presentation to Atikokan Mayor and Council July 30, 2012.
- Presentation to the Metis Nation of Ontario August 3, 2012.
- Community News Brief August 13, 2012.
- Consultation Update meeting with provincial and federal government leads August 14, 2012.
- Community Open House August 18, 2012.
- Presentation to Fort Frances Chiefs Secretariat September 17, 2012.
- Letter to the CEA Agency September 20, 2012.
- Letter to the MOE EAB September 20, 2012.
- Letter from CEA Agency to Aboriginal communities October 26, 2012.
- Alternatives Assessment Workshop (GEAA, DFO, EC, NRCan, and MNM) November 20, 2012.

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Both options of an on-site worker accommodation camp and off-site worker accommodation are being reconsidered and evaluated. The alternatives are described below.

Alternative 1 consists of an on-site worker accommodation camp located near the north end of Sawbill Bay adjacent to the existing exploration camp. The location is shown in Figure 4-5. The camp will have a capacity of up to 1,200 persons and will be constructed and operated during the Project construction phase. The camp would remain in operation until the end of the closure phase of the Project, at which time all facilities would have been removed. The camp would have an approximate footprint area of 1.6 ha, including parking facilities and will be designed and constructed with appropriate buffer areas, in accordance with the Forest Fires Prevention Act.

Alternative 2 involves off-site worker accommodation in the Town of Atikokan and surrounding communities. Employees would commute to work for Alternative 2 via the mine access road. The socio-economic assessment considers the number and availability of housing in Atikokan.

Both alternative worker accommodation arrangements were screened against the criteria presented in Section 4.2.2, and both were considered viable alternatives and advanced for a comparative evaluation. The comparative evaluation considered the biophysical impacts of camp construction as well as the socio-economic issues associated with worker attraction, travel, and value to the community.

4.2.9.1 Selection of Preferred Worker Accommodation Alternative

Based on the comparative evaluation, specifically the technical challenges, Alternative 1, on-site worker accommodation camp, was selected as the preferred alternative. This alternative enhances the ability to attract and provide for skilled workers from areas beyond the LSA by offering flexible living arrangements, which is a key success factor for the Project.

Offering on-site worker accommodation is key to the successful recruitment of skilled workers. It will also improve worker safety by reducing the potential for traffic accidents involving OHRG staff through reducing the number of vehicle trips on the access road (Hardtack/Sawbill).

Some of the deciding factors included the fact that Aboriginal communities are interested in working on the Project, however the site is over 2 hours away from the closest First Nations community; the socio-economic baseline study has shown that the demographics of the Town can't supply the necessary workforce; Housing availability in Town is not able to accommodate an increased population of 1,200 workers, the 2006 occupancy rate for private dwellings in Atikokan was 92.4%, representing 108 unoccupied dwellings; Other regional mines provide a fly in/fly out option and Osisko needs to be competitive to attract the skilled workforce.

Although Osisko will construct an on-site camp, workers will still be encouraged to consider living in Town. Osisko is committed to providing incentives for workers to live in Town, the details of which will be further informed through the Atikokan/Osisko committee.

Importantly, the selection of Alternative 1 does not preclude the ability for individual workers to live in and commute from Atikokan. As part of OHRG's commitment to enhancing community benefits from the Project, we have committed to working with the Town to encourage workers to live in Town. Alternative 1 provides opportunities for both workers wishing to live in Town, commuting daily by bus or personal vehicle, and workers preferring a shift rotation, allowing them to reside in the RSA or elsewhere in Canada. Finally, carrying Alternative 1 forward into the effects assessment provides a conservative approach to evaluating the total effects of the project.

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Several environmental, technical, economic and social criteria were considered when choosing the best alternative for worker accommodation for the Project. The key environmental considerations include loss of terrestrial habitat and potential changes to water quality. The key technical factor considerations include the availability of land near the Project Site, the ability to staff the Project. Key economic considerations include potential capital, operating and maintenance costs. Key socio-economic considerations include potential effects to cultural heritage, services and infrastructure, local resources and benefits to the local population and economy.

Environmental Criteria

Project-environment interactions resulting from off-site worker accommodations are minimal. No interactions are anticipated with water quality, terrestrial ecology, aquatic ecology, hydrology or hydrogeology. Some potential interactions are possible with air quality, due to increased traffic on the access road from daily worker commuting. Negligible effects to the environment would occur as a result of off-site worker accommodations.

Some project-environment interactions are associated with the construction of a 1,200-person worker accommodation camp on-site. Domestic wastewater discharge volumes will increase, and an additional discharge point will be included in the Project design near the worker accommodation camp. The effects to water quality are anticipated to be negligible because wastewater will be treated prior to discharge. An on-site worker accommodation camp will result in wildlife disturbance due to the increased presence of humans, and minor habitat loss associated with an increased Project footprint. Effects to aquatic ecology are not anticipated since camp construction will include a buffer zone from the Marmion Reservoir and wastewater will be treated prior to discharge. There will be a potential for interaction with flow patterns and water levels due to water withdrawals for worker accommodation camp use, however the effects are anticipated to be negligible. No interaction with groundwater quality or quantity or air quality is anticipated.

Social Criteria

Several Project interactions with the social environment are anticipated as a result of an off-site worker accommodation alternative. Throughout consultation activities, OHRG learned that the Town of Atikokan preferred an off-site worker accommodation alternative and perceived this alternative to be a direct source of benefits to the Town. The following discussion summarizes some of the key points OHRG learned throughout consultation with the Town.

An off-site worker accommodation alternative would result in an increased local population. Population decline has been a challenge to the Town of Atikokan due to loss of municipal tax base and the Town's ability to maintain services. Increased local population would result in a diversified economy, stimulation of local markets and increased local incomes.

Some concern has also been expressed with regards to the potential change in community character, increased traffic volumes, and the strain on municipal services and infrastructure that could result from rapid population growth. An off-site worker accommodation alternative is not anticipated to interact with cultural heritage or land and resource use.

The on-site worker accommodation alternative would also result in interactions with the social environment. Local population growth would not be as pronounced; therefore, some economic benefits may also be less immediate. The municipal tax base may not increase as quickly as it would with an off-site worker accommodation alternative; however, the strain on municipal services would also be less. The on-site worker accommodation alternative would limit the increase in traffic volumes in Town and on the Project access road.

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No effect on cultural heritage is anticipated as the site has been surveyed for archaeological potential and identified as being low. A stronger interaction with land and resource use would result from the on-site worker accommodation alternative, since the camp would increase the Project footprint, and the potential for workers to take part in fishing and hunting would be increased.

The Town of Atikokan and surrounding communities favour off-site worker accommodation as the local economy benefits from increased population. The economy is enhanced by stimulating local markets and boosting incomes. On the other hand, commuting time may be considered a drawback to potential employees.

In the Town of Atikokan, housing availability currently may not meet demand once mine construction and operation commences, and construction of additional housing may be necessary. As the Project has continued to develop, it has become apparent that a portion of the skilled workers hired may be recruited from various regions across Canada. Atikokan and neighbouring towns have small populations and therefore, a small pool of employee candidates to draw from. In addition, many of the skilled worker positions required to be filled are in very high demand as a result of the number of mines being developed in Northern Ontario. Offering the flexibility for workers to continue to live in their existing communities and commuting to the Mine will help attract local skilled workers. Lastly, paid food and accommodation is a benefit to young workers. Another advantage related to the on-site worker accommodation camp is reduced likelihood of traffic accidents involving Project staff due to the fact that the number of vehicle trips on the access road (Hardtack/Sawbill), particularly in the winter, will be decreased.

Technical Criteria

An off-site worker accommodation alternative has several technical challenges. As discussed in the meetings held with the Town of Atikokan, government regulators and Aboriginal communities, the socio-economic baseline studies undertaken for the Project indicated that staffing the project from the Town was not possible due to the volume and education levels of the available labour force. Worker accommodation in Town would be a distance of approximately 40 km from the Mine representing a commute time of 30-60 minutes. Additionally, Aboriginal communities are located more than two hours away from the site, and daily commuting was determined to be impractical.

The on-site worker accommodation alternative has several technical requirements that were considered. The land base was identified as being available at the current location of the exploration camp, approximately 1 km from the mine site. Additional requirements include potable water and sewage treatment facilities which were deemed feasible at site.

Economic Criteria

The capital and operating cost for an off-site worker accommodation option are lower for OHRG. The Town of Atikokan perceives that the economic benefits to them would be increased should an off-site worker accommodation alternative be selected, through the increased municipal tax base associated with population growth. An on-site worker accommodation alternative would have a higher cost to OHRG due to the construction of worker accommodation, potable water treatment and sewage treatment facility.

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4.2.10 Tailings Deposition Technology

Version 3 Update: During construction, closure, and post-closure tailings will not be deposited, thus tailings deposition technology is only applicable to the Operations phase, although amenability to closure was considered in the original assessment summarized below.

The ore processing plant will generate tailings that must be deposited in the Tailings Management Facility (TMF). Two common tailings deposition technologies, conventional slurry tailings and thickened tailings, were investigated as available alternatives for the Project. Both alternatives are considered feasible and safe when managed in a responsible manner.

A comparative evaluation was carried out to determine whether surface disposal of conventional slurry tailings or thickened tailings is the preferred tailings deposition technology for the Project.

The operations phase is selected as the bounding scenario for the assessment of tailings deposition technology alternatives because tailings generation occurs during the operations phase of the Project.

4.2.10.1 Selection of Preferred Tailings Deposition Alternative

Based on the comparative evaluation, specifically the reduced reclaim water storage and pumping requirements, reduced dam height and volume, lower life of mine costs and reduced consequence of failure, Alternative 2, thickened tailings deposition was selected as the preferred alternative. Thickened tailings are less likely to segregate and form problematic areas of tailings slimes. In addition, thickened tailings disposal simplifies water management and reduces the overall risks typically associated with conventional slurry tailings disposal. Another key advantage of thickened tailings is that they are generally easier to rehabilitate for site closure.

Several environmental, technical, economic and social criteria were considered when choosing the best technology for tailings deposition. The key environmental considerations include TMF footprint, dusting, potential for water quality impacts, and consequence of failure. The key technical factors and considerations include tailings beach slope, containment dam height, dam volume, slope stability, dam design/construction and reclaim pond requirements. Key economic considerations include estimated capital, operating and maintenance costs. Key socio-economic considerations include risk of failure, community safety and aesthetics.

Environmental Criteria

Some project-environment interactions associated with tailings deposition include; loss of vegetation, impacts to air quality from dusting, and environmental risk associated with dam failure or poor performance of the tailings management facility.

Alternative 1, conventional slurry tailings requires higher dams and more impounded water resulting in an increased likelihood of dam failure. In the event of a tailings containment dam failure, the downstream environmental consequences could include significant loss of terrestrial and aquatic habitat. There is a higher potential for impacts to air quality from dusting with conventional tailings because the tailings will segregate resulting in areas with coarse-sized tailings particles that are more susceptible to wind erosion. Dust mitigation measures may be required on inactive beaches.

Flatter topography at OHRG makes stacked thickened tailings deposition more favourable because Alternative 2 requires lower dam heights. The thickened tailings alternative requires a smaller reclaim pond which would somewhat reduce the amount of clearing and grubbing. The smaller reclaim pond with thickened tailings

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would reduce the risk of failure and have a lower consequence of a facility breach. The potential for impacts to air quality from dusting are less with thickened tailings because the tailings are non-segregating and maintain a higher level of saturation. A tailings surface with well-graded particles (i.e., mixture of fine and coarse grained) is less susceptible to wind erosion. However, there is some potential for impacts to air quality from dusting of the desiccated thickened tailings surface until another layer of saturated tailings is deposited over top. Continual rotation of tailings discharge from the central deposition point will reduce the potential for dusting.

Social Criteria

Community safety and aesthetics are key concerns for stakeholders. With both tailings deposition technology alternatives, there is a risk of tailings dam failure. Conventional tailings, with a larger water pond and higher dams, would have a higher inherent risk and consequence of failure than thickened tailings, which would have a smaller water pond and lower dams.

Visually, lower dams associated with thickened tailings are less obtrusive than the higher dams of conventional tailings. Furthermore, the closed thickened tailings management facility will have less visual impact after the tailings are revegetated because the perimeter dams are smaller.

No effects on cultural heritage are anticipated from the tailings management facility for either tailings deposition alternative.

Technical Criteria

A conventional slurry tailings management facility would require higher perimeter containment dams and would therefore have a higher likelihood of failure. Higher dams and dams that retain water have increased likelihood and consequence of failure. The conventional slurry tailings alternative would require higher dams and larger water retaining dams that are more expensive to construct. The conventional tailings alternative would have increased rates of tailings and reclaim water pumping between the process plant and TMF.

A thickened tailings management facility would require lower perimeter containment dam crest elevations (i.e., lower dam heights) and smaller dam volumes to provide the required tailings storage capacity. Lower dams would generally have a lower consequence of failure. Thickened tailings are non-segregating which would result in lower permeability tailings and reduced seepage from the TMF. With thickened tailings deposition, only the perimeter dams adjacent to the reclaim water pond would be water retaining. The thickened tailings alternative would require less pumping of reclaim water back to the process plant and would have a smaller reclaim water pond.

Economic Criteria

The estimated capital and operating costs are lower for the thickened tailings alternative. Dam construction costs would be lower for the thickened tailings alternative. Pipeline and pump capital and operating costs are higher for the conventional tailings alternative. Operating costs are lower for the thickened tailings alternative because smaller tailings and reclaim water volumes would require less energy to pump. However, it should be noted that the dam construction and pipeline cost savings associated with the thickened tailings alternative would be offset by the capital and operating costs of a tailings thickener plant.

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4.2.11 Summary of Preferred Non Mine Waste Alternative Means of Carrying Out the Project

A full range of non-mine waste alternative methods of carrying out the Project have been examined and assessed, as presented in the Alternatives Assessment Report and discussed herein. Alternatives that meet the Project objectives were identified in the ToR and an initial screening process was completed. The alternatives that were deemed reasonable were carried forward for further evaluation and were investigated in greater detail. Comparative summaries of the features of the alternatives, environmental and social impacts, cost requirements, and discussions of the degree to which the alternative fulfills the need identified were used to determine which option is best overall. A summary of the preferred alternative for each Project constituent is presented below in Table 4-2.

The above alternatives are carried into this EIS/EA Report and described in detail in Chapter 5 and further assessed for physical, biological and socio-economic effects in Chapter 6.

4.3 Mine Waste Disposal Alternatives

An assessment of mine waste disposal alternatives for the Osisko Hammond Reef Gold Project (the Project) is required under Environment Canada's Guidelines for the Assessment of Alternatives for Mine Waste Disposal (the Guidelines) (Environment Canada 2011). In order to appropriately meet the requirements of these guidelines as they relate to waste disposal, the structure of Section 4.3 differs from the Sections above. The Project, located in northern Ontario, will include a Tailings Management Facility (TMF) and a Waste Rock Management Facility (WRMF), both of which may impact natural water bodies frequented by fish and may need to be designated as Tailings Impoundment Areas (TIAs)¹ per Schedule 2 of the Metal Mining Effluent Regulations (MMER).

The objective of the mine waste alternatives assessment is to effectively evaluate and identify the most appropriate methods and locations for disposal of mine waste based on various environmental, technical, economic and socio-economic considerations. The preferred facility alternatives should result in minimal net effects on the environment and be technically sound and economical.

In accordance with the Guidelines, a Multiple Accounts Assessment (MAA), a decision matrix method of analysis, was used to evaluate TMF and WRMF alternatives and select the preferred facilities for the Project. This type of analysis allows for transparency in the decision-making process. The mine waste disposal alternatives assessed in the Mine Waste Disposal Alternatives Assessment Report for the selection of the TMF site and the waste rock stockpile site are listed in Table 4-3 and shown on Figures 4-6 and 4-7, respectively. A description, characterization and qualitative/quantitative assessment of each alternative are summarized in the following sections and provided in detail in the Alternatives Assessment Report, and Appendix 4.1 of the Alternatives Assessment Report - the Mine Waste Disposal Alternatives Assessment Report.

¹ The term Tailings Impoundment Area (TIA) refers to a natural water body frequented by fish into which tailings, waste rock, and any effluent that contains any concentration of the deleterious substances specified in the Metal Mining Effluents Regulations (MMER), and of any PH, are disposed (Environment Canada 2011).

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The assessment procedure follows Environment Canada's (2011) guidelines which describe a seven-step approach, as follows:

- Step 1: Identify candidate alternatives.
- Step 2: Pre-screening assessment.
- Step 3: Alternative characterization.
- Step 4: Multiple Accounts Ledger.
- Step 5: Value-based decision process.
- Step 6: Sensitivity analysis.
- Step 7: Document results.

The candidate alternatives and pre-screening (Steps 1 and 2) are described in this section, below. Section 4.3.1 and 4.3.2 describe the approach to the alternative characterization (Step 3) and multiple accounts Ledger (Step 4), while Section 4.3.3 provides additional detail on how stakeholders were engaged in order to evaluate the various options. Each of the waste facilities are then evaluated with respect to the Value-based decision process (Step 5), a sensitivity analysis (Step 6), as documented in Section 4.3.4 (Waste Rock) and 4.3.5 (Tailings) respectively (Step 7).

Steps 1 and 2 of the assessment of the Project's mine waste disposal alternatives were completed during the ToR development and approval process. An additional alternative waste rock stockpile location was subsequently identified during the advancement of site layout and mine planning work. Finally, during the comment period for the draft EIS/EA report, Environment Canada proposed another alternative WRMF because it was perceived to have limited impact to aquatic habitat. The results of the alternatives identification and pre-screening process are the alternatives shown in Table 4-3.

The Environment Canada (2011) guidelines suggest that at least one of the alternatives for each project constituent should be "dry land" alternative, which is one that does not impact a natural water body that is frequented by fish. The physical size requirements of both the TMF and the waste rock stockpile combined with the abundant and frequent fish-bearing water bodies that exist throughout the regional setting within a reasonable distance of the Project Site made it impossible to identify a dry land alternative of sufficient size without incurring significant costs that would undermine the Project's feasibility. Care was taken, however, to identify alternatives that would minimize the impact on natural water bodies frequented by fish. The degree of impact of each alternative was evaluated in the assessment, as required.

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4.3.1 Alternative Characterization

Version 3 Update: Fish habitat ‘compensation’ refers to ‘offsetting’ under the current Fisheries Act.

To transition towards the next steps of the evaluation process, it is necessary to characterize the mine waste disposal alternatives. Characterization criteria for the Project alternatives are categorized into the four broad groups or “accounts” identified below. Accounts are then sub-divided into more focused components that are described in the following sections.

- **Environmental** – This account focuses on characterizing the environment surrounding the alternatives including considerations such as hydrology, hydrogeology, water quality, air quality and potential impacts to aquatic, terrestrial and bird life.
- **Technical** – This account focuses on engineering considerations such as foundations conditions, dam size and volume, water management requirements, pipeline and haul road routes and lengths and closure design.
- **Economic** – This account focuses on potential costs including capital and operational costs, and costs for fish habitat compensation and closure.
- **Socio-economic** – This account focuses on influences to local and regional land users including considerations such as aesthetics, the presence of archaeological sites, land claims and effects to land uses such as hunting, fishing and tourism.

4.3.2 Multiple Accounts Assessment

Details on indicators used in the multiple account assessment are provided in responses to A-7 and T-6 (general methodology); T-8 (aquatic habitat indicators); T-9 (wildlife indicators); T-5 (water quality); and in T-7, T-10, and R(2)-02 (hydrogeology) (see Addendum Part A; Table A-1).

The response to MOE-GW 3 (see Addendum Part B; Table B-1) provides minor clarifications regarding the characterization of the hydrogeological conditions of the TMF alternatives and the proximity to waterbodies indicator.

A multiple accounts assessment (MAA) is used to compare the waste disposal facility alternatives. The MAA employs a multi-level assessment approach beginning with broad generalized characterization *accounts* (as described in Section 4.3.1, Step 3 – Alternative Characterization). Accounts are further broken down into specific *sub-accounts*, and measurable *indicators*. The MAA decision making tool is used to identify elements that differentiate alternatives and provide a basis for quantifying assessment considerations through a weighting and scoring system.

Sub-accounts are used to assess a specific consideration within the broader account. An example of a sub-account is the *Aquatic Habitat* within the *Environmental* account. Sub-accounts should be differentiating, meaning they demonstrate distinction amongst the alternatives.

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In order to assess and compare the sub-accounts, measurable attributes, called *indicators*, are assigned to each sub-account. Indicators allow for the qualitative or quantitative measurement of factors associated with the sub-accounts. Indicators are focused, specific components that represent their respective parent sub-account. An example of an indicator is the *Permanent Streams Impacted* within the *Aquatic Habitat* sub-account.

4.3.3 Public, Aboriginal and Government Consultation

Public, Aboriginal and government groups were engaged on the subject of alternatives assessment and selection, including mine waste alternatives on an ongoing basis. Chapter 7 details Project Public Consultation and Aboriginal Engagement and provides a full summary of activities, including meeting notes and information materials.

A summary of the meetings and discussions regarding Alternatives that took place with Public, Government and Aboriginal groups is provided below.

4.3.3.1 Public

A Community News Brief has been published on a biweekly basis since November 2010. Examples of publication titles which touched on the topic of Project alternatives and the results of the assessment include:

- Project Phases and Schedule
- Working out the Project Details
- Waste Rock
- Tailings Management and Reclamation
- Sharing the Results of the Environmental Assessment
 - Hydrogeology
 - Hydrology
 - Terrestrial Biology
 - Aquatic Biology
 - Water Quality
 - Atmospheric
- Environmental Assessment – Considering Comments and Finalizing the Report

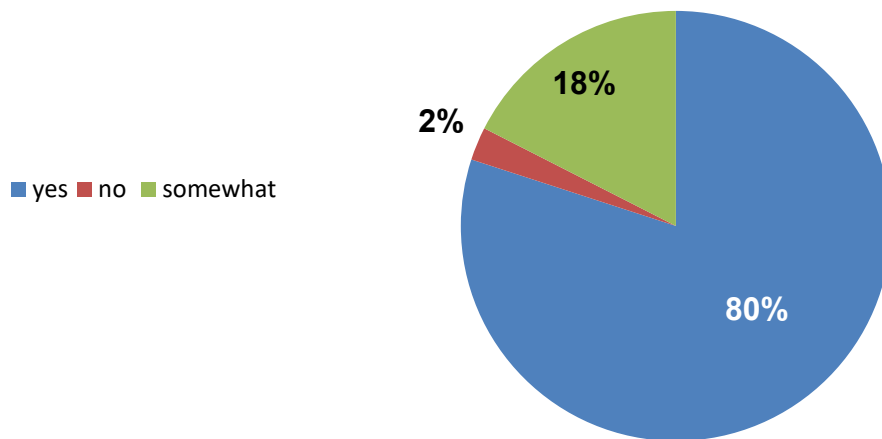
Five Community Open Houses have been held from February 2011 to April 2013. The Community Open Houses include sharing information about the Project description, alternatives and the results of the assessment. Project details were also shared with a variety of community groups, including high school students, seniors, tourist outfitters and the local fishing and hunting club.

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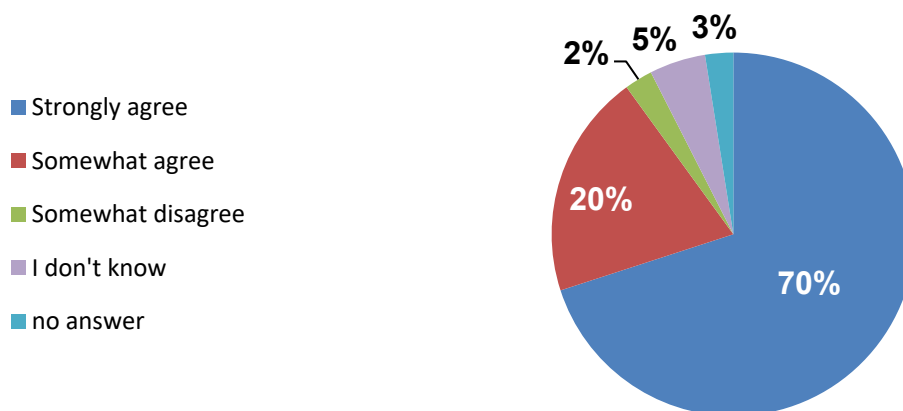


The most recent feedback received from public comment forms indicate a strong understanding of the Project details, and support for the Project moving forward. The pie charts below show the responses provided by members of the Public who attended the Open House on April 3, 2013 in Atikokan. Eighty percent of the 40 people who completed a comment form feel up to date on the status of the Hammond Reef Project and 90 percent feel confident in Osisko's environmental management plans.

I feel up to date on the status of the Hammond Reef Gold Project



I am confident that Osisko's plan will minimize environmental impacts from the Project



OHRG is committed to ongoing consultation with the Public as detailed in Chapter 8, should the Project go forward, a Town Committee will be formed to ensure ongoing information sharing and community involvement in the Project.

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4.3.3.2 Government

Several hundred written comments were received from the Government Review Team following the publication of the Draft EIS/EA Report.

Approximately 35 of these comments included questions on alternatives, mostly requesting further detail and requesting a stronger link to the regulatory requirements. Comments on the alternatives assessment were provided by the following regulatory agencies:

- Ministry of Environment, EAB
- Canadian Environmental Assessment Agency
- Ministry of Natural Resources
- Environment Canada

Written responses to all comments were provided in draft form to agencies for discussion at scheduled meetings. Formal written responses will be provided to agencies and published as part of the Final EIS/EA Report.

Mine waste alternatives were a specific area of concern for Environment Canada. OHRG travelled to Gatineau to meet with Environment Canada regarding this topic on July 23, 2013. Subsequent correspondence to the meeting outlined Environment Canada's specific requests for report revisions.

Environment Canada requested that OHRG undertake a more detailed mine waste alternatives assessment by including additional sub-accounts and indicators in the multiple accounts analysis. Environment Canada provided a detailed list of suggested sub-accounts and indicators for Environment, Economic and Socio-Economic accounts. OHRG incorporated all these revisions to the report as summarized in Table 4-4 below.

4.3.3.3 Aboriginal

The Community News Brief has been published in the Wawatay Times on a biweekly basis since spring 2012 and hard copies have been sent to the First Nations band offices.

During the period from February 2011 to April 2013, OHRG has given presentations to the FFCS (10 meetings), LDMLFN (8 meetings) and MNO Region 1 Consultation Committee (7 meetings).

OHRG visited each First Nations community and shared the Project details, alternatives and conclusions presented in the EIS/EA Report. Community feasts were held with the 4 Metis communities to share project details. Feedback received from Aboriginal communities regarding alternatives and mine waste tailings alternatives were considered in the assessment. Information provided by Aboriginal groups that informed Project design and alternative selection included:

- Identification of fish habitat
- Identification of sacred sites
- Avoidance of siting tailings in important lake on trap line = Lizard Lake
- Agreement with trap line holder

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Throughout communications and engagement events OHRG has heard many concerns about potential long-term effects of the Project on the environment. Although the focus of these comments is often expressed through the importance of the whole and interconnected environment, the following specific environmental concerns have been stated in writing by identified Aboriginal communities.

These concerns are identified in Table 4-5 which also shows the corresponding MAA account/sub-account that addresses the concern.

OHRG is committed to ongoing consultation with Aboriginal groups as detailed in Chapter 8. OHRG has formed four Resource Sharing Committees with the First Nations who are signatories to the Resource Sharing Agreement. Technical working groups will also be formed with the Metis Nation of Ontario should the Project proceed and move on towards construction. Ongoing engagement with Aboriginal communities will ensure they are involved in the Project planning process as it moves forward.

The active and ongoing participation of the Aboriginal, public and government in the project planning process is a key aspect of the EA Process. OHRG's commitment towards ongoing engagement with Aboriginal communities and the public through information sharing and formation of committees is directly tied to the environmental assessment process, and our commitments are outlined in Chapter 8 Social Management and Chapter 9 Commitments Registry of the EIS/EA Report.

4.3.4 Waste Rock Management Facility Siting

Version 3 Update: Response to T-44 (see Addendum Part A; Table A-1) provides minor clarification on the reasoning for the selection of Alternative 3 for siting of the WRMF. As per comment T-3, Alternative 4 under Tailings Management Facility heading in Figure 4-9 is a Waste Rock alternative and should be under the Waste Rock Management Facility heading.

The Project is expected to generate approximately 260 million tonnes of waste rock during the life of mine. Waste rock from the east and west pits is estimated to be approximately 132 million cubic metres. About 16.1 million tonnes of waste rock will be deposited in the west pit during the later stages of mining. During operations, waste rock will either be used for construction or placed in a WRMF.

The WRMF will be designed with conservative side slopes (about 2.5H:1V) with bench configurations and stockpile heights that are stable, while providing the required storage volume.

The selection of candidate locations was based on consideration of terrain, available space and the distance of the site to the mine pits. A 7-km radius from the centroid of the mine pits was considered as a spatial boundary for identifying candidate alternatives and locations not directly accessible by haul truck (i.e., across Marmion Reservoir) were not considered viable. Beyond the spatial boundary of 7 km, it was considered that the costs required to haul waste rock from the mine pits to the WRMF would render the project uneconomical.

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The results of the preliminary screening process described in the ToR identified two WRMF alternatives (i.e., Alternatives 1 and 2), as shown on Figure 4-6. As a result of advancement of the Site Layout and mine planning work, an additional alternative (Alternative 3) for the WRMF was identified. As the proposed overburden stockpile abuts the Alternative 3 WRMF, the footprint of the WRMF includes the overburden stockpile area. Finally, during the comment period for the draft EIS/EA report, Environment Canada proposed another alternative WRMF because it was perceived to have limited impact to aquatic habitat.

The WRMF alternatives have been characterized with respect to the environmental, technical, economic and social accounts described in Section 4.3.1 to 4.3.3. A multiple accounts ledger was generated in which the sub-accounts and indicators have been used as a framework for characterizing the alternatives. The alternative characterization considers the entire Project life cycle from construction through closure.

The multiple accounts ledger (Step 4) was developed for each alternative in which each account was further broken down into sub-accounts that reflect the material impact (i.e., benefit or loss) associated with the alternative being evaluated. The sub-accounts were measured through indicators. The multiple accounts ledger sought to identify those elements that differentiated alternatives and provided the basis for scoring and weighing the alternatives in Step 5 of the assessment, known as the value-based decision process.

The multiple accounts ledger for the WRMF alternatives is provided in Tables 4-6 to 4-9 below. The indicator quantities for each alternative and the qualitative value scales that determined the indicator quantities are provided in the Alternatives Assessment Report.

4.3.4.1 Environmental Account

The environmental account encompasses a range of issues pertaining to the direct and indirect effects to the environment as a result of developing the WRMF alternatives. The environmental account, sub-accounts, indicators, and metrics for each indicator are summarized in Table 4-6.

4.3.4.2 Technical Account

The technical account assesses the technical merits of the alternatives. The account considers the full life cycle of the Project life (construction, operation, and closure). The technical sub-accounts, indicators, and metrics for each indicator are summarized in Table 4-7.

4.3.4.3 Economics Account

The economics account considers issues pertaining to the direct and indirect costs associated with the development of the alternatives. The economic sub-accounts, indicators, and metrics for each indicator are summarized in Table 4-8.

4.3.4.4 Socio-Economics Account

The socio-economic account addresses the social and cultural impacts of each WRMF siting alternative. The socio-economic sub-accounts, indicators, and metrics for each indicator are summarized in Table 4-9.

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4.3.4.5 Non-differentiating Indicators

The following indicators were considered to be non-differentiating between alternatives, thereby providing no value or merit if included in the MAA. This section demonstrates that these indicators were considered, assessed and ultimately omitted from the in-depth MAA.

4.3.4.5.1 Potential for Acid Rock Drainage

Geochemical testing has shown that the waste rock produced is non-acid generating with excess neutralizing potential and that sulphide concentrations are generally very low. The potential for acid rock drainage is independent of WRMF site selection and has been considered to be a non-distinguishing characteristic for WRMF site selection and is not included in the MAA.

4.3.4.5.2 Potential for Metal Leaching

Geochemical testing has shown that the waste rock produced will have limited potential for metal leaching. The potential for metal leaching is independent of WRMF site selection and has been considered to be a non-distinguishing characteristic for WRMF site selection and is not included in the MAA.

4.3.4.5.3 Seismic Risks

The geotechnical properties pertaining to seismic risk do not vary from one alternative WRMF site to another. The inherent risk of seismic activity within the Hammond Reef mine site area is very low according to the Global Seismic Hazard Map produced by the Global Seismic Hazard Assessment Program. Therefore, seismic hazards are not anticipated for any of the evaluated alternatives and are not considered in the MAA.

4.3.4.5.4 Impacts on Protected Areas and Conservation Lands

The EIS Guidelines indicate that protected areas and conservation lands are areas that are designated by federal, provincial or municipal jurisdictions as ecologically or historically important. These designated areas include wilderness areas, parks, and sites of historical or ecological significance, nature reserves, and federal migratory bird sanctuaries. There are neither lands designated as protected areas nor conservation lands within any of the alternative WRMF footprints.

A value-based decision process (Step 5) was applied using quantitative analyses to determine the relative merit ratings and final ranking of each alternative. Each alternative was evaluated and assigned a score under each indicator. Weighting factors were then introduced to weight the relative importance of each account, sub-account and indicator. The scoring and weighting systems are detailed in the Mine Waste Disposal Alternatives Assessment. A sensitivity analysis was carried out to eliminate potential bias and subjectivity that is inherent in the evaluation and weighting process. The sensitivity analysis evaluates the influence of the selected account, sub-account and indicator weighting on the alternative ranking results by varying the assigned weightings.

The sensitivity analysis considered the following scenarios:

- 1) **Base Case:** Account weightings were selected based on the recommendations of the Guidelines (environmental account weighted 6, technical account weighted 3, economic account weighted 1.5 and socio-economic account weighted 3). Sub-account and indicator weighting was selected based on input from technical and environmental experts.
- 2) **Sensitivity Case 1:** Same as the base case but with the economics account removed (i.e., economics account weighting equal to zero).

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- 3) **Sensitivity Case 2:** Same as the base case but only the environmental and socio-economic accounts considered (i.e., economics and technical account weightings are equal to zero).
- 4) **Sensitivity Case 3:** Same indicators and sub-account weighting as the base case and all accounts weighted equally.
- 5) **Sensitivity Case 4:** All weighting factors (i.e., accounts, sub-accounts, indicators) weighted equally

The detailed assessment results for all cases are provided in the Mine Waste Disposal Alternatives Assessment Report. The final results and rankings of the base case and sensitivity cases are presented in Table 4-10.

Based on the results of the analyses, the waste rock stockpile alternative with the highest ranking is WRMF 3, and is therefore regarded as the preferred alternative. The factors that contributed to WRMF 3 attaining the highest score are its smaller footprint and hence least biophysical impacts, proximity to the open pits, and lowest life of mine costs.

4.3.5 Tailings Management Facility Siting

Version 3 Update: Minor clarifications about the footprint and dam heights of the TMF are provided in response to T-4 (see Addendum Part A; Table A-1).

Fish habitat 'compensation' refers to 'offsetting' under the current Fisheries Act.

The tailings management facility (TMF) is a facility to store waste produced by processing the ore. The project is expected to generate approximately 165 million cubic metres of tailings over the life of the project. Thickened tailings will be hydraulically transported from the processing facility to the TMF where the tailings will be contained through natural (topographic) containment, constructed perimeter dams or a combination of both.

The perimeter containment dams will be designed to comply with the Canadian Dam Association (CDA) Dam Safety Guidelines (CDA 2007). The containment dams will be designed to have sufficient freeboard above the elevations of adjacent tailings beaches to contain extreme precipitation events and the TMF will be equipped with an Emergency Spillway to prevent the overtopping of the perimeter containment dams.

The perimeter containment dams will be constructed of rockfill and designed with transition/filter zones to prevent piping or internal erosion (e.g., migration of tailings particles). In the case of low-permeability starter dams, seepage will be reduced using a geomembrane liner. An external seepage collection system with pump stations will collect and return any seepage back into the TMF.

At closure, exposed tailings beaches will be revegetated and erosion protection will be placed in drainage ditches will be upgraded where required. Runoff from the revegetated tailings surface is expected to eventually be suitable for discharge without treatment. After the water quality of the runoff from revegetated surface meets discharge criteria, the TMF reclaim pond will be lowered by reducing the spillway invert and flows will be released to the environment.

The identification of candidate TMF siting alternatives was carried out and documented in January 2012 as an Appendix to the Hammond Reef Terms of Reference (ToR). Five on-site locations (i.e., located within the Osisko

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mining claims) as well as one off-site location were considered as possible locations for the TMF. The candidate locations were selected based on considerations such as the presence of suitable topography and the distance of the site from the processing plant. A 25 km radius from the processing plant was considered as a spatial boundary for identifying candidate alternatives. Beyond this distance, it was considered that the maintenance and operational costs required to pump the tailings from the plant to the TMF would render the project uneconomical.

The Hogarth Pit alternative was originally considered as an opportunity to make use of an already disturbed area, and the possible remediation of ongoing environmental liabilities. However, due to the distance of the Hogarth Pit from the Project Site, the length of pipeline required (approximately 30 km), the extensive site characterization that would be required, and the long term liabilities and security issues involved, this alternative was excluded from further consideration. Implementation of the Hogarth Pit alternative for tailings storage would make the Project unfeasible.

Three TMF alternatives were considered to be viable alternatives through the pre-screening assessment and have been carried forward for assessment using the MAA and value based decision-making process. The base case as presented in the ToR has been subsequently revised to take further advantage of the natural topography in the area and minimize dam volumes, capital costs, and improve protection of the environment by increasing setbacks from Lizard Lake. However, the revised footprint impacts a small unnamed waterbody (identified as API #2) which is a fish-bearing water body thereby increasing the compensation requirements for the Project. The Tailings Management Facility Siting Alternatives carried forward for assessment in the MAA are shown on Figure 4-7.

The TMF alternatives have been characterized with respect to the environmental, technical, economic and social accounts described in Section 4.3.1. A multiple accounts ledger was generated in which the sub-accounts and indicators have been used as a framework for characterizing the alternatives. The alternative characterization considers the entire Project life cycle from construction through closure.

A multiple accounts ledger (Step 4) was developed for each alternative in which each account was further broken down into sub accounts that reflect the material impact (i.e., benefit or loss) associated with the alternative being evaluated. The sub accounts were measured through indicators. The multiple accounts ledger sought to identify those elements that differentiated alternatives and provided the basis for scoring and weighing the alternatives in Step 5 of the assessment, known as the value based decision process.

The multiple accounts ledger for the TMF alternatives is provided in Tables 4-11 to 4-14 below. The indicator quantities for each alternative and the qualitative value scales that determined the indicator quantities are provided in the Mine Waste Disposal Alternatives Assessment Report.

4.3.5.1 Environmental Account

The environmental account encompasses a range of issues pertaining to the direct and indirect effects to the environment as a result of developing the TMF alternatives. The environmental sub-accounts, indicators, and metrics for each indicator are summarized in Table 4-11.

4.3.5.2 Technical Account

The technical account assesses the technical merits of the alternatives. The account considers the full life cycle of the Project life (construction, operation, and closure). The technical sub-accounts, indicators, and metrics for each indicator are summarized in Table 4-12.

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4.3.5.3 Economics Account

The economics account considers issues pertaining to the direct and indirect costs associated with the development of the alternatives. The economic sub-accounts, indicators, and metrics for each indicator are summarized in Table 4-13.

4.3.5.4 Socio-Economics Account

The socio-economic account addresses the social and cultural impacts of the TMF siting alternatives. The socio-economic sub-accounts, indicators, and metrics for each indicator are summarized in Table 4-14.

4.3.5.5 Non-differentiating Indicators

The following indicators were considered to be non-differentiating between alternatives, thereby providing no value or merit if included in the MAA. This section demonstrates that these indicators were considered, assessed and ultimately omitted from the in-depth MAA.

4.3.5.5.1 Potential for Acid Rock Drainage

Geochemical testing has shown that the ore to be mined and the tailings produced are non-acid generating with excess neutralizing potential and that sulphide concentrations are generally very low. The potential for acid rock drainage is independent of TMF site selection and has been considered to be a non-distinguishing characteristic for TMF site selection and is not included in the MAA.

4.3.5.5.2 Potential for Metal Leaching

Geochemical testing has shown that the ore to be mined and the tailings produced have limited potential for metal leaching. The potential for metal leaching is independent of TMF site selection and has been considered to be a non-distinguishing characteristic for TMF site selection and is not included in the MAA.

4.3.5.5.3 Seismic Risks

The geotechnical properties pertaining to seismic risk do not vary from one alternative TMF site to another. The inherent risk of seismic activity within the Hammond Reef mine site area is very low according to the Global Seismic Hazard Map produced by the Global Seismic Hazard Assessment Program. Therefore, seismic hazards are not anticipated for any of the evaluated alternatives and are not considered in the MAA.

4.3.5.5.4 Impacts on Protected Areas and Conservation Lands

The EIS Guidelines indicate that protected areas and conservation lands are areas that are designated by federal, provincial or municipal jurisdictions as ecologically or historically important. These designated areas include wilderness areas, parks, and sites of historical or ecological significance, nature reserves, and federal migratory bird sanctuaries. There are neither lands designated as protected areas nor conservation lands within any of the alternative TMF footprints.

4.3.5.6 Results and Sensitivity Analysis

A value-based decision process (Step 5) was applied using quantitative analyses to determine the relative merit ratings and final ranking of each alternative. Each alternative was evaluated and assigned a score under each indicator. Weighting factors were then introduced to weight the relative importance of each account, sub-account and indicator. The scoring and weighting systems are detailed in the Mine Waste Disposal Alternatives Assessment. A sensitivity analysis was carried out to eliminate potential bias and subjectivity that is inherent in

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the evaluation and weighting process. The sensitivity analysis evaluates the influence of the selected account, sub-account and indicator weighting on the alternative ranking results by varying the assigned weightings.

The sensitivity analysis considered the following scenarios:

- 1) **Base Case:** Account weightings were selected based on the recommendations of the Guidelines (environmental account weighted 6, technical account weighted 3, economic account weighted 1.5 and socio-economic account weighted 3). Sub-account and indicator weighting was selected based on input from technical and environmental experts.
- 2) **Sensitivity Case 1:** Same as the base case but with the economics account removed (i.e., economics account weighting equal to zero).
- 3) **Sensitivity Case 2:** Same as the base case but only the environmental and socio-economic accounts considered (i.e., economics and technical account weightings are equal to zero).
- 4) **Sensitivity Case 3:** Same indicators and sub-account weighting as the base case and all accounts weighted equally.
- 5) **Sensitivity Case 4:** All weighting factors (i.e., accounts, sub-accounts, indicators) weighted equally

The detailed assessment results for all cases are provided in the Mine Waste Disposal Alternatives Assessment Report. The final results and rankings of the base case and sensitivity cases are presented in Table 4-15.

Based on the results of the analyses, the tailings management facility alternative with the highest ranking is TMF 3, and is therefore regarded as the preferred alternative. The factors that contributed to TMF 3 attaining the highest score are the lowest life of mine costs, absence of impacts to areas of cultural heritage and less obtrusive visual impacts during operation and post-closure.

4.3.6 Summary of Preferred Mine Waste Disposal Alternatives

A full range of mine waste disposal alternatives have been examined and assessed, as presented in the Mine Waste Disposal Alternatives Assessment Report and discussed herein. Alternatives that met the Project objectives were identified in the ToR and an initial screening process was completed. The alternatives that were deemed reasonable were carried forward for further evaluation and were investigated in greater detail. A summary of the potential impacts associated with all mine waste disposal alternatives are presented in Appendix 4.I Mine Waste Disposal Alternatives Assessment of the Alternatives Assessment Report. A multiple accounts analysis including a qualitative/quantitative assessment and value-based decision process was applied to each alternative in accordance with Environment Canada's *Guidelines for the Assessment of Alternatives for Mine Waste Disposal* (Environment Canada 2011), leading to the selection of the best overall option. Figure 4-8 shows the preferred sites of all mine waste disposal facilities.

A summary of the preferred alternative for each mine waste disposal constituent is as follows:

- **Waste Rock Management Facility – WRMF 3**, located immediately east of the open pit and mine processing plant.
- **Tailings Management Facility – TMF 3**, Optimized “Base Case,” located approximately 9 km northeast of the processing plant.

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4.4 Preferred Project Alternatives

Version 3 Update: A summary of the assessment of closure alternatives is provided immediately following this section. The selected closure methods are as follows:

- *Open Pit – Passive flooding of the pit;*
- *Tailings Management Facility – Direct revegetation of tailings;*
- *Waste Rock and Low Grade Ore Stockpiles – Natural revegetation;*
- *Overburden Stockpiles – Revegetation in place;*
- *Site Infrastructure – Reclaim site infrastructure as proposed in the Conceptual Closure and Rehabilitation Plan TSD when no longer required for post-closure monitoring and maintenance.*
- *Site Water Management – Restore normal runoff patterns and direct site runoff to open pits to reduce passive flooding time*

The evaluated alternatives for the project transmission line, water discharge location, access road, tailings management facility and waste rock management facility are presented together in Figure 4-9. The preferred Alternative Means of Carrying out the Project and the preferred Mine Waste Disposal Alternatives are summarized in Table 4-16.

These alternatives comprise the proposed Project and are described in detail in Chapter 5. The physical, biological and socio-economic effects of the Project, including these alternatives, are assessed in Chapter 6.

Assessment of Closure Alternatives

The Version 2 EIS/EA report included an assessment of alternatives for closure in Part B of the Version 2 Conceptual Closure and Rehabilitation Plan TSD. Subsequent to the submission of the Version 2 EIS/EA report, a supplemental assessment of closure alternatives was completed following a tabular approach at the request of the MNRF. This supplemental assessment is provided in Part 3, Appendix A, Tables 6-11 of the Version 3 Alternatives Assessment TSD. The MOECC and MNRF requested that a discussion on closure alternatives be brought forth into the main body of the EIS/EA. This section has been included in response. The reader is directed to the above references for the detailed evaluation.

Open Pit

*Three alternatives have been considered: **Alternative 1:** Passive flooding of the pit; **Alternative 2:** Active accelerated flooding of the pit; **Alternative 3:** Backfilling with waste materials.*

- *Technical and/or System Integrity/Reliability – No preference (all Preferred). All alternatives can be implemented with standard technology and predictable success.*
- *Ability to Service the Site Effectively – Not applicable*

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- *Effects to the Natural Environment – Alternative 1 is Preferred as it has the advantage prolonging the filling period, which allows longer time for effluent containment and encourages stratification which is a benefit to water quality. Alternatives 2 and 3 are Acceptable; accelerated flooding may inhibit stratification and carries increased risk with respect to discharge water quality; backfilling with waste rock would generate noise and additional emissions.*
- *Effects to the Human Environment – No preference (all Preferred). No apparent advantages or disadvantages.*
- *Amenability to Reclamation – Alternatives 1 and 3 are Preferred. Alternative 2 is Acceptable provided that water quality can be guaranteed. Alternative 1 provides advantage with respect to water quality. Alternative 3 would support establishment of a terrestrial environment. Alternative 2 carries increased risk with respect to discharge water quality.*
- *Consideration of Effects from Climate Change – No preference (all Preferred). No apparent effects of climate change.*
- *Cost effectiveness – Alternative 1 is Preferred and is most cost effective. Alternative 2 is Acceptable carries increased cost for pumping and infrastructure. Alternative 3 would be cost prohibitive and is Unacceptable.*

Selected Alternative: *Alternative 1 (passive flooding) is the preferred due to the low cost and certainty with respect to final discharge water quality.*

Tailings Management Facility

Three alternatives have been considered: **Alternative 1:** Direct revegetation of tailings; **Alternative 2:** Revegetation using an overburden and/or topsoil cover; **Alternative 3:** Relocate tailings to the open pit(s).

- *Technical and/or System Integrity/Reliability – Alternatives 1 and 3 are Preferred and can be accomplished using standard practices. Alternative 2 is Acceptable but placement of overburden/topsoil over soft tailings carries constructability challenges.*
- *Ability to Service the Site Effectively – Not applicable.*
- *Effects to the Natural Environment – Alternatives 1 and 2 are Preferred. Revegetation will improve runoff quality, stabilize surface soils and has potential to create new terrestrial habitat. Alternative 3 is Acceptable and has the potential to impair water quality in the flooded pit.*
- *Effects to the Human Environment – All Alternatives are Preferred with no apparent advantages or disadvantages from a land use perspective.*
- *Amenability to Reclamation – Alternatives 1 and 2 are Preferred. Surface revegetation is anticipated to be successful. Alternative 3 is Acceptable.*
- *Consideration of Effects from Climate Change – All Alternatives are Preferred with no apparent effects of climate change.*
- *Cost effectiveness – Alternative 1 is Preferred and has the lowest overall cost. Alternatives 2 and 3 are cost prohibitive and Unacceptable.*

Selected Alternative: *Alternative 1 is Preferred as it provides a low-cost solution and is anticipated to be successful. Mitigation measures are available if needed to improve success.*

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Waste Rock and Low Grade Ore Stockpiles

Three alternatives have been considered: **Alternative 1:** Natural revegetation; **Alternative 2:** Revegetation using an overburden and/or topsoil cover; **Alternative 3:** Relocate materials to the open pit(s).

- *Technical and/or System Integrity/Reliability – Alternatives 1 and 3 are Preferred and can be accomplished using standard practices. Alternative 2 is Acceptable.*
- *Ability to Service the Site Effectively – Not applicable.*
- *Effects to the Natural Environment – Alternatives 1 and 2 are Preferred. Revegetation will create terrestrial habitat with native species. Alternative 3 is Acceptable; it provides no advantage over Alternative 1 and increases emissions due to double handling of materials.*
- *Effects to the Human Environment – No preference (all alternatives are Preferred) with no apparent advantages or disadvantages from a land use perspective.*
- *Amenability to Reclamation – Alternatives 1 and 2 are Preferred; revegetation is anticipated to be successful. Alternative 3 is Unacceptable as it is unnecessary to achieve closure objectives because waste rock and low grade ore are expected to be physically and geochemically stable.*
- *Consideration of Effects from Climate Change – No preference (all alternatives are Preferred) with no apparent effects of climate change.*
- *Cost effectiveness – Alternative 1 has the lowest overall cost and is Preferred. Alternatives 2 and 3 are cost prohibitive and Unacceptable.*

Selected Alternative: *Alternative 1 is Preferred. Alternatives 2 and 3 are cost prohibitive and are considered unnecessary to achieve closure objectives.*

Overburden Stockpiles

Two alternatives have been considered: **Alternative 1:** Revegetation in place; **Alternative 2:** Use in assisting reclamation of other site facilities.

- *Technical and/or System Integrity/Reliability – No preference (both Preferred). Both alternatives can be accomplished using standard practices and have high anticipated level of success.*
- *Ability to Service the Site Effectively – Not applicable.*
- *Effects to the Natural Environment – No preference (both Preferred).*
- *Effects to the Human Environment – No preference (both Preferred) with no apparent advantages or disadvantages from a land use perspective.*
- *Amenability to Reclamation – No preference (both Preferred). Both alternatives are expected to be successful.*
- *Consideration of Effects from Climate Change – No preference (both Preferred) with no apparent effects of climate change.*
- *Cost effectiveness – Alternative 1 is Preferred. Alternative 2 carries a high cost and is Unacceptable.*

Selected Alternative: *Alternative 1 is preferred based on cost considerations.*

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Site Infrastructure

Two alternatives have been considered: **Alternative 1:** Reclaim site infrastructure as proposed in the Conceptual Closure and Rehabilitation Plan TSD when no longer required for post-closure monitoring and maintenance. **Alternative 2:** Retain site infrastructure onsite for future industrial operation.

- *Technical and/or System Integrity/Reliability – No preference (both Preferred). Alternative 1 applies actions/technologies consistent with industry standards. Alternative 2 requires no technology.*
- *Ability to Service the Site Effectively – Not applicable.*
- *Effects to the Natural Environment – Alternative 1 is Preferred because it provides opportunity for re-establishment of a naturalized environment. Alternative 2 is Acceptable.*
- *Effects to the Human Environment – Alternative 2 is Preferred because it provides advantage of continued economic benefit and usefulness of developed infrastructure. Alternative 1 is Acceptable; it is consistent with closure and land use objectives but does not support future economic benefit.*
- *Amenability to Reclamation – No preference (both Preferred). Both alternatives are consistent with industry standards in Ontario and closure plan objectives.*
- *Consideration of Effects from Climate Change – No preference (both Preferred) with no apparent effects of climate change.*
- *Cost effectiveness – Alternative 1 is Preferred; although costly, Alternative 1 is consistent with industry standards and has more potential to be approved. Alternative 2 is Unacceptable because transfer of facilities and infrastructure to another industrial operation is not considered to be realistic, considering the remote location and specialized nature of the facilities.*

Selected Alternative: *Alternative 1 is Preferred; it provides opportunity for re-establishment of a naturalized environment and is consistent with industry standards in Ontario and closure plan objectives. Alternative 2 is not considered to be realistic considering the remote location and specialized nature of the facilities.*

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Site Water Management

Two alternatives have been considered: **Alternative 1:** Restore normal runoff patterns and direct site runoff to open pits to reduce passive flooding time; **Alternative 2:** Long-term effluent treatment and discharge.

- *Technical and/or System Integrity/Reliability – No preference (both Preferred). Both alternatives apply actions/technologies that are consistent with industry standards.*
- *Ability to Service the Site Effectively – Not applicable.*
- *Effects to the Natural Environment – Alternative 1 is Preferred because it allows for the establishment of a zero discharge condition for a significant period of time and provides greater certainty of final effluent quality prior to discharge. Alternative 2 is Acceptable but requires effective and active ongoing environmental management and supervision.*
- *Effects to the Human Environment – No preference (both Preferred) with no apparent advantages or disadvantages from a land use perspective.*
- *Amenability to Reclamation – Alternative 1 is Preferred because it allows for the development of a naturalized site. Alternative 2 is Acceptable but will delay the development of a naturalized site.*
- *Consideration of Effects from Climate Change – No preference (all alternatives are Preferred) with no apparent effects of climate change.*
- *Cost effectiveness – Alternative 1 is preferred. Alternative 2 is Acceptable but requires ongoing cost for effluent treatment and is not consistent with industry standards for a geochemically stable site.*

Selected Alternative: Alternative 1 is preferred under all indicators and has been selected.