MELIADINE GOLD PROJECT

SD 2-1
Alternatives Assessment Report

APRIL 2014

VERSION 3

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3	April 2014	4 5.1.2 5.10	15 18 24-25 43	Added Port Facilities options to Table 4-1 Added Salt Water Management to Table 4-1 New section on port facilities New section on salt water management	Josée Noël, Env. Coord., AEM

EXECUTIVE SUMMARY

The Meliadine Project needs to be technically, economically, environmentally, and socially viable if it is to proceed. Alternatives to Project components and activities were assessed using the following criteria: technical feasibility, economic viability, environmental acceptability, community preference, social acceptability, and reclamation and closure. Select mine components could be constructed in different locations or operated differently. Activities can be completed or achieved in different ways. This led to alternatives being evaluated and rated using the criteria. The alternative with the most favorable ratings was preferred among those considered. A “no-go” alternative was also evaluated.

The approach recognises that community preferences are important, and positive and negative effects on valued ecosystem components and valued socio-economic components have to be carefully weighed in selecting the preferred alternative. The process gave due consideration to the vulnerability of the Arctic ecosystem, the potential for extension of the mine life, reclamation and closure, and potential for cumulative effects.

Options discussed in this report include: shipping route, port facilities, use of Rankin Inlet airport, roads routes, location of infrastructure, type and location of power generation infrastructure, tailings and waste rock management, salt water management, waste management, ore process methods, etc. Reference to more detailed reports describing option selection process for specific Project’s components and activities are provided when appropriate.

ACRONYMS

AEM	Agnico Eagle Mines Limited
AP	Attenuation Pond
ATV	All-Terrain Vehicle
AWAR	All-weather Access Road
CIL	Carbon-in-Leach
CN	Cyanide
EIS	Environmental Impact Statement
GN	Government of Nunavut
HFO	Heavy Fuel Oil
HPGR	High Pressure Grinding Rollers
HSE	Health, Safety and Environment
IIBA	Inuit Impact and Benefit Agreement
IOL	Inuit Owned Lands
IPG	Institutions of Public Government
IQ	Inuit Qaujimajatuqangit (Traditional Knowledge)
KIA	Kivalliq Inuit Association
LFO	Light Fuel Oil
LNG	Liquefied Natural Gas
MAA	Multiple Accounts Analysis
MW	Megawatt
N/A	Non-Applicable
NIRB	Nunavut Impact Review Board
NLCA	Nunavut Land Claims Agreement
NPC	Nunavut Planning Commission
NTI	Nunavut Tunngavik Incorporated
NWB	Nunavut Water Board
ROM	Run-of-Mine
SAG	Semi Autogenous Grinding
SD	Support Document
SO_2	Sulfur Dioxide
tpd	tonnes per day
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
ULSD	Ultra Low Sulfur Diesel
VEC	Valued Ecosystem Component
VSEC	Valued Socio-Economic Component
WRSF	Waste Rock Storage Facility

SECTION 1 • INTRODUCTION

1.1 The Proponent

Agnico Eagle Mines Limited (AEM or Agnico Eagle) is a long established gold producer based in Toronto, Ontario, with operations located in Canada (northwestern Québec and Nunavut), Finland and Mexico, and exploration and development activities in Canada, Finland, Mexico and the United States. AEM opened the Meadowbank Mine in the Kivalliq region of Nunavut in 2010.

The Company is listed on the New York and Toronto Stock Exchange under trading symbol “AEM”. It is held approximately 15 % by individuals and 85 % by institutions, primarily in North America. As of December 31, 2011, AEM had 170.3 million fully diluted shares outstanding.

AEM has an exceptional track record of growing gold reserves and resources through exploration. It has full exposure to higher gold prices consistent with its policy of no forward gold sales and maintains a corporate strategy based on increasing shareholders exposure to gold, on a per share basis. It has paid a cash dividend for 30 consecutive years.

Agnico Eagle strives to earn and retain the trust of shareholders through a steadfast commitment to sound and effective corporate governance. Our governance practices reflect the structure and processes we believe are necessary to improve company performance and enhance shareholder value. As governance standards change and our company grows, these practices are assessed and modified as needed.

The Company can rely on a highly experienced management team averaging approximately 20 years of service with the Company. It has an excellent record, both as a local employer and for controlling the environmental impact of its work.

The Board of Directors is ultimately responsible for overseeing the management of the business and affairs of the company and, in doing so, is required to act in the best interests of the company. It consists of 13 directors, all but one being independent of management and free from any interest or business that could materially interfere with their ability to act in the company’s best interests. The Board discharges its responsibilities either directly or through four committees:

- Corporate Governance Committee;
- Audit Committee;
- Compensation Committee; and
- Health, Safety and Environment (HSE) Committee.

Amongst other, the Corporate Governance Committee advises and makes recommendations the Board of Directors with respect to the development of the Corporation’s corporate governance policies, principles, practices and processes. The HSE Committee advises and recommends with respect to (a) monitoring and reviewing of the health, safety and environmental policies, principles, practices and processes, (b) overseeing health, safety and environmental performance, and (c) monitoring and reviewing current and future regulatory issues relating to health, safety and the environment.

1.2 Land Use

The Meliadine Project is located on Inuit Owned Lands (IOL) and territorial lands within the municipality of Rankin Inlet.

The Nunavut Land Claims Agreement (NLCA) sets out the governance for development activities in Nunavut. Certain lands were granted to Inuit under the NLCA, with the Meliadine Project located on surface and subsurface land owned by Inuit. On behalf of Inuit Beneficiaries as designated under the NLCA, surface lands and subsurface (mineral) rights are administered by the Kivalliq Inuit Association (KIA) and the Nunavut Tunngavik Incorporated (NTI), respectively. Access to surface lands requires land use permits and/or land leases from the KIA. Mineral leases held by the Meliadine Project predate the NLCA and are administered by Aboriginal Affairs and Northern Development Canada under the Canadian Mining Regulations. AEM will pay royalties to the Crown who will then transfer the monies to NTI as contemplated in the NLCA.

A 2.3 km segment of the All-weather Access Road (AWAR) and the 5.1 km bypass road are located on commissionaires land managed by the Community and Government Services, Government of Nunavut, for the benefit of the Hamlet of Rankin Inlet. Land use permits are/will be granted to build the roads, which would be followed by right-of-way leases following completion of the roads and legal surveys of the same. A land lease was negotiated with Nunavut Airports for 14 ha of airport land to serve as a laydown yard, sea can storage, and tank farm at Itivia.

Alternatives were assessed prior to selecting the preferred route for the access roads, the location of mine infrastructure in Rankin Inlet and at the proposed mine site.

1.3 Social Considerations

The Project is within the Kivalliq region of Nunavut and five (5) communities (Arviat, Baker Lake, Chesterfield Inlet, Rankin Inlet and Whale Cove) make up the local study area for the purpose of this report. The closest community to the Meliadine Project site is Rankin Inlet 25 km to the south, Chesterfield Inlet is 80 km northeast, Whale Cove is approximately 80 km south, Arviat is approximately 220 km south, and Baker Lake is approximately 234 km northwest. Meadowbank Gold Mine, owned and operated by AEM, is the nearest large-scale industrial development, 285 km northwest of the Project.

The economy of Nunavut is mixed, combining both land and wage based components. The land-based economy and associated values are reflected in people’s preferences and concerns, and in government deliberations. It continues to provide important economic, social and cultural benefits to Inuit while also providing the foundation upon which economic development priorities are based, including moving forward (GN 2007).

Land-based activities rely on Inuit Qaujimajatuqangit (IQ) and practices. Hunting, trapping and fishing remain an integral part of the economy and serve to supplement household food security and nutrition (subsistence). Most individuals are, or strive to be, active in both the land- and wage-based components of the economy.

A recurring theme heard from community leaders and Elders is the need for employment for “our young people”. Population growth in Nunavut remains high as does the unemployment rate. Nonetheless, the upswing in mining exploration in the Kivalliq region, and operations of Meadowbank, has provided much needed jobs and an awareness of the benefits that can flow from mining activities. The Meliadine Project will build on existing positive socio-economic benefits while remaining mindful of values derived from land-based activities in designing, constructing, operating and closing the proposed gold mine.

Economic and social benefits are expected from the Meliadine Project for the communities in the Kivalliq region. Such benefits will largely derive from employment, training and business opportunities, and from social investment consequent on the terms of the Inuit Impact and Benefit Agreement (IIBA) that will be signed between AEM and the KIA.

Rankin Inlet and Chesterfield Inlet are the communities closest to the mine. There is also potential for negative economic and social effects on individuals and on the two (2) Kivalliq communities largely associated with the challenges of transitioning from a land-based economy into the formal wage economy. The recruitment of Inuit for employment is expected to be highest in those two communities.

Social acceptability, benefits to be realised and community preferences were considered in selecting the preferred alternatives for mine components and processes. Benefits are largely seen as being positive with social and economic benefits flowing to Inuit, Kivalliq region, and Nunavut.

1.4 Consultation – Project Design and Public Preferences

AEM’s approach to public engagement and consultation was conceived to provide people with the mechanisms so that they can provide environmental, socio-economic and IQ feedback on alternatives proposed for the Project[1]. The Project benefits from this feedback in allowing modifications to its mine design and operations should they have the potential to negatively impact valued ecosystem or socio-economic components.

[1] For more information, see the SD 3-1 Public Engagement and Consultation Baseline and SD 9-5 Community Involvement Plan.

AEM public engagement and consultation program has the following objectives relevant to how public consultation has influenced Project design and planning, and how public preferences have been considered by AEM in selecting the preferred Project alternatives:

- To build trust relationships and sustain constructive external relationships with Inuit and other stakeholders over time;
- To create an understanding of the Project among Inuit and other stakeholders;
- To listen to issues and concerns through a dialogue with Inuit and other stakeholders, and allow them to have a say in improvements to the Project's plans and outcomes, and for AEM to communicate how their input were incorporated in the alternatives selected for the Project;
- To learn traditional knowledge from local knowledge holders and attendant historical patterns of land and resource use for incorporation in the Project;
- To respectively listen to Inuit explain the local conditions in which the Project activities will occur;
- To make the Project a success with benefits flowing to AEM shareholders, Inuit, communities and other stakeholders; and
- To participate with communities, Inuit organizations, government, and institutions of public government (IPG)[2] in evaluating trends in economic and social development and well-being in the Kivalliq region, as well as the relationship between these and the Project.

A good part of all community meetings was devoted to the discussion of jobs, particularly for the young people. The prospect of employment in the mining industry was not presented as an alternative to the land-based economy. AEM structured work on a two-week rotation: two weeks working at the mine site followed by two weeks in the employee's home community. This rotation was presented and discussed at community meetings. Inuit have a concern with the inherent family dislocation that this type of rotation can cause. However, it represents the best trade-off between wage and land-based economies.

AEM was sensitive to the fact that the land-based economy provides important economic, social and cultural benefits to Inuit. The wage economy is also important, and Elders are certain in their convictions that the young cannot live as they did in the past and should take the opportunity to work in the wage economy. In moving forward with the wage-based component of the economy, the Elders' hope is that ties to the land are not lost. The alternative of two weeks in - two weeks out rotation allows Inuit participation in both the wage and the land economies.

AEM's focus remains on providing timely and useful information to the general public, community organizations and government so that they can have meaningful input to the assessment of

[2] Five (5) IPG were formed as part of the Nunavut Land Claims Agreement. Of those, the Nunavut Planning Commission (NPC), the Nunavut Impact Review Board (NIRB) and the Nunavut Water Board (NWB) have a mandate in the environmental assessment and permitting of the proposed mine. AEM has worked closely with the NPC, NIRB and NWB.

alternatives and they receive feedback on how their input influenced the selection of the preferred alternative.

Significant input was received on the following alternatives:

- The route of the AWAR in crossing the Meliadine River. Three crossings were proposed by AEM (and Comaplex before it). The route through Iqalugaarjuup Nunanga Territorial Park was not acceptable nor was a crossing point close to Prairie Bay. The intermediate site between the two was preferred.
- The route of the community bypass road was discussed with the community. Three routes were presented to the hamlet; the route that completely avoids residential and built-up areas in the hamlet is preferred. The preferred option would involve constructing a new road south of the Rankin Inlet airport runway up to the existing hamlet road to the Char River.
- The AWAR and bypass road will have unrestricted access by the public. This was the preference voiced by the hamlet.
- AEM will not have an airstrip at site as the community did not favour this option. Instead, AEM will use the Rankin Inlet airport.
- AEM will keep the areas disturbed by waste rock and tailings as small as possible as this will limit the impact on the land.
- Inuit do not want any negative impacts on Meliadine Lake; contact water will be sampled, analysed, and treated if necessary before being discharged to Meliadine Lake.
- The training of potential employees is needed, and the option selected was to provide support to the Kivalliq Mine Training Society to supplement training on-site. This organization has been very successful in training Kivalliq residents for jobs in the mining industry. This addresses the concern that training should be local, not far removed from Kivalliq (e.g. in southern Canada).
- The community wanted a boat launch on Meliadine Lake as part of the access road to Discovery, and AEM committed to build it.

As a result of ongoing public engagement and consultation, AEM and the general public developed a dialogue on the proposed development, which provided valuable insights into community and cultural values, their priorities and preferences.

SECTION 2 • RELATED DOCUMENTS

The Environmental Impact Statement (EIS) includes detailed studies and plans that provide more detail on mine components and processes. Greater detail can be found in documents devoted to a single or a few mine components than can be provided in this Alternatives Assessment Report. Significant plans, studies and reports are listed in Table 2-1.

Table 2-1 Project Components, Alternatives and Reference Document

Project Components or Activities	Alternatives Considered	Reference Document for Further Information
Transportation	Transportation of dry cargo and fuel from the south to Rankin Inlet by sea and air	SD 8-1 Shipping Management Plan Volume 2 Project Description
Location of tank farm, storage and laydown yard	Two locations considered within Rankin Inlet, one next to the community tank farm and the other at Itivia harbour	SD 8-1 Shipping Management Plan Volume 2 Project Description
Airport	Use of Rankin Inlet airport or building an airstrip at site	Volume 2 Project Description
Access to the ore deposits	Layout of open pits and underground configuration with an emphasis on the resultant layout of infrastructure	Volume 2 Project Description
Road access	Dedicated haul roads versus shared public and mine roads	SD 2-9 Roads Management Plan Volume 2 Project Description
Processing of ore	Type of crushers, mill and location	Volume 2 Project Description
Cyanide	Other chemicals that could be used to extract gold for ore	Volume 2 Project Description
Tailings storage/disposal	Forms of tailings and possible storage location	SD 2-2 Tailings Alternatives Assessment Report SD 2-3 TSF Preliminary Design Report
Power generation	Location of power plant, type of energy generation	Volume 2 Project Description
Closure and reclamation	Options for closure and reclamation	SD 2-17 Mine Closure and Reclamation Plan
Waste rock and overburden	Locations near the open pits	SD 2-8 Mine Waste Management Plan
Waste	Management and disposal options of waste materials – kitchen and office waste, hazardous waste, materials that can be recycled	SD 2-11 Landfill and Waste Management Plan 2-13 Hazardous Materials Management Plan
Site water management	Various alternatives considered in managing water on site	SD 2-6 Surface Water Management Plan
Mine dewatering	Removing water from the open pits and from the underground	SD 2-6 Surface Water Management Plan

SECTION 3 • MINING IN THE ARCTIC

The general physical setting of the Project site is typical of a remote, relatively undisturbed polar tundra, which is comprised of a hummocky topography having glacial landforms draped with water bodies and tundra vegetation that are home to fish, wildlife and birds. The regional surface drainage patterns are controlled by a series of low relief ridges composed of glacial deposits. A zone of continuous permafrost underlies the Project site. The Tiriganiaq deposit is currently the only deposit that is planned to be mined below the inferred depth of permafrost at the site.

3.1 Technical Challenges – Biophysical Environment

3.1.1 Climate

The Meliadine area is located in an arid Arctic environment that experiences extreme winter conditions. Mean temperatures are 12°C in July and -31°C in January with an annual mean of -10.4°C. It is subject to great seasonal changes with daylight reaching a minimum of 4 hours per day in the long winter, and a maximum of 20 hours in the short summer. The annual average total precipitation at the mine site is 404.8 mm/year and falls almost equally as snow and rainfall. Average annual evaporation for small waterbodies in the Project area is estimated to be 323 mm between June and September. The average annual loss of snowpack to sublimation and snow redistribution is estimated to vary between 46 % and 52 % of the total precipitation for the winter period, and occurs between October and May. Climate was considered in assessing alternatives.

The recorded prevailing winds blows from north and north-northwest direction more than 30 % of the time. The least frequent wind direction is west-southwest, with a frequency of 2.1 %. The calm frequency is 2.8 % of the time. The mean values for wind speed show that the north-northwest together with north and northwest winds have the highest speeds and tend to be the strongest. This knowledge influenced the alternatives considered in locating the AWAR. The preferred alternative selected was to keep the road on the height of land and route in a northerly direction thereby reducing the deposition of drifting of snow on the AWAR.

Because of its location, the Meliadine Project infrastructures will require special cold climate and permafrost design considerations. The Arctic design of the buildings will be reflected notably in heavy insulation and special foundation requirements, use of heated utilidors (insulated, enclosed utilities corridors) to connect the buildings, and extreme space-heating requirements. Distances between mine buildings are minimized as much as possible to keep utilidors short thereby reducing capital costs in construction and operational costs in heating them during the winter.

Space-heating requirements and hot water needs will be met through recovery of waste heat from the diesel engines driving the power generators. Auxiliary glycol/water-heating boilers will be provided for heating requirements in extreme conditions and emergencies. Another climate-driven feature will be heat-tracing of fuel, water and tailings lines located outside buildings.

3.1.2 Permafrost Challenges

The Meliadine Project is located in a zone of continuous permafrost within the Southern Arctic terrestrial ecozone, one of the coldest and driest regions of Canada[3] and within the Arctic tundra climate region. Thick and continuous permafrost underlies the Project site with intervening taliks and thaw bulbs induced by lakes.

Temperature data was collected from 37 thermistors on a regular basis with the depth to permafrost ranging from depths of 360 to 495 m based on historical and recent ground temperature data from thermistors installed near Tiriganiaq, F Zone, and Discovery deposits. The variation in depth results in an irregular bottom to the permafrost layer. The ground temperature data indicates that the surface active layer thickness is 1.0 to 3.0 m in areas of shallow soil away from the influence of waterbodies. It is anticipated that the active layer adjacent to waterbodies or below streams and rivers will be deeper. Permafrost was considered in assessing alternatives.

Taliks (areas of unfrozen ground) are to be expected where lake depths are greater than about 1.0 to 2.3 m. Formation of an open talik, which penetrates through the permafrost, would be expected for lakes which exceed a critical depth and size.

Challenges exist in first understanding the permafrost regime before selecting the preferred location of mine infrastructure, construction methods and how to operate the mine component without unnecessarily changing the permafrost regime and having unwanted permafrost degradation. All mill and associated infrastructure foundations will be insulated above bedrock to preserve the permafrost. All open pits and the initial stages of underground mining will be carried out in permafrost. Groundwater will need to be managed once underground mining extends below the bottom of the permafrost.

3.1.3 Hydrogeological Challenges

From the late spring to early autumn, when temperatures are above 0°C, the active layer thaws. Within the active layer, the shallow water table is expected to be a subdued replica of topography, and is expected to parallel the topographic surface. Groundwater gradients would, therefore, be similar to topographic gradients. Groundwater in the active layer flows to local depressions and ponds that drain to larger lakes.

Permafrost reduces the hydraulic conductivity of the rock and, as a result, the frozen rock at Meliadine would be virtually impermeable to groundwater flow. The shallow groundwater flow regime, therefore, has little to no hydraulic connection with the deep groundwater regime located below the permafrost.

[3] Document SD 6-1 Permafrost Baseline Report presents the soil thermal regime baseline studies.

The deep groundwater is quite different from the shallow. Taliks (unfrozen ground surrounded by permafrost) exist beneath lakes which have sufficient depth such that they do not freeze to the bottom over the winter. Taliks beneath larger lakes can extend down to the deep groundwater regime. The elevations of these lakes provide the driving force for deep groundwater flow. The presence of thick permafrost beneath land masses results in negligible recharge to the deep groundwater flow regime from these areas. Consequently, recharge to the deep groundwater flow regime is predominantly limited to areas of open talik beneath waterbodies. Generally, deep groundwater will flow from higher-elevation lakes to lower-elevation lakes. To a lesser degree, groundwater beneath the permafrost is influenced by density differences due to the upward diffusion of deep seated brines (density-driven flow). Hydrogeology was considered in assessing alternatives.

Challenges exist in managing lake basins having a talik and in mining below the permafrost where groundwater can be expected. The salinity level of the deep groundwater in the Project area is anticipated to be elevated, which is expected to result in a freezing point depression of up to 3.3°C[4]. This suggests that the depth of frozen ground may be less than the depth of ground with temperatures continuously below 0°C as ground between 0°C and -3.3°C is likely unfrozen in the presence of saline groundwater.

3.2 Logistical Challenges – Shipping Season

The shipping season for delivering fuel and dry good to Itivia in Rankin Inlet is limited from late July to late October. During this time window, all dry cargo and fuel must be transported by sea for a full year of mine operations. After the close of the shipping season, air freight is the only means of receiving emergency supplies, and this is can be inordinately expensive. Planning is of utmost importance as contingencies must be considered in deciding the quantity of consumable materials required over the coming year, and ensuring that replacement parts or equipment are present on site. The store of consumable materials, machine and equipment parts will exceed that of southern mines. This in part places an “Arctic premium” on operating a mine in the Arctic where comparable costs are much higher.

Logistics were considered in assessing alternatives.

[4] See Section 7.2 of Volume 7 – Hydrogeology and Groundwater.

SECTION 4 • METHOD OF ASSESSING PROJECT ALTERNATIVES

The Meliadine Project needs to be technically, economically, environmentally, and socially viable if it is to proceed. Alternatives to Project components and activities were assessed using the following criteria: technical feasibility, economic viability, environmental acceptability, community preference, social acceptability, and reclamation and closure. Select mine components could be constructed in different locations or operated differently. Activities can be completed or achieved in different ways. This led to alternatives being evaluated and rated using the criteria. The alternative with the most favorable ratings was preferred among those considered. The approach recognises that community preferences are important, and positive and negative effects on Valued Ecosystem Components (VECs) and Valued Socio-Economic Components (VSECs) have to be carefully weighed in selecting the preferred alternative. In this process, due consideration was given to the vulnerability of the Arctic ecosystem, to the potential for extension of the mine life, to reclamation and closure, and to the potential for cumulative effects. The temporal boundaries of the various alternatives considered do not differ significantly, and therefore, varying temporal boundaries was a non-differentiating factor and was not considered further in the evaluation of Project alternatives.

Alternatives that were not technically feasible because of key constraints were not considered, an example being one centralized waste rock storage facility for all open pits. Similarly, if an alternative was deemed not economically viable, it also was not considered; such instances arose when capital and/or operating costs were prohibitive. This ensured that only viable technical and economic alternatives were given due consideration before the preferred alternative was selected.

Consideration of environmental, community, socio-economic, and reclamation and closure criteria was necessary in assessing each alternative. Baseline data collection for the Meliadine Project has been extensive and impact assessments are provided in the EIS and related supporting documents. Professional judgement was used to score the criteria leading to the selection of the preferred alternatives described in Table 4-1.

The alternatives for tailings storage were assessed using multiple accounts analysis methodology favoured by Environment Canada (2011). This methodology allows for an unbiased assessment of all tailings management options. This assessment is presented in detail in a separate report[5] and only a summary is presented here.

Potential interactions with other past, present and reasonably foreseeable developments in the local and/or regional study area were also considered in selecting preferred alternatives. Particular attention was paid to the potential for cumulative effects on traditional activities. Nevertheless, it was commonly found that all alternatives for the same mine component had the same potential for cumulative effects. As well, not every mine component required an analysis of the potential for

[5] SD 2-2 Tailings Alternatives Assessment Report

cumulative effects due to an absence of potential interactions. The potential for cumulative effects in these two cases did not have a significant bearing in the selection process of the preferred alternative. Where the potential for cumulative effects did enter in the alternatives assessment was when different alternatives for the same mine component had markedly different potentials for cumulative effects. Only under this circumstance did the potential for cumulative effects have a bearing on the selection of the preferred alternative. Upon completing the assessments, the conclusion was reached that for the alternatives assessed, the potential for cumulative effects in the local and/or regional study was absent to inconsequential for most alternatives considered.

4.1 Technical Feasibility

Technical feasibility assesses the alternatives from an engineering and operational perspective. It is based largely based on a detailed feasibility study carried out by AEM to determine if the gold resource can be technically and economically mined. In this, engineering and operational options were assessed with an emphasis on the known performance of employees, machinery and vehicles reliability operating together. AEM built on experience from the Meadowbank in designing the mine infrastructure, and selecting machinery and vehicles that proved capable of withstanding Arctic conditions and demands of mining. Rankings of technical feasibility are described as follows[6]:

- “2” is the preferred alternative. The operational efficiency in the Arctic and reliability based on Meadowbank’s experiences are technically effective and reliable with manageable contingencies. This alternative will provide superior service to the Project;
- “1” represents the next best acceptable alternative. It is in part based on engineering and operational aspects but without a proven Arctic record, on experiences elsewhere or modelling/theoretical results. Contingencies are available if the alternative does not perform as expected; and
- “0” represents an unacceptable technical option. The effectiveness appears uncertain or unproven and relies on unproven feasibility.

4.2 Economic Viability

Economic viability relates to the economic benefits that can be gained from Project components and activities less the costs of capital, operation and maintenance, and reclamation and closure. This criterion evaluates the costs and pay back of alternatives, from design to closure. If benefits exceed costs, the alternative rates favourably. The alternative with the best cost/benefit would rate most favourably. Ranking were determined as follows:

- “2” is the preferred alternative which will yield the most favourable return on investment for the investor and benefits for Inuit and businesses in Nunavut;

[6] AEM opted to use the rankings developed by Baffinlands Mary River Project with some modifications (Baffinlands 2010).

- "1" represents an acceptable alternative, which can be supported by the Project, but will result in a lower profitability and fewer benefits; and
- "0" represents an unacceptable alternative in terms of return on investment and, therefore, cannot be supported by the Project as currently defined.

4.3 Environmental Acceptability

Environment in this instance encompasses only the natural environment, with due consideration given to the vulnerability of the Arctic ecosystem, and technical and logistical challenges from operating in the Arctic.

The environmental effects of the preferred technical and economic alternatives need also to be considered as part of the alternative selection process. Preferred technical feasibility and economic viable alternatives can have either positive, neutral or negative effects on the environment. Effects on VECs are evaluated. Some negative effects will be mitigable while others will have residual effects that cannot be fully mitigated. The latter is to be avoided if at all possible, especially if the residual effects are significant and long-term.

The potential environmental effects and ensuing residual effects are ranked as follows:

- "2" represents the alternative that has the least impact on the environment with no mitigation being required;
- "1" represents an acceptable alternative which minimizes adverse impacts to the environment with mitigation and no residual effects, and
- "0" represents an alternative that is the least environmentally acceptable due to severity of impacts and residual effects.

4.4 Community Preference

This criterion is based on preferences voiced in consultation with the general public, hamlet councils, Inuit organizations, business community, and government. These preferences tend to be mentioned at more than one consultation venue, thereby reinforcing the preferred alternative.

Community preference alternatives are ranked as follows:

- "2" represents the option that is deemed to be the "preferred option" by one or more stakeholders, meaning a clear preference for a given alternative is voiced;
- "1" represents an option that is acceptable. Little to no indication of preference has been received from one or more stakeholders, or a balance of perspectives has been heard on a given alternative, and
- "0" represents an option that is the least acceptable or completely unacceptable, meaning substantial opposition has been expressed by most or all stakeholders.

AEM paid particular attention to the Rankin Inlet and Chesterfield Inlet preferences and tried to meet them wherever possible. The community of Rankin Inlet, which is closest to the Meliadine Project, voiced strong preferences in some instances. The community and its businesses are quite entrepreneurial and want to maximize social and business benefits to the hamlet.

4.5 Social Acceptability

With respect to enhancing socio-economic effects, it is recognized that some alternatives may provide tangible benefits to local communities and the region. As a result, both positive and negative effects were considered for this criterion. Rankings are as follows:

- “2” indicates the preferred alternative which provides the most socio-economic benefit and fewest negative impacts in relation to the other alternatives;
- “1” indicates the next best alternative, which provides fewer socio-economic benefits and possibly more negative impacts than the preferred alternative; and
- “0” represents an alternative having significant negative socio-economic effects and few to no benefits thereby making it the least acceptable or completely unacceptable.

4.6 Reclamation and Closure

Reclamation objectives are to minimize negative environmental effects of mining wherever practicable, to practice progressive reclamation, and when mining operations are closed, return areas that have been negatively affected to productive and lasting use by wildlife and humans. Reclaimed areas should be chemically and physically stable, and should ultimately support the same functions as the surrounding, undisturbed land. Because of the proximity of the mine site to Rankin Inlet, particular attention will be paid to ensuring that reclaimed areas are safe for future traditional use.

Project components to be reclaimed include those that change the landscape (e.g. waste rock storage facilities, roads, tailings storage facility, portals) or infrastructure that was built and needs to be dismantled and removed (e.g. accommodations complex, conveyors, tank farms). All components of the Meliadine Project will be reclaimed and closed at the end of mine life or through progressive reclamation. Long-term considerations entered into the decision as these have the potential for cumulative effects on reasonably foreseeable developments in the regional study area.

This criterion relates to the reclamation and closure of various components through progressive reclamation and at the end of mine life. Alternatives are ranked against this criterion as follows:

- “2” is the preferred alternative where reclamation and closure is technically assured at low costs and enhanced effectiveness;
- “1” is the alternative which requires moderate to extensive reclamation within tolerable limits of effort, reliability and effectiveness, and

- "0" is an alternative which requires reclamation that is not practical, feasible or requiring perpetual maintenance.

4.7 Overall Rating

The six criteria were individually ranked with scores tabulated to give an overall rating. Professional judgement was used, largely based on experience from other mining developments, in particular Meadowbank. As mentioned before, AEM did not score alternatives that were not technically feasible or economically viable.

Some alternatives were easily selected as they rated highest under all criteria. Other alternatives had mixed results with high scores in some criteria and low scores in others. The alternative with the highest score was determined to be the preferable alternative. However, community preference received particular attention and, in some cases, overrode all other criteria. This resulted in some preferred alternatives with high technical and economical ranking to be rejected in favour of community preference. Table 4-1 presents the six criteria, the alternatives to mine components and activities, scores and overall rating.

Table 4-1 Rating of Alternatives

Alternative	Technical Feasibility		Economic Viability		Environmental Acceptability		Community Preference		Social Acceptability		Reclamation and Closure		Overall Ranking	
Shipping Route for Fuel and Dry Cargo														
Shipping from Quebec	Technically feasible.	2	Most cost effective.	2	Proper shipping should lead to no environmental impact. Marine mammals in Hudson Strait a community concern.	1	Disturbance of marine mammals a concern expressed by Coral Harbour, especially with winter shipping.	1	Same benefits for both options. Jobs at Itivia unloading barges and ships.	1	Not applicable (N/A)	-	7	Most dry cargo and fuel will originate from eastern ports.
Shipping from Churchill	Technically feasible but involves extra shipment by rail to reach Churchill.	1	Least cost effective.	1	Proper shipping should lead to no environmental impact. Rail transport to Churchill could lead to increased spill frequency.	2	No community preference voiced.	-	Same benefits for both options. Jobs at Itivia unloading barges and ships.	1	N/A	-	5	Requires rail transport to Churchill. More expensive, higher risk of fuel spills due to rail transport.
Port Facilities														
Use Itivia as a port area to fulfill marine shipping needs for the Project	Technically feasible. Involves installing a spud barge to act as a docking-reception area. Flexible installation.	2	Capital costs for installing the spud barge. Operation and maintenance costs to operate the spud barge.	2	Environmental impacts and mitigations discussed in the current EIS. Spud barge allows for minimal disturbance.	2	Itivia already used by the community to access Hudson Bay. Potential conflicts and mitigations discussed in current EIS.	1	Itivia already used by the community to access Hudson Bay. Potential conflicts and mitigations discussed in current EIS. General acceptance.	1	Remove the spuds only. Easy to reclaim.	2	10	Preferred alternative. More flexibility, less potential impact on the environment.
Use a private port to fulfill marine shipping needs for the Project	Technically feasible. No private port currently available in the area of Rankin Inlet. Would require a private partner to complete the Project.	1	Would pay port owner to use the installation. No capital cost involved (unless AEM partners for the construction of the port).	2	Depends on the area where the private port would be installed and type of infrastructure. Anticipated permanent and fixed. Would require environmental impact assessment (by others).	0	Community interested in seeing a private port developed in the area.	2	Community support, so anticipate social acceptability.	2	Permanent installations that may need more effort at reclamation. Would probably leave in place after the Project.	0	7	Requires third party to complete the Project. Constraints with time and uncertainties.
Use of the Rankin Inlet Airport														
Use the Rankin Inlet airport for AEM employees and air freight	Existing facility has long, wide paved runway and aprons to accommodate several planes at once.	2	No capital costs for AEM. Costs associated with transportation (25 km) to and from the airport.	2	Greater emissions in driving 25 km to and from site to airport.	2	Community preferred that AEM use the Rankin Inlet airport.	2	Offers greater business opportunities.	2	No reclamation required and no cumulative effects.	2	12	Preferred alternative technically and economically. Also preferred by community and local businesses.
Build an airstrip at the Meliadine site for AEM's sole use	Technically feasible with gravel strip. Limits planes that can land.	1	Capital cost of building gravel airstrip and operating it for life of mine.	1	Ten (10) hectares of land would be disturbed and need to be reclaimed.	1	Not preferred by the community.	0	Limited business opportunities.	1	Ten (10) hectares of land to be reclaimed and all infrastructure removed.	1	5	Not the preferred alternative. Not preferred by community.
Community Bypass Road														
No bypass road; employees, freight and fuel passes through hamlet	N/A	2	No cost; use existing roads through community.	2	No impacts on the natural environment.	2	Community rejected this option. Too much traffic in hamlet - noise, dust safety concerns.	0	Not acceptable, too much noise, traffic and dust in the hamlet combined with safety concerns.	0	No road to reclaim.	2	8	Best option economically; not acceptable to community.
Bypass road skirts the hamlet	Technically feasible.	2	Economically viable.	1	Most impacts from new road can be mitigated. Increased noise in hamlet not mitigable.	1	This option will restrict future expansion of the hamlet and increase noise in hamlet.	1	Acceptable today but not in the future. Noise and possibly dust impacts the community. Some safety concerns remain.	1	Shorter road to reclaim, scarify and remove culverts.	1	7	Restricts future expansion of community, not acceptable to GN and hamlet.

Alternative	Technical Feasibility		Economic Viability		Environmental Acceptability		Community Preference		Social Acceptability		Reclamation and Closure		Overall Ranking	
Bypass road furthest removed from hamlet and longest	Technically feasible.	2	Economically viable but most expensive to build due to the length of the road.	1	Longest road with impacts being mitigated, least noise and dust in hamlet, more emissions, close to Nippisar Lake.	1	Preferred option selected by the community.	2	Noise from traffic not heard in the community.	2	Longest road to reclaim, scarify and remove culverts; or third party assumes responsibility for it and it not reclaimed.	1	9	Alternative preferred by the community. Best alternative from a safety perspective.
Location of Mill Complex and Associated Infrastructure														
Inland 700 m southwest of the present advanced exploration site	Technically feasible; bedrock close to the surface simplifying construction.	2	Not economically viable as condemnation drilling found mineralization under the site.	0	Not rated	-	Not rated	-	Not rated	-	Not rated	-	-	Not rated
Inland 1 km NW of the present advanced exploration camp	Technically feasible but has poor drainage. Piles will be used for all construction.	1	Economically viable; condemnation drilling did not reveal mineralization under the site.	2	Design of the mine infrastructure led to the control of all surface water.	2	Archaeological sites needed to be mitigated.	1	Mine infrastructure is largely behind an esker and not visible from Meliadine Lake.	1	The layout of mine infrastructure is compact thereby reducing the area to be reclaimed.	2	9	Preferred option controls potential environmental effects and does not condemn any mineralization.
All -weather Access Road														
Restricted road use by public	Same road will be built for both alternatives.	2	Economically viable; gate close to hamlet would have to be manned.	1	Restricted access will result in less traffic, less emissions, and possibly less dust.	2	Not acceptable to community.	0	Limits public access to traditional areas north of Rankin Inlet. Road covers existing ATV trails.	0	Reclamation of road the same for both options.	2	7	A road with restricted access was unacceptable to the community.
Unrestricted road use by the public	Same road will be built for both alternatives.	2	Economically viable; no manned gate close to the hamlet.	2	More traffic on the road with increased emissions and possibly more dust.	1	Community wants open access.	2	Unrestricted access to Meliadine Lake and other traditional areas. Safe use of the road remains a concern.	2	Reclamation of road the same for both options.	2	11	Community preferred an open access road.
Location of Tank Farm														
Next to Community Tank Farm	Technically feasible.	1	Economically viable but separate from laydown and sea can storage.	1	Next to existing tank farm, spill risk in community from tanker trucks.	1	Tanker trucks will drive through the hamlet; not acceptable.	0	Not acceptable due to noise, traffic, congestion, dust and public safety.	0	Remove tanks and reclaim lined, bermed areas.	2	5	Not preferred by community due to increased traffic in hamlet.
Itivia (also the location where dry cargo will be off-loaded from ships - sea can storage, laydown yard, spud barge)	Technically feasible.	2	Economically viable; centralizes all AEM infrastructure in one location.	2	Uses 14 hectares of previously disturbed land for all infrastructure.	2	Fuel delivery tankers would bypass the community; less noise, dust, and traffic in hamlet.	2	Community preferred alternative.	2	Remove tanks and reclaim lined, bermed areas, scarify laydown.	1	11	Preferred option as it centralises all mine components in one convenient location.
Power Generation (diesel generators were selected for power generation)[7]														
Power plant at Meliadine site	Technically feasible.	2	Economically viable; lowest capital cost.	2	More emissions in transporting fuel to site for power generation. Positive effect as no transmission line to be built and no use of fuel for heating buildings.	2	No community preference.	-	On-site operation and maintenance of power plant leading to specialized employment.	1	Dismantle power plant and building. Remove from site.	2	9	Preferred alternative technically and economically.

[7] The use of liquefied natural gas (LNG) remains under review but heavy fuel oil were rejected due to economic and technical considerations.

Alternative	Technical Feasibility		Economic Viability		Environmental Acceptability		Community Preference		Social Acceptability		Reclamation and Closure		Overall Ranking	
Power site in Rankin Inlet	Technically feasible.	1	Economically viable; highest capital cost. Require transmission line and boiler on site for heat and hot water.	1	Would require boiler on site for heat and hot water and a transmission line from Rankin Inlet to Meliadine site.	1	No community preference noted but GN supported this alternative.	-	Supported by GN as Rankin Inlet power plant needs major upgrading. Supply power to both site and hamlet.	1	Power plant would remain providing purchase by GN. Remove transmission line.	1	5	More environmental impacts due to transmission line and emissions from boiler installed on-site for heating building and hot water.
Power plant split between site and Rankin Inlet	Technically feasible.	1	Economically viable; capital cost in-between other two first alternatives.	1	Could require boiler on site for heat. Transmission line required.	1	No community preference.	-	Supported by government as Rankin Inlet power plant needs major upgrading. Supply power to both site and hamlet.	1	Dismantle power plant at site and leave one in Rankin Inlet providing GN willing to purchase power plant. Remove transmission line.	1	5	Requires a transmission line between Rankin Inlet and site. Lower emissions in transporting fuel to site.
Wind energy combined with power plant	Technically feasible with additional research.	1	Higher capital cost as wind cannot be used for base load. Still need 30 MW power plant. Risk factor in using technology in Kivalliq.	1	Savings in diesel fuel only. Effects on birds and from noise need to be assessed (area has high density of peregrine falcons).	1	No community preference. Consultation on wind turbines has not been undertaken.	-	Operations and maintenance of both the power plant and wind turbines would lead to more specialized employment (more jobs).	2	Wind turbines and power plant would need to be dismantled and road to wind turbines reclaimed.	1	6	Wind alone cannot be used for power. Still requires 30 MW power plant for base load.
Solar, hydroelectric, thermal	Not technically feasible.	0	Not economically viable.	0	Not rated	-	Not rated	-	Not rated	-	Not rated		-	Not rated
Location of Tailings Storage Facility (the form of tailings will be thickened slurry as it can be pumped while filtered tailings needs to be transported to the TSF by truck)														
Drainage basin B7 near mill	Technically feasible.	2	Economically viable; less cost in reclamation as nearby source of waste rock/overburden to cover Tailing Storage Facility (TSF).	2	Location is at the top of the watershed, no diversion of water. Close to mill, less risk of tailings spill.	2	Keep the TSF away from Meliadine Lake.	1	Keeps visibility low from Meliadine Lake. No social benefits advantages.	2	Stabilize slopes surrounding the TSF, blend with local topography, cover with 3 m of waste rock/overburden.	2	11	Preferred option based on distance from the mill and topography. Cumulative effects less than for other alternatives.
Drainage basin B4 further from mill than B7	Technically feasible but conflicts with location of waste rock storage facility for Pump and Wesmeg open pits.	1	Economically viable but longer pipeline, higher capital and operating costs.	1	Diversion of water needed around TSF. Further distance from mill, more risk of tailings spill.	1	Keep the TSF away from Meliadine Lake.	1	Keeps visibility low from Meliadine Lake. No social advantages.	2	Similar reclamation as B7. Transportation costs of cover material higher.	1	7	Second choice but requires relocation of a preferred waste rock storage facility.
On-land OL5, furthest from mill	Technically feasible.	1	Economically viable but longest pipeline, higher capital and operating costs.	1	Furthest from mill, highest risk of tailings spill due to length of pipeline.	1	Keep the TSF away from Meliadine Lake. This option is close to Meliadine Lake.	0	Close to Meliadine Lake and most visible. No social advantages.	1	Similar reclamation as B7. Transportation costs of cover material higher.	1	5	Is technically and economically acceptable but has higher operating costs and environmental risks.
Waste Rock Storage Alternatives														
Five (5) waste rock storage facilities (WRSF) for Tiriganiaq, Wesmeg, F Zone, Pump and Discovery ore deposits	Technically feasible. Space available to accept waste rock/overburden from multiple open pits.	2	Waste rock storage facilities that have a shorter access route will result in lower operating costs.	2	Has less potential to affect the environment as shorter transportation routes and avoids lakes/ponds wherever possible.	2	Keep the waste rock away from Meliadine Lake. Do not want impacts on the lake.	2	Measures the potential that the site interferes with traditional, recreational, and tourist activities in the area.	1	Minimize erosion, thaw settlement, slope failure, collapse and/or the release of contaminants or sediments. Blend in with current topography.	2	11	Due to the distance between the mining areas, five (5) WRSF are required.

Alternative	Technical Feasibility		Economic Viability		Environmental Acceptability		Community Preference		Social Acceptability		Reclamation and Closure		Overall Ranking	
One centralized WRSF for Tiriganiaq, Wesmeg, F Zone and Pump	Not technically feasible.	0	Higher costs in transportation of waste rock and overburden.	-	Longer transportation distances; more lakes and ponds likely affected.	-	Keep the waste rock away from Meliadine Lake. Do not want impacts on the lake.	-	Not rated	-	Not rated, not technically feasible.	-	-	Not rated, not technically feasible.
Salt Water Management														
Discharge to ocean (concentrated or not)	Technically feasible, by pipeline or truck (if concentrated).	2	Economically viable.	2	Need good diffusion at effluent discharge to mitigate impact on marine environment. Would require further impact assessment.	1	No community preference; further consultation required.	1	Represents increased trucking or a pipeline infrastructure (booster pumps).	1	Remove infrastructure.	2	9	Would need more investigation (social, community, environmental impacts, etc.).
Treat, temporarily store concentrated brine on site and pump back into underground voids	Technically feasible. Evaporators could decrease the volume to be managed.	1	Economically viable.	2	Similar water quality returned underground to what would be pumped out, so minimal impact expected.	2	Further consultation required but anticipated to be the preferred option.	2	Infrastructure on site only. Storage requirements to be confirmed.	2	Pump brine into underground voids and remove WTP-DESAL.	2	11	Preferred alternative pending confirmation of storage availability.
Hiring Point for Workers														
Hire from Kivalliq and southern Canada	Technically feasible.	2	Economically viable with flights from Kivalliq communities and charter flights from south.	2	Greenhouse gas emissions expected to be higher.	1	Preferred option selected by the community.	2	Benefits accrue to employees, Inuit organizations, Kivalliq and Nunavut.	2	No reclamation required.	2	11	Preferred alternative.
No local hires in Kivalliq	Technically feasible.	2	Economically viable with charter flights from the south.	2	Greenhouse gas emissions expected to be lower.	2	Rejected by communities, KIA and government.	0	No benefits to Kivalliq and Nunavut.	0	No reclamation required.	2	8	Rejected by community, KIA and GN. All want local employment.
Backfilling of Selected Open Pits with Waste Rock														
No backfilling of open pits	Technically feasible; all waste rock is placed in a WRSF.	2	Economically viable.	1	Pits will need to be flooded upon closure.	1	No community preference; further consultation required.	1	Takes longer to flood the pits with water, longer period of employment at closure.	1	The flooded pits will be deep and will provide less high quality fish habitat.	1	7	Reclaims open pits to deep lakes.
Backfilling of selected pits to reduce waste rock storage on surface and create fish habitat	Technically feasible if there is no potential for underground mining below the open pit.	1	Economically viable; less waste rock stored on surface and less water required to flood pit.	2	Filling pits with waste rock to within 20 m of the top will create fish habitat and have less waste rock stored on surface. Less water used in flooding the pit.	2	Community supports the backfilling of pits to create fish habitat but wonder about the quality of the fish.	2	Creates high quality fish habitat that is deep enough for fish to overwinter. Replaces lakes that were lost and leads to more fish production.	2	Creates high quality fish habitat that is deep enough for fish to overwinter which could lead to more fish production. Replaces lakes that were lost to allow Project development.	2	11	If possible, the backfilling of pits would be beneficial to fish habitat.
Waste Management - Disposal of Sewage Sludge														
Used as a soil amendment in progressive reclamation	Technically feasible but there is a health risk.	1	Economically viable but will require special handling.	1	Useful in reclaiming disturbed land.	2	No community preference.	1	Special handling required as sewage sludge carries health risks.	1	Sustainable use of sewage sludge.	2	8	Possible but requires acceptance of the use of sewage sludge as a soil amendment in reclamation. Consultation required.

Alternative	Technical Feasibility		Economic Viability		Environmental Acceptability		Community Preference		Social Acceptability		Reclamation and Closure		Overall Ranking	
Disposed along with tailings in the TSF	Technically feasible.	2	Most cost effective.	2	The sewage sludge would be a minor addition to the tailings (in volume). Could influence overall TSF chemistry.	1	No community preference.	1	No benefits expected.	1	Alongside the tailings, the sewage sludge would be covered with 3 m of waste rock and below the permafrost active zone.	1	8	Simple and avoids special handling, but may complicate TSF chemistry.
Burned in the incinerator	Technically feasible.	2	Additional fuel costs to incinerate the sewage sludge, but heat recycled. Requires special handling.	2	Increased air emissions in burning the sludge.	1	No community preference.	1	Handling sewage sludge carries health risks.	1	Ash would be buried in the on-site landfill.	1	8	Preferred alternative.
Alternatives to using Cyanide in the Mill Process														
Use cyanide (CN) in the mill process	Technically feasible.	2	Cyanide has the lowest cost of chemicals considered.	2	Safety concerns with cyanide well controlled. Destruction of CN in tailings before being pumped to TSF.	2	Concerns were voiced with the use of CN.	1	Same benefits for both options.	2	CN is destroyed before tailings sent to TSF. Residual trace CN will naturally degrade in the TSF.	2	11	Preferred alternative. CN is commonly used at most gold mines around the world.
Use other chemicals in the mill process	Not technically feasible as different chemicals have not been tested.	0	Reagent costs using other chemicals is prohibitive.	0	Chlorine - chloride was used to 1989 to be replaced by CN; Thiosulfate and Thiourea are experimental.	-	No community preference.	-	Same benefits for both options.	-	Destruction of different chemicals not well known in an Arctic environment.	-	-	Not rated
Form of Tailings														
Thickened tailings - up to 65 % solids	Technically feasible; tailings can be pumped via pipeline to TSF. AEM is familiar with this technology.	2	Economically viable. Higher capital costs as tailing containment structures and pipeline necessary; lower operating costs.	2	A pipeline has a lower risk of spills than trucking of tailings.	2	No community preference.	-	More construction jobs in building dikes and pipeline.	1	Tailings are to be covered with at least 3 m of waste rock.	2	9	Thickened tailings pumped to the TSF is the preferred alternative. AEM is familiar with this technology.
Filtered tailings - up to 85 % solids	Technically feasible with tailings being trucked to TSF. AEM not familiar with technology and is exploring the use of this technology.	1	Economically viable. Lower capital costs; higher operating costs.	1	Trucking can lead to dust outside the TSF, interruptions in tailings deposition due to weather, more risk of spills. More trucks on the road (emissions, accidents).	1	No community preference.	-	More positions for truck drivers during operations.	1	Tailings are to be covered with at least 3 m of waste rock	2	6	Filtered tailings is possible but has a higher risk in mill shutdowns. AEM not familiar with technology.
Road Options to Discovery Gold Deposit (the feasibility of the options remains to be investigated)														
All-weather haul road combined with access road to allow year-round trucking of ore from Discovery to the process plant	Technically feasible. Traffic on the haul road would be separated from traffic on the access road by a safety berm.	2	Higher capital cost in building the road and lower operating costs due to year round use.	2	Ore is largely fed directly to the mill. Geochemistry of Discovery deposit supports immediate transport and processing of ore. One road corridor thereby limiting environmental effects.	2	The community wants access to Meliadine Lake during the summer to access cottages, camps and to go fishing and hunting. They will be able to do so on the spur road.	2	Year round employment in transporting ore to the mill.	2	The road would need to be reclaimed.	1	11	An all-weather road is the preferred alternative.

Alternative	Technical Feasibility		Economic Viability		Environmental Acceptability		Community Preference		Social Acceptability		Reclamation and Closure		Overall Ranking	
An all-weather haul road independent of the access road to truck ore from Discovery to the process plant	Technically feasible. The length of the road would be shortened a little by taking a more direct route to Discovery. No safety berm required over its entire route.	2	Higher capital cost in building the road and lower operating costs due to year round use.	2	Ore is largely fed directly to the mill. A separate road route independent of the access road would disturb more surface area.	0	The community wants access to Meliadine Lake during the summer to access cottages, camps and to go fishing and hunting. They will be able to do so on the spur road.	2	Year round employment in transporting ore to the mill.	2	The road would need to be reclaimed.	1	9	A haul road independent of the access road would disturb more surface area and is thus less desirable. This option was rejected on overall score and on potential increased environmental effects.
Winter road with Discovery ore being transported to ore pads and mill during the time the winter road is in operations	Technically feasible but the winter road would need to be built every year mining is ongoing at Discovery.	1	Lower capital cost but higher operating costs.	1	Less dust.	1	The community wants access to Meliadine Lake during the summer to access cottages, camps and to go fishing and fishing. They will be able to do so on the spur road.	2	Winter work only in transporting ore to ore main mine site.	1	Very little reclamation.	2	8	A winter road is not preferred as it does not provide year round employment in transporting ore from Discovery to the mill.

4.8 No-Go Alternative

There always remains the possibility that the Project as planned will not proceed to development. Various reasons could be that it is not technically feasible, the Project will fail to make a profit, major environmental effects could not be mitigated, or the Project is not socially acceptable to Inuit and/or government. The Project could also be delayed due to unforeseen circumstances.

Currently, Kivalliq offers limited, and usually seasonal, employment opportunities. The population is predominately young with a high level of unemployment. Elders have stated that the young must find jobs in the wage economy as they will not be able to live off the land as Inuit did earlier. The proposed mine has the potential to offer year-round employment to interested Nunavummiut in Kivalliq. Benefits will accrue to Inuit from the IIBA, and also from royalties paid to NTI over the operating life of the mine.

Many of the policies and strategies for Nunavut speak to self-reliance and improved quality of life as drivers for economic development that requires both the protection and use of renewable resources balanced with the development of non-renewable resources. Sustainable development of the Meliadine Project will contribute to the economic development of Nunavut in ways that support self-reliant communities. It will reduce dependence on government without compromising the health of the people or the land through the creation of stable private sector employment that will contribute to a better standard of living for the residents of Kivalliq as well as reducing dependence on social assistance programs. The Project will lend support to the vision and contribute to the goals of Inuit Beneficiaries of Nunavut as expressed by NTI and KIA. It will also contribute to the vision and goals for a more self-reliant Nunavut for all Nunavummiut as projected by the Government of Nunavut in its published objectives and strategies. The Project will also contribute to the economic vision of a more self-reliant Nunavut as a key contributor to the future economic well-being of Canada as projected by the Government of Canada (GN 2007, GN 2009).

The NLCA states that the purpose of IOL is to "…promote economic self-sufficiency of Inuit through time, in a manner consistent with Inuit societal and cultural needs and aspirations (NLCA 17.1.1) and this economic self-sufficiency will be obtained through balanced economic development and selection of IOL that holds value both for renewable resources and the development of non-renewable resources (NLCA 17.1.2 and 17.1.3)". Approximately 90 % of all IOL identified in the NLCA is IOL-Surface lands in which Inuit organizations administer surface rights only. The remaining IOL is designated to have both surface and subsurface (mineral) rights administered by Inuit organizations. All five of the deposits included within the proposed Meliadine Project are located on IOL where the surface rights and subsurface mineral rights are administered for the benefit of Inuit Beneficiaries by Inuit organizations, KIA and NTI, respectively.

The Government of Nunavut describes the vision for Nunavut to the year 2030 and lists an improved standard of living; active, healthy and happy individuals and families; self-reliant communities with strong Inuit societal values and recognition for Nunavut's unique culture. Nunavut's economic and social development plans focus on the economic sectors that can provide the most growth and employment potential, without harming the environment. These sectors are mining, tourism (and arts and crafts) and commercial fishing (GN 2007).

To forgo the development of the Meliadine Project would mean abandoning forthcoming benefits and revenue stream to NTI and KIA, from direct taxes paid to hamlet, territorial and federal governments, personal income tax and sales tax from employment. The policies and strategies of Government and Inuit organizations will not easily be met in Kivalliq and Nunavut. Continued underemployment and limited opportunities for young members of society is likely to lead to increased social stress.

SECTION 5 • MAJOR ALTERNATIVES WITHIN THE PROJECT

5.1 Shipping Alternatives

5.1.1 Shipping Fuel and Dry Cargo from the South to Rankin Inlet

AEM gained extensive experience in shipping fuel and dry cargo to the Meadowbank Gold Mine since its construction began in 2008 and commercial production in 2010. Similar shipping and lightering procedures developed and in use for the Meadowbank Gold Mine will be employed for the proposed Meliadine Project. All shipping for the Meliadine Project will be carried out during the open water summer season when Hudson Bay is free of ice cover. There will not be any ice breaking to extend the shipping season[8].

The priorities in shipping dry cargo and fuel will be:

- The protection of the crews life and others in small boats that the ship may come across;
- The protection of the marine environment; and
- The preservation of the ship and its cargo.

A total of approximately 40,000 tonnes of dry cargo and 122 million litres of diesel fuel will be required annually for the operations of the Meliadine Project. All shipping will follow established shipping lanes that are presently in use for the annual sea lift to Rankin Inlet and other communities.

Annually, a total of 4 to 6 vessels will deliver dry cargo, and 4 to 6 tankers, diesel fuel. These will provide equipment, supplies and fuel for a full year of Project operation. All ships, tugs and tankers will have electronic navigation aids to provide safety in transit, reduce the risk of accidents, and remain within established sea lanes. Navigation along the coast of Labrador, Hudson Strait and Hudson Bay is routinely conducted during the open water season and is not expected to present any new challenges for this Project. As current practices dictate, once ships approach the offshore islands and reefs near Rankin Inlet, the ship's speed will be slowed to navigate the shipping lane to its anchor point outside Melvin Bay. Land-based navigational markers are located on islands along the shipping lanes near Rankin Inlet. The route does not pose any significant hazards and can be carried out without pilotage. Ships will not be serviced in Rankin Inlet and will arrive with enough fuel for the return voyage south.

The marine transport of fuel and dry cargo will be comprised of four main segments, all within established shipping lanes:

- Bécancour, Québec and/or other eastern sea ports, along the coast of Labrador to the Hudson Strait;

[8] See SD 8-1 Shipping Management Plan for more details.

- Through Hudson Strait to Hudson Bay;
- Across Hudson Bay to Marble Island, this being approximately 40 km offshore from Rankin Inlet; and
- From Marble Island to the barrier islands, through the islands to an anchoring point outside the access passage to Itivia where AEM will maintain a laydown yard, sea can storage and tank farm.

The alternative use of the port of Churchill was contemplated but it did not have significant economic benefits for AEM. All fuel for the Project originates from east coast refineries. Although fuel could be transported to Churchill in rail tankers, the cost would be higher, and environmental risks would increase due to the increased handling. The vast majority of dry cargo for the Meliadine site originate in Québec making the port of Bécancour the preferred southern port based on convenience and economics.

Social benefits and impacts would not vary in using either Bécancour or Churchill.

Potential cumulative effects are different for the two routes. Hudson Strait is a migration route for whale populations in Hudson Bay, including belugas, narwhals, and bowheads. Increased shipping traffic through Hudson Strait by all developments has the potential for cumulative effects on all species of marine mammals that may be resident there for some portion of the year or year round. This concern extends to the areas between Southampton Island and Coats Island. The major concern remains with shipping that occurs in the fall as this is when many whale species are migrating out of Hudson Bay via Hudson Strait. Any winter traffic that involves ice-breaking could impact marine mammals resident in Hudson Strait over the winter. As shipping by AEM does not involve icebreaking, the potential for cumulative effects would be significantly less than those developments shipping year round.

The route from Churchill is shorter and does not pass through Hudson Strait where there is a potential for cumulative effects. There is, however, potential for cumulative effects on beluga whales that frequent estuaries near Churchill should dry cargo and possibly fuel originate from this port.

The Bécancour route scored higher in most criteria and remains the preferred alternative.

5.1.2 Port Facilities

The Project will require cargo and fuel to be transported to Rankin Inlet by sea, and two alternatives were considered with reference to port facilities.

The Itivia area, near Rankin Inlet, is already used by the community as an area to dock boats and access Hudson Bay. The physical configuration of the area (in a bay), and its location near the airport land, make it a good alternative to install and operate a spud barge for the Project. A spud barge installation was preferred over a permanent dock because of the current usage of the area, and considering potential impacts to the marine environment. A spud barge installation is used in Baker Lake for providing marine shipping services to the Meadowbank Mine, and it has proven to be efficient and easy to operate. The spud barge necessitates initial capital cost to install the spuds and to buy the barge. Operational and maintenance costs are minimal. Potential impacts were considered during the current EIS and mitigation measures developed.

In January of 2014, the Rankin Inlet Harbour Corporation submitted a Request for Proposal to develop a deep sea port facility near Rankin Inlet. The port would likely require dredging and would include a pipeline system linked to fuel tanks farms. The deep sea port would eliminate the need for a spud barge and the ship-to-ship transfer of fuel and dry cargo in deeper waters outside of Melvin Bay. The activity of smaller cargo vessels in Melvin Bay would also be reduced but would bring larger barges, freighters, and fuel tankers into Melvin Bay. While this option might have been a viable alternative for AEM should the facilities have been already in place, the timeframe and capital expenditures associated with the construction of a deep sea port make this option less interesting when considering the schedule of the Meliadine Project. That said, should a third party be interested in promoting the construction of a private port, AEM may be interested in using such facilities.

5.2 Access Roads Alternatives

The Phase 1 All-weather Access Road (AWAR) is constructed between Rankin Inlet and the Meliadine site to support advanced exploration works. Phase 2 of the access road will follow the completion of the environmental assessment and will be done upon receiving the necessary authorizations. Alternatives were not considered for widening the AWAR. The preferred alternatives for Phase 2 road construction are as follows:

1. A 5.1 km bypass road around the Hamlet of Rankin Inlet from the Itivia to the AWAR; and
2. A 9.8 km Discovery access road from the AWAR to the Meliadine Lake boat launch and to the Discovery gold deposit[9].

The alternatives considered for hamlet bypass road is described below.

5.2.1 Hamlet Bypass Road

All fuel and dry cargo for the Project will arrive at Itivia. AEM signed a lease with Nunavut Airports for 14 ha of land that will be used for a tank farm, sea can storage and laydown yard. Fuel and dry cargo arriving at Itivia will be delivered to the Meliadine site via the AWAR but one first has to reach it. Three alternatives were considered in moving all fuel and dry cargo from Itivia to the AWAR, these were:

[9] No alternatives were considered for the route of the Discovery access road or how it will be built. Two routes were considered for the route of the haul road.

1. Use existing roads in the hamlet to reach the AWAR. This would necessitate that all traffic pass through the community;
    a. This has the advantage of no capital costs being incurred in building new roads;
    b. It has the disadvantage of increasing traffic in the community resulting in noise, dust and potential congestion; and
    c. It has the disadvantage of increasing the risk of accidents involving large trucks destined for the Meliadine site and small vehicles and/or pedestrians on hamlet roads.

    This alternative was rejected by the community.

2. Build a bypass road that skirts built-up areas in the hamlet and uses a minimum of hamlet roads;
    a. This has the disadvantage of requiring capital expenditures to build a bypass road;
    b. It has the advantage of reducing the risk of accidents on hamlet roads but does not remove the risk as some hamlet roads would continue to be used;
    c. It has the disadvantage of constraining the expansion of the hamlet. The route would impinge on lands set aside for future subdivisions; and
    d. It has the disadvantage of increasing noise and dust in the hamlet.

    This alternative was rejected by the community and Government of Nunavut.

3. Build a bypass road south of the airstrip to connect to the AWAR;
    a. This has the disadvantage of being the most expensive alternative to build;
    b. It has the advantage of not creating noise and/or dust in the community;
    c. It eliminates the potential for accidents involving trucks carrying dry cargo and fuel to the mine site with community vehicles and pedestrians on hamlet roads; and
    d. It does not compromise the future expansion of the hamlet.

    This alternative is supported by the community. The preferred alternative avoids the built-up part of the hamlet thereby ensuring homes, businesses, recreation centres and schools are not disturbed by Project traffic. It does not interfere with the operation of the airport or the new community landfill. It allows AEM to bypass the hamlet in delivering personnel, dry cargo and fuel from Itivia to the Meliadine site. AEM is undertaking a feasibility study for the bypass road.

All alternatives for building of additional roads will largely have the same potential for cumulative effects while they are in operation. The Manitoba-Nunavut road provides a valid pathway for new roads. Once the roads are reclaimed following closure, the effect will largely be removed as it is expected the roads will re-vegetate over time.

The potential for cumulative effects on individual and community wellness[10] will be lower for the preferred alternative as it will reduce noise, dust, risk of accidents, and traffic congestion in the hamlet.

5.3 Use of Rankin Inlet Airport

Ideally, the airstrip serving the Project should be in close proximity to the site. AEM contemplated building an airstrip at the Meliadine site but this option was not favoured by the community. The community wanted to be involved in the Project's development, not be an observer. To have AEM install an airstrip at site would have isolated local businesses from business opportunities arising from air travel, possibly a new terminal, workforce transportation, air freight and aircraft fuelling.

The Project will rely on Rankin Inlet municipal airport infrastructure for air transportation of personnel and some cargo (for example, perishable food, emergency repairs of mine equipment, and supply of emergency maintenance parts). Both commercial and charter flights will be used with the preference given to charter flights due to convenience and lower costs. Expediting services will transport incoming air freight from the airport to the mine site via the bypass road and the AWAR.

AEM recognised that:

- Rankin Inlet has a strong business ethic in wanting to attract opportunities to grow business development. With AEM using the airport, air transport of mine workers and air cargo would be received in Rankin Inlet for delivery to the Meliadine site;
- Rankin Inlet wanted to be intimately involved in the Project; they wanted a role in the Project design (no airstrip, unrestricted access to the AWAR, boat launch on Meliadine Lake, AEM use of Itivia); and
- A small airstrip for Twin Otters was contemplated as part of the Phase 1 AWAR but consultation with the community and government did not support this option.

The alternative of building a gravel airstrip at the Meliadine site was found unacceptable by the community. Use of the Rankin Inlet airport has the following advantages:

- Rankin Inlet is the airport hub for Kivalliq and has a plan to expand the airport to accommodate more and bigger aircraft. AEM's business will assist in this expansion;
- The community benefits from business opportunities arising from AEM's use of the airport. It also meets social needs in providing local employment within the hamlet;
- AEM saves capital in not constructing a gravel airstrip and related infrastructure. Such an airstrip would need to measure a minimum of 1,830 m long and 45 m wide to accommodate 737 jets;

[10] Individual and community wellness is a Valued Socio-Economic Component.

- A gravel airstrip could only accommodate aircraft having the ability to land on gravel, such as turboprops and jets outfitted with a gravel kit (Boeing 737-200);
- The Rankin Inlet airport has asphalt surface and is long and wide enough to accommodate a 767 air freighter. The use of this freighter aircraft will significantly reduce the cost of air freight for the Project and Kivalliq;
- An airstrip on site would disturb 10 ha of land which eventually would need to be reclaimed;
- The use of the Rankin Inlet airport will not have the potential for cumulative effects while an airstrip on site would have the potential for cumulative effects due to the disturbance of 10 ha of tundra; and
- Two airports within 25 km of each other do not reflect sustainable development.

5.4 Location of the Mill and Associated Infrastructure

The preferred location of the mill and related infrastructure was approximately 700 m to the southwest of the advanced exploration camp. Before the final location of the mill and associated infrastructure could be confirmed, condemnation drilling[11] was carried out. Drilling revealed mineral potential thereby ruling out the use of the preferred location for the mill and associated infrastructure.

The final location of the Meliadine infrastructure is approximately 1 km northwest of the advanced exploration camp. This location is not ideal but it is devoid of mineral potential. The site has several archaeological sites that will need to be mitigated prior to construction. It is poorly drained with standing water, which will require special attention in ensuring the design of the pad allows for proper drainage and does not lead to permafrost degradation. Also, due to the poor drainage of the site, additional piling will be required to secure the mill and associated infrastructure. The selected area is not as flat as the preferred location thereby necessitating additional backfilling. This could prove problematic in winter with excessive snow accumulation and higher maintenance costs in keeping the pad and roads clear of snow. Finally, the final location is further from the open pits than originally planned, which will result in longer access and haul roads, and increased construction and operating costs.

In this instance the preferred location was rejected due to economic considerations. Although the location selected poses technical challenges, the mill and associate infrastructure can be constructed and operated with an increase in capital and operating costs, respectively. Positive features include that it is centrally located relative to the mining sites but at a sufficient distance from the open pits (a minimum safety distance of 750 m has been used) to reduce the potential impact of vibration and fly rock resulting from blasting. The compact plant arrangement is primarily

[11] Condemnation drilling is carried out to ensure no mineral resources exist below a defined surface area. If drilling reveals no mineral resource potential, the area is condemned and available for construction of surface infrastructure.

designed to reduce site preparation and pad construction costs, as well as the overall Project footprint.

5.5 Production Rate and Mining Methods

As described in the Detailed Project Description (Section 2.0 of Volume 2 – Project Components and Activities), the current mining plan (February 2012) includes approximately 37.5 million tonnes (Mt) of ore mined from open pits and underground over a mine life of 13 years. The combination of the two will generate about 378.6 million tonnes (Mt) of waste rock, 57 Mt of overburden, and about 37.5 Mt of tailings. About 2.2 Mt of waste rock generated by the underground development will be used as backfill, and therefore will not be stockpiled at surface. A production rate of up to 8,500 tonnes per day (tpd) is forecast with 6,000 tpd from open pits and 2,500 tpd from underground.

The production rate determines everything from the number of employees, bedrooms in the accommodation complex, size of mill equipment, number of haul trucks, annual fuel use, etc. It is only after the production rate has been set that one can determine the size and number of associated mine infrastructure.

Lower and higher production rates than 8,500 tpd were assessed before selecting the preferred one. The preferred production rate provides the best economics based on known ore resources.

5.5.1 Open Pits

Open pits are located where ore of sufficient grade and quantity is found near or at surface thereby making open pit mining economically viable. Considerable diamond drilling was carried out beforehand to define the ore resources prior to selecting the location, size and depth of the open pits. The ultimate surface expression of the pits and their depth was modelled to arrive at detailed pit plans, production schedules, equipment and labour requirements, operating and capital cost estimates. All these factors were considered simultaneously to arrive at pit designs that provide the best economics.

The mining sequence of the open pits was based on a number of considerations. These included, but were not limited to:

- The resources available in the ore body;
- Grade of deposit;
- Proximity to the mill; and
- Proximity of waste rock storage facilities near the open pits.

The present mining sequence is not based on one consideration alone but on weighing all simultaneously. This allows the selection of the preferred mining schedule for open pits based on cost effectiveness, design, operations and closure. The following mining development sequence is currently planned:

1. ***Tiriganiaq***: Open pits in this area are the first to start and will be exploited for the entire mine life. Underground mining will also occur below the Tiriganiaq open pits. The waste rock generated by the underground work will largely be used as backfill with any excess reporting to a waste rock storage facility.
2. ***F Zone***: The second open pit area to be developed alongside Wesmeg. This area is somewhat remote and, given its location, the need for a separate WRSF for this mining area was deemed necessary.
3. ***Wesmeg:*** A large open pit area located immediately south of the Tiriganiaq deposit. Wesmeg will be mined using multiple open pits. Consideration was given to store waste rock from Wesmeg open pits along with that from the Pump mining area.
4. ***Pump***: Located close to Wesmeg; consideration was given to store waste rock from the Pump open pit area along with that from Wesmeg. It will be developed the same time as Discovery.
5. ***Discovery***: Open pit area located at a distance from the mill and other mining infrastructure. It is currently planned to start mining the Discovery open pit area at the same time as Pump. However, given its remoteness, this area will require a standalone WRSF.

Exploration will continue throughout the environmental assessment and permitting processes to better define the ore resources that can be economically mined. If the mine life were to be extended, existing pits may be enlarged or new open pits developed[12]. This would necessitate the appropriate environmental review and permits. Also, ongoing improvements to the ultimate pit designs could eliminate areas at depth that require high stripping and have marginal profitability. The effects would be to lower the cost per ounce of gold, reduce waste stripping in the mining plan, and lead to shallower open pits.

Standard open pit mining equipment will be used and is provided in Table 5-1 (models in brackets are indicated as examples only; the ones bought could differ slightly). The equipment was selected on the basis of reliability and effectiveness. The equipment to be used for open pit mining is further described in the Detailed Project Description (Section 2.0 of Volume 2 – Project Components and Activities).

[12] Extending the mine life would extend benefits to Kivalliq, KIA and NTI, and taxes paid to governments.

Table 5-1 Meliadine Open Pit Equipment

Equipment requirement	Quantity	Equipment requirement	Quantity
Excavator (Terex RH120)	2	Water truck (Kenworth T800)	1
Wheel loader (Cat 993k)	2	Tire handler truck (Kenworth T800)	1
Excavator (Cat 390DL)	2	Fuel/lube truck (Kenworth T800)	2
Mining truck (Cat 777F)	20	Lowboy 125 t	1
Production drill (Sandvik DR560)	6	Light tower	8
Motor grader (Cat 16M)	2	Pickup trucks	15
Wheel dozer (Cat 824H)	2	Pit busses	2
Track dozer (Cat D9T)	4	Mobile welding machine	2
Excavator (Cat 345DL)	1	Mobile compressors	2
Excavator (Cat 345DL; rockbreaker)	1	Dewatering	2
Compactor (Cat CS56)	1	Dispatch system	1
Tool carrier (Cat IT62H)	2	Emulsion plant infrastructure	1
Service truck (Kenworth T800)	2	Tools for maintenance shop	1

Flooding of the open pits, water management, and closure monitoring activities will take approximately 10 years following completion of pit operations, and will be followed by post-closure monitoring. All pits will be reclaimed progressively as mining is completed excepting those having the potential for underground mining below the open pit(s).

AEM is investigating the possibility of backfilling mined-out open pits, partly or totally, with overburden and waste rock. If practical and time permitting, this approach could help minimizing the final footprint of the operation and create fish habitat at the same time. Depending on the volume of a given pit, it will take some years to fill with water. Water quality will be monitored throughout this time, and when the pit is full, to ensure discharges meet standards for receiving water.

There is a valid pathway for potential cumulative effects in combination with other mining developments at Meadowbank, Kiggavik and possibly in the future with the Churchill Diamond and Ferguson Lake projects. A valid pathway also exists for the Manitoba-Nunavut road.

5.5.2 Underground

All underground mining tonnes will come from the deeper portions of the Tiriganiaq deposit. However, Tiriganiaq extends vertically close to surface and the top portion of the deposit will be mined by open pit. The question is, at what depth should the mining transition from open pit to underground methods. A pillar approximately 60 m thick is to be left between the floor of the open pit and the underground mining area. The pillar is located at an open pit depth of 200 m where the grade of the ore is lower than that above and below. This maximizes the gold recovered and improves the economics of the open pit mining.

The material handling system for the underground evaluated five alternatives, these were:

- **Headframe with full shaft ("Full Shaft"):** (545 m from bottom to surface) with long surface conveyor between the head frame and the mill area.
- **Long conveyor ("HW Conveyors"):** from bottom of the mine to the mill area at surface in an independent ramp, and short conveyor to surface.
- **Long conveyor along production ramp ("FW Conveyors"):** (in an independent ramp near the footwall) fed directly on each level. Long conveyor at surface between mine and mill area.
- **Conveyor with short shaft ("Conv + Shaft"):** (330 m from bottom to surface) located close to the mill area with long and direct underground conveyor from the bottom of the mine to the loading station at the bottom of the shaft.
- **Trucking only:** This scenario considers only a trucking fleet for materials handling.

The ore body configuration complicates the shaft option due to the 55-60°dip angle. The hanging wall long conveyor scenario was selected based on having the lowest operating and capital costs. A crusher will be necessary underground to reduce the ore to a size that can be accommodated on the conveyor belt. This alternative has the added advantage of facilitating deep exploration drilling[13].

Table 5-2 provides a description of underground equipment to be employed at Meliadine. This is standard underground equipment with proven reliability and effectiveness. The equipment to be used for underground mining is further described in the Detailed Project Description (Section 2.0 of Volume 2 – Project Components and Activities).

[13] Surface drilling limits exploration to a depth of approximately 500 m, leaving the ore body open at depth.

Table 5-2 Proposed Underground Mining Equipment

Equipment Requirement	Quantity
Two-boom, electric-hydraulic development jumbo	4
Single-boom, electric-hydraulic stope jumbo	1
Longhole drilling rig	2
3-4-yard scooptram	3
6-7-yard scooptran	6
Mobile rockbreaker	1
Grader	1
Jeep	8
Material/modular truck	3
Scissor lift	2
40-ton mine haul truck	5
Explosives truck	2
Screening/bolting rig	4
Service truck	2

The surface expression of underground mining will be minimal and the potential for cumulative effects does not exist. Upon closing the mine, the two portals will be backfilled with waste rock, leaving a small positive topographical feature on the tundra. Ventilation shafts will be covered as dictated by the *Mine Health and Safety Act* and associated regulations.

5.5.3 Alternatives to Processing Ore

A single process plant structure is proposed, which will reduce both capital and operating (heating) costs. The proposed ore processing facility will be centrally located relative to the mining sites at a distance of at least 750 m of pits to reduce the impact of vibration and fly rock caused by blasting. The facilities will comprise crushing, grinding, gravity recovery, cyanidation and gold recovery in a carbon-in-leach (CIL) circuit. The main ore processing streams will be continuous operations, while the carbon-handling and gold recovery circuits will be batch operations. The plant operating schedule will set to be on a continuous basis with 92 % plant availability, with a design processing rate at 385 tonnes/hour (8,500 tonnes per day).

In more detail, the ore will be crushed in the crushing circuit described below and fed by conveyor to the ore stockpile, which will consist of either a dome (covered stockpile) or silo. AEM favours the use of a dome, which has proved successful at Meadowbank and some of its other mines. The ore will be reclaimed from the stockpile and fed via conveyor belt to the grinding circuit where the ore will first be reduced to a sand sized consistency in a semi-autogenous grinding (SAG) mill. This will be followed by secondary grinding in a ball mill, which will reduce the rock to fine slurry. The target grind size for cyanidation should be 80 % passing 105 µm, pending final results of the feasibility study.

Gravity recovery test work showed that gold is amenable to recovery in a centrifugal concentrator, and a gravity recovery circuit is therefore included in the process plant. It is expected that about 30 % of the gold will be recovered in the gravity circuit, and the final gravity recovery number will be ascertained in an ongoing feasibility study, which could reach as high as 65 %. Gravity concentrate will be subjected to intensive cyanidation in a batch inline leach reactor followed by electrowinning to produce a gold sludge suitable for smelting.

Cyanidation tailings will go to a thickener to recover cyanide solution, which will be recycled within the mill. Tailings containing residual cyanide will pass through cyanide destruction prior to being discharged to the tailings storage facility. Cyanide destruction will employ the conventional SO_2/air process where SO_2 and air are added to oxidize and destroy cyanide present in solution. The reaction is catalyzed by the presence of copper ions, which is added in the form of copper sulphate. The SO_2 will be generated by a sulphur burner with a sodium metabisulphate reagent system acting as a back-up. The final reagent additions and circuit configuration for cyanide destruction will be determined during the ongoing feasibility study.

Three process plant circuits received considerable attention as the various alternatives all had pros and cons to consider before selecting the preferred alternative. The preferred alternatives were largely based on economics, performance of the equipment for the ore found at Meliadine, and familiarity of AEM's technical staff with the process and equipment.

Comminution Circuit Alternatives

The options investigated include:

- Conventional three stage crushing followed by two-stage ball milling;
- Primary crushing and SAG milling followed by ball milling in closed circuit with a cyclone; and
- Two-stage crushing followed by high pressure grinding rolls (HPGR) and ball milling.

Feasibility results indicate that the HPGR circuit would have reduced energy consumption compared with the SAG-based circuit but it would also carries higher risks as a relatively unknown technology and as it will require additional material handling.

The preferred alternative for the present is a SAG-based circuit with pre-crushing. This selection was based on AEM's expertise with the SAG option, and pre-crushing was included to provide flexibility, a more consistent feed to the milling circuit, and to reduce the risk of not meeting the expected tonnage.

Alternative crushing/grinding circuit configurations such as the inclusion of secondary crushing or where the ball mill is replaced by a Vertimill continue to be considered, and the final selection will be made pending ongoing studies. These options have the potential to reduce the overall mill power consumption.

Flotation Alternatives

The inclusion of flotation with cyanidation of the concentrate was previously considered in the 43-101 technical report (AEM 2011) and earlier by Comaplex, but was not retained because the reagent cost savings was not sufficient to offset the significant loss in gold recovery.

Thickener Alternatives

A significant reduction in the process plant footprint could be realized if E-CAT type thickeners were selected over the more conventional high rate thickeners. The general height disadvantage that E-CAT thickeners have is less of a concern in this case since the leach tanks will be located inside the main process plant building. However, additional sedimentation test work is ongoing to support E-CAT thickener sizing with the preferred alternative to follow the conclusion of tests.

Alternatives to Cyanide

The first step in processing the crushed and ground ore is to recover any free gold using gravity recovery processes. Free gold is commonly recovered in a centrifugal gravity concentrator, which takes advantage of the high density of gold to produce a primary gravity concentrate. The primary concentrate can be upgraded either on shaking tables (analogous to panning for gold) or dissolved in an intensive leach reactor prior being sent to the refinery. Shaking tables represent a security concern due to the need for considerable manual manipulation of the concentrates. Intensive cyanidation is therefore the preferred method if there are no restrictions on the use of chemical reagents. For Meliadine, the overall gravity recovery potential is 65 % of the gold but is likely to be lower in practice.

Recovery of the residual gold following gravity separation typically requires hydrometallurgical processes and gold dissolution requires the use of both a complexant and oxidant. The use of chlorine-chloride leaching was applied commercially to recover fine gold and gold associated with sulphides until the establishment of the cyanidation process in 1989. Cyanidation commonly uses oxygen as the oxidant and remains the most commonly applied process due to its low cost, high efficiency and selective dissolution of gold and silver over other metals. Despite the high toxicity of cyanide, its use has minimal risk to health, safety and the environment due to controls employed. The recovery of cyanide for reuse in the milling circuit is well understood and cyanide destruction prior to discharge to the tailings storage facility is technically proven. Cyanide is available as both solid salts and liquid form. It will be shipped to Meliadine in a solid form as part of the summer sea lift in sealed plastic bins housed within sea cans.

Chlorine is no longer used to treat primary ores due in part to its high cost. Applications using chlorine to treat refractory ores have been proposed at other mines, which is not the case at

Meliadine. Other alternative chemicals to cyanide include thiosulfate and thiourea, but these involve prohibitively high reagent costs and have therefore not been applied commercially. The use of alternate reagents to cyanide also have technical risks such as difficulty in metal recovery from the leach solution and thus requires additional investigations before being employed. Due to the above considerations, cyanide will remain the chemical of choice for the recovery of gold.

Tailings will be treated to destroy cyanide to meet International Cyanide Management Code guidance concentrations prior to its discharge to the TSF (ICMC 2012). Any excess water from the TSF pond will be appropriately treated to meet effluent discharge criteria regarding cyanide before being release into the environment. Reclamation and closure of the TSF will see 3 m of waste rock covering the tailings. This will insure the permafrost active layer remains in the cover materials and tailings remain frozen year round.

Alternate Forms of Tailings[14]

Two forms of tailings were assessed, these being thickened tailings and filtered tailings. Thickened tailings have a solids content of approximately 65 percent and can be pumped via a pipeline to the TSF. Filtered tailings have a solids content of up to 85 percent and are commonly known as dry tailings. These cannot be pumped and need to trucked or moved by conveyor to the TSF.

Thickened tailings require a containment structures such as dikes to prevent the release of water and tailings to the environment. Water recycling “at the source” (directly in the mill) is less for thickened tailings when compared to filtered tailings. A tailings pond usually forms in the TSF when tailings settle. This implies a more complex water management when compared to filtered tailings.

Filtered tailings do not need containment structures and the only water management activities at the TSF would be the collection of any seepage from the tailings and water running off the surface. They are however too thick to be pumped; they are typically transported by truck or conveyor system and then “dry stacked” in a TSF.

The trucking of filtered tailings does pose a risk in the event of bad weather. During blizzards, trucking of tailings would be curtailed and, if the blizzard were long lasting, the operation of the mill could be interrupted due to no tailings being moved to the TSF. This risk does not exist with a pipeline as it can continue operating during bad weather.

On balance, both alternatives had advantages and challenges and no clear preferred alternative was identified. However, when combined with other considerations (environment, social and economic), thickened tailings were found to be the appropriate technology for use at the Meliadine site.

[14] Document SD 2-2 Tailings Alternatives Assessment Report provides greater detail on the selection of the preferred alternative.

5.6 Alternate Road Access to Ore Deposits

The current pit designs include at least one or several pits to be mined for each ore deposit. It is possible that, with additional drilling, some of these pits coalesce on surface to form a larger pit. This strongly influences the layout of the haul roads between the various pits, waste rock management storage facilities and the mill. Tiriganiaq, F Zone, Pump and Wesmeg ore deposits are located, respectively, 1.2, 4.0, 2.7 and 1.6 km from the planned mill site, while the Discovery deposit is approximately 15.9 km south-east of the planned mill.

Waste rock and run-of-mine (ROM) ore will be transported from the open pit mine operations in large haul trucks. The waste rock will be delivered to a waste rock storage facility while the ore will either be fed directly to the ore receiving dump pocket of the primary crusher, or delivered to the ROM stockpile.

The ramps and haul roads were designed for the largest equipment, 100-tonne-class haul trucks. For double lane traffic, the minimum width is 26 m and includes a drainage ditch and, where required, a 1.45-m-high safety berm, this being half the rolling radius of the largest tire using the ramps and haul roads. The safety berm will be continuous along the open pit ramps but intermittent along the haul roads and only present when the drop off the road exceeds 3 metres.

The haul roads are being designed to facilitate, where practicable, the shortest, safest and most economical route between the open pits, waste rock storage facilities, ore storage pads and the primary crusher. With four of five ore deposits being in relative close proximity to each other, and in designing the layout of the mine infrastructure to minimize the land disturbed, there were limited opportunities to consider alternate routes. The ore haul road between Discovery and the mill is expected to be combined with the Discovery access road and the AWAR leading to the mine site. This is to restrict potential environmental impacts to a single road corridor. A safety berm will separate traffic on the access road from that on the haul road.

Two alternatives were however considered transporting ore from the underground, this being ore trucks and a conveyor. Based on economics and technical feasibility, the conveyor alternative was selected.

5.7 Alternatives to Tailing Storage Facility

Tailings are the material by-product of the gold recovery process. With the current mine plan, the Meliadine Project will create approximately 37 million tonnes (Mt) of tailings, 27 Mt from open pits and 10.5 Mt from underground, with all to be directed to the Tailing Storage Facility (TSF).

Tailings storage alternatives assessment using a multiple accounts analysis (MAA) was carried out in accordance with the Environment Canada *Guidelines for the Assessment of Alternatives for Mine*

Waste Disposal (Environment Canada, 2011)[15]. The overall objective of the site selection process for tailings was to identify the most appropriate alternative, which minimizes the footprint of the area occupied by tailings, and to avoid environmentally and socially sensitive areas, to the extent practicable.

Once the feasible location options were identified from the pre-screening assessment, consideration was given to potential tailings disposal technologies. Two technologies, thickened tailings and filtered tailings[16] were chosen to represent hydraulic deposition and mechanical deposition, respectively. The combination of the three siting locations and two tailings technologies resulted in the six TSF alternatives for evaluation.

A multiple accounts analysis (MAA) approach was used to evaluate the six (6) TSF alternatives. As well, a risk assessment was conducted in parallel with the MAA process to further evaluate the tailings technologies being considered for the TSF (thickened and filtered). The primary and significant risks associated with thickened and filtered tailings identified in the risk assessment were considered in the MAA.

The 6 options were weighed in selecting the most appropriate alternative with some major considerations including:

- Thickened tailings can be pumped to the TSF via a pipeline while filtered tailings need to be trucked. Moving tailings by truck is more expensive and risky than using a pipeline;
- Alternatives that can result in a major tailings spill are not preferred. The distance from the mill to the TSF has to be considered as well as the type of transportation. A shorter distance from the mill to the TSF and use of a pipeline were assessed as less likely to result in major spills. Trucking of tailings would lead to more dust, greater greenhouse emissions and an increased risk of trucking accidents that may result in a spill with possibly health and safety consequences;
- Proximity to the mill can influence the risk of interruption of tailings transport with shorter pipelines being preferred. Being close to the mill also reduces capital costs;
- Tailings alternatives that can be expanded to accommodate tailings beyond a mine life of 13 years are preferred;
- Tailings alternatives that allow for progressive reclamation are preferred as they spread the costs out during operation, and typically have less risk related to material availability and fewer requirements for re-handling of materials;
- Alternatives that have lower annual operating costs for transport, and deposition/ placement of tailings are preferred. The distance the tailings have to be transported will

[15] For complete details on alternatives considered for tailings storage, please refer to SD 2-2 Tailings Alternatives Assessment Report. Current report only provides a summary of some major considerations.

[16] Thickened tailings have up to 65 percent solids and can be pumped using a pipeline; filtered tailings have up to 85 percent solids and need to be transported by truck.

have an impact on operational costs for both types of transportation, but trucking is much more expensive than pumping;

- Alternatives that require less fresh water make up are preferred. The quantity of freshwater needed has a direct cost as per the Water Licence and Water Compensation Agreement, and an indirect cost due to extra pumping capacity needed;
- Alternatives that have a smaller surface area will require less waste rock cover on closure, and those that are closer to a WRSF will have a lower cost and are therefore preferred; and
- Alternates further removed from Meliadine Lake are preferred.

The MAA concluded that the preferred option is thickened tailings disposal using a pipeline in B7 area with the deciding factors being the favourable topography and proximity to the mill. The risk assessment supported the alternative selected.

If the mine life were to extend beyond 13 years, dikes on the TSF could be raised to accommodate the additional tailings.

The potential for cumulative effects is anticipated to be largely the same for all alternatives so it did not enter into the alternative assessments. The thickness of the cover over TSF takes into account the potential for cumulative effects. As cumulative effects encompasses climate change and natural phenomenon, this caused the thickness of the cover material to be increased as there could be an increase of the active layer resulting from warming expected in the period 2050 to 2080. All alternatives assessed had a cover of 3 m.

5.8 Alternatives to Waste Rock Storage Facilities

The overall objective of the waste rock storage facility (WRSF) selection process was to minimize the footprint of the areas occupied by the waste rock and overburden and to avoid environmentally and socially sensitive areas, to the extent practicable[17]. Waste rock and overburden generated from the open pit operations are transported to a designated storage location by haul truck.

The total tonnes of waste rock and overburden to be generated by open pit mining during the mine life will be approximately 430 million tonnes, broken down as follows:

- Overburden: 57 million tonnes
- Waste Rock: 373 million tonnes

The WRSF were designed with due consideration given to geotechnical stability and geochemistry of the waste rock, and will be operated to minimize the impact on the environment. The material will be generally transported by truck and end-dumped, following a sequence developed for the operation. Most waste rock and overburden will be frozen when mined and upon placement should

[17] For complete details on how the waste rock/overburden storage areas were selected, please refer to SD 2-8 Mine Waste Management Plan.

remain frozen or be totally frozen within two years as experienced at Meadowbank. The waste rock and overburden are not considered to have acid-rock drainage potential; therefore, the management of the facilities do not need to consider that aspect and no capping will be required. It is expected that there will only be minor runoff from the facilities as it is anticipated that any water infiltrating the facility will freeze and not reach the receiving environment.

Constraints were placed on selecting the location of the WRSF. These included:

- The facilities should be placed on land and avoid water bodies where practicable[18];
- No archaeological sites are to be found in selected areas;
- The facilities are to remain within AEM claim boundaries; and
- The facilities are to be located in proximity to open pits.

It is important to note that the layout of multiple open pits over a relatively large area did not allow for a single WRSF for the Tiriganiaq, F Zone, Wesmeg and Pump deposits. The building of a single WRSF was not considered a feasible alternative.

A number of alternate sites were eliminated based on the constraints outlined above. These were as follows:

- Alternate storage locations between Pump and F Zone were found too difficult to develop given the tight space and evidence of some mineralization potential;
- Alternate storage areas West of Tiriganiaq and Wesmeg were also discarded as there was insufficient information to determine whether these areas will be condemned (i.e., not have mineralization potential);
- Some preliminary modelling indicated alternate areas located north and west of F Zone were too small to accommodate the anticipated waste rock and overburden tonnages from F Zone, and were removed from further consideration;
- Alternate storage areas located west of the Discovery open pit exhibit too many anomalies suggesting the presence of ore and were discarded from the selection process; and
- Remaining alternates located at a distance from the immediate surroundings of the open pits were removed and not considered further.

The dominate factor in selecting suitable WRSF locations was the distance from the open pits. This was to avoid long trucking distances. Six (6) waste rock storage facility areas were selected. These areas can accommodate the total waste rock and overburden expected from multiple open pits in their proximity.

- The B7 facility (East, South and West) located in a U-shape around the TSF, north of the Tiriganiaq deposit;
- The B4 facility located west of the Wesmeg and Pump deposits;

[18] However, waterbodies that will be impacted by other mining activities could be considered as available for storage.

- The A-45 facility located south of the F Zone deposit; and
- The Discovery (DE) facility located east of the Discovery deposit.

The alternative of disposing of waste rock in mined out pits is being considered for select F Zone open pits where the pits will be filled to within 20 m of its top. This will have two advantages in reducing the quantity of waste rock being added to the WRSF while at the same time creating more fish habitat in the pit once it is flooded. AEM will evaluate the possibility of backfilling other pits once more information is available on ore body definition and underground potential, and considering the mine plan.

Proposed closure strategies for WRSF include the following:

- The waste rock storage facilities will be designed for long-term stability. No additional re-grading or construction of wildlife ramps will be carried out as part of closure activities; and
- The waste rock storage facilities will be allowed to naturally re-vegetate with lichens and other plants over time.

There were no differences in the closure strategies for all the alternatives considered.

The extension of the mine life beyond 13 years would likely result if new ore deposits are found or if more reserves are confirmed from known deposits. If this were to occur, an existing WRSF would be used or a new one next to a new open pit would be established. This would however be subject to environmental review and authorizations.

The potential for cumulative effects is the same for all WRSF. There will be a reduction in wildlife habitat encompassing the natural area covered while the mine is in operation.

5.9 Waste Management and Disposal Alternatives

Procedures common to northern mines will effectively manage wastes at the Project site and significantly reduce the risk of environmental impacts arising from waste management and disposal. The design of waste management practices at the Meliadine Project will be based on tested and proven procedures developed at northern mines, in particular the Meadowbank Mine. Segregation of waste and recycling initiatives, an incinerator, landfill in WRSF, hazardous waste management, keeping food waste indoors before incineration all form part of sound waste management[19]. Incremental improvements to proven procedures can be expected but no significant changes are foreseen nor different alternatives employed until proven in a test program. The one area where alternatives exist is in the management of sewage sludge removed from the sewage treatment plant. This is described below.

[19] For greater detail on waste management, please refer to report SD 2-11 Landfill and Waste Management Plan.

Waste at the Meliadine Project will be divided into the following categories:

1. Domestic waste: general waste materials coming from the kitchen, cafeteria, lunch rooms, dormitories, and offices will be incinerated;
    - Bins will be located in high traffic areas for segregating wastes destined for incineration, landfilling or recycling;
    - Will require the education of all employees in the segregation of waste; and
    - All solid wastes that may contain food waste, food packaging waste or other organic waste that could attract wildlife will be incinerated in the site's incinerator.
2. Medical waste: medical waste generated in the Health Care station will require special handling and will be placed in easily identifiable single use medical waste containers.
    - Medical waste containers cannot be recycled; both the containers and its contents will be incinerated.
3. Industrial waste: waste arising from operations in the truck shops, process plant, emulsion plant, and warehouses. Each work area will have specially marked bins for segregating waste for incineration, recycling or disposal. Special bins or areas will be set aside for hazardous waste. Large bulky items that cannot be incinerated will be prepared for shipment south for recycling or cleaned of any hydrocarbon contamination and have the electronics removed before disposal in the landfill.
4. Sewage: waste water from the accommodation complex that is treated in the sewage treatment plant before release to the environment.
    - Sewage sludge is removed from the sewage treatment plant and can be burned in the on-site incinerator or disposed of in the TSF.
5. Used oil and waste fuels: used engine oil, hydraulic fluids, fuels that do not meet specifications for designated use. It does not include solvents or paints.
    - The used oil and waste fuel will be used in waste oil burners if found acceptable.
6. Incinerator ash: the ash removed from the on-site incinerator.
    - The ash will be tested and, if found acceptable, will be placed in containers and disposed of in the landfill where it will be ultimately covered with waste rock.
7. Hazardous waste will be appropriately packaged and sent to a certified waste management facility for treatment, recycling and/or disposal in another provincial or territorial jurisdiction.

The development of the landfill in a WRSF will minimize the area required for waste storage and re-handling of waste. Its location in a WRSF represents the preferred alternative and is anticipated to serve as a solid waste disposal site for the life-of-mine. Waste will be regularly covered with waste rock and, upon closure, a minimum of 3 m of waste rock will cover the landfill. At this depth, the waste will be below the permafrost active zone and inaccessible to wildlife.

Reduce, reuse, and recycle will be actively pursued within the waste management program. Waste management begins by keeping all materials that can be economically recycled out of the waste stream destined for the landfill or incineration. Materials for recycling will be sent south to a certified waste management facility in another provincial or territorial jurisdiction.

There is no potential for cumulative effects resulting from waste management at the Meliadine Project. Recognised cradle-to-grave procedures are used in controlling, recycling and/or disposing of waste.

5.10 Salt Water Management

Options for managing the excess brine from the underground saline water treatment were analyzed and compared. The first option considered was to discharge underground inflows to the ocean (either directly or as a concentrated brine following treatment), and the second option was to treat the underground water, temporarily store the concentrated brine from the treatment process on site, and then pump this brine back underground at the end of mine life.

Both options are technically feasible, although the treat and store option requires that sufficient temporary brine storage capacity exists on site, and may include the use of complex technology to decrease the volume of brine water to be managed. Potential brine storage alternatives include bladders, or storage in mined out open pits. The treat and store option only involves infrastructure on site, while the discharge to the ocean would require trucking (using the current AWAR), or the construction of piping infrastructure. From an environmental point of view, discharging to the ocean would require an effluent discharge point with a diffuser, and would need further impact assessment. Pumping the concentrated brine underground would return water with similar quality to that currently encountered underground. Based on the considerations identified above, the treat and store option has been provisionally identified as the preferred alternative; however, both options will be further evaluated during the feasibility design stage for the Project. This evaluation will include consideration of the potential environmental and social impacts associated with each alternative.

5.11 Power Generation

The Meliadine Project is anticipated to use approximately 122,000 m^3 of fuel annually. The fuel is to be used for transportation, heating, mine equipment, explosives and power generation. The preferred alternative is a diesel power plant which would use approximately 45,000 m^3 of fuel annually[20]. It will generate approximately 30 megawatts (MW) average electrical power output. In addition, mine buildings and Arctic utilidors will require up to 10 MW of thermal power for heating

[20] 150 m^3 of fuel daily for power generation.

purposes and hot water, dependent on the time of year. The powerhouse is separate from the process plant but connected by a heated Arctic utilidor. This reduces the need for sound attenuation measures and firewalls.

There is no potential for cumulative effects arising from locating the power plant, type of fuel used, generating equipment and in selecting the means to deliver fuel to the mine site. There will be an increase in greenhouse gases in burning diesel fuel to generate power.

5.11.1 Power Plant Location

Three potential power plant location alternatives were studied, namely, the Meliadine site, Rankin Inlet, and a dual location with smaller plants in Rankin Inlet and at the Project site.

The lowest capital cost is obtained by building the entire power plant at the Meliadine site. This location will also eliminate the need for an electrical transmission line between Rankin Inlet and the Meliadine site, as well as the electrical equipment that would be necessary in Rankin Inlet to increase the voltage to transmission level if all or part of the power generation infrastructure were installed in the hamlet. The Meliadine site will have 6 diesel generators installed to generate the required power. The 10 MW of thermal power can easily be found through heat capture from the diesel engine generators.

The chief disadvantage of the Project site location is that fuel for power generation would have to be transported from Rankin Inlet to the site. Of course, regardless of the power plant location, fuel used by other equipment and vehicles at the Project site will have to be transported from Rankin Inlet to the site. In the scenario where all fuel is being transported by truck, the Meliadine site location for the power plant would have the largest environmental impact in terms of air emissions due to tanker truck air emissions.

The Rankin Inlet power plant location is the most expensive capital and operating cost alternative. With the power plant solely located in Rankin Inlet, fuel would be required on-site to generate 10 MW of heat for buildings and Arctic corridors. It would thus require that a separate boiler be installed at the Project site to meet those heating requirements. The fuel required by this boiler would have to be transported to the site. This extra heating cost could be offset by sending and disturbing heat captured in Rankin Inlet to various buildings in the hamlet[21].

Another disadvantage in having the power plant in Rankin Inlet is that it would not result in drop in power rates in the community. The Government of Nunavut sets a single power rate for the entire territory, and no advantage would accrue to Rankin Inlet in having the power plant within the community.

[21] For this to happen, infrastructure to distribute heat to various buildings in the hamlet would need to be constructed beforehand.

The dual location option, where smaller plants would be installed at both Rankin Inlet and the Meliadine site, showed a capital cost in-between the two other options. It could have the lowest operating cost if thermal energy is distributed and sold to buildings in the hamlet. In a dual configuration, heat capture from the generators on-site would not be sufficient to heat all buildings and Arctic corridors if less than 3 diesel engine generators were installed. This again would necessitate burning fuel to generate heat. Like the Rankin Inlet option, this option requires a transmission line between the hamlet and the Project site. It also shares the benefit of leaving a power plant for the hamlet, which not only would benefit the hamlet but could reduce decommissioning costs when the mine closes. This option requires less fuel to be transported than the Meliadine site location.

5.11.2 Fuel Transportation

The two options for transporting fuel from Itivia to the Meliadine site are truck and pipeline. Assuming a 13 year Project life, there does not appear to be a significant lifetime cost difference between a pipeline and truck transport. The pipeline option would require a larger initial capital investment while transportation by truck would lead to higher operational costs. There could, however, be a difference in the impact of air emissions between pipeline and truck transportation since the latter method would increase air emissions. The pipeline would also be expected to offer a smaller risk of a spill, particularly if the power plant is located at the Project site.

A pipeline would first require a feasibility study be carried out and, as a result, this alternative has been set aside for the time being.

5.11.3 Choice of Generating Equipment

Two types of electrical generating equipment were considered, namely, diesel engine generators and gas turbine generators. The fact that three times as much electrical energy as thermal energy is required affects the consideration of these two equipment types. Simple-cycle gas turbines are not as efficient as diesel engines and produce a large amount of high-temperature waste heat. Gas turbines are better suited to situations where the thermal and electrical energy requirements are more balanced and where the thermal energy requirement is for higher temperatures than those associated with space or district heating, which the Project requires.

Diesel engines are more efficient than simple-cycle turbines and therefore produce less waste heat at lower temperatures. Thus, they are better suited to situations where more electrical energy than thermal energy is required, and also better suited to situations where the thermal requirement is for relatively low grade (low temperature) waste heat such as space and/or district heating. Diesel engines are also a better-known and more commonly-utilized technology than gas turbines, particularly in a remote location such as the Meliadine site.

5.11.4 Fuel Choice

Fuel types considered included light fuel oil (LFO), heavy fuel oil (HFO) and natural gas.

Liquefied natural gas (LNG) remains under consideration and cannot be ruled out. Cost-benefit analyses are pending for December 2012. LNG has to be delivered in liquid form and be kept at a temperature of -162°C. This requires a special ship that needs an adapted port for offloading. LNG has a low density: the volume needed would be large and the storage costs would be high.

HFO is not considered a viable choice. First, no supplier delivers this type of fuel to Rankin Inlet at this time. Second, due to its high viscosity, HFO has to be heated while it is being transported and stored, which would require a major capital investment to provide suitable facilities for unloading delivery ships and transferring the fuel to storage. Currently, fuel ships are anticipated to unload through a 300 to 500 m long floating pipeline with the ship anchored offshore. This method would not work with HFO as its temperature could not be maintained above a minimum temperature at which it would flow. Therefore, a new wharf or jetty would have to be constructed to permit ship unloading. Third, the ship would have to be cleaned out after each delivery, which represents potentially high additional costs.

For the time being, LFO is considered to be the best choice for fuel type. There are different blends/grades of LFO available. All LFO currently supplied to the Government of Nunavut (GN) is ULSD-43. This is ultra low sulphur diesel (ULSD) oil with a cloud point of -43°C, which is adapted for use in northern regions. As of the end of 2011, diesel in either on-road or off-road engines in Nunavut was ULSD.

5.11.5 Wind Energy

The average wind speed at the Meliadine site is approximately 21 km/h making wind energy a possibility[22]. However, anemometers and other measuring instruments would need to be installed on a tower to collect data at various elevations above the ground before a wind turbine suitable for the local wind conditions can be chosen. Technical problems of operating a wind turbine under the local climatic conditions would also have to be overcome, rime ice being one. Environmental considerations such as birds colliding with the turbine blades would need to be considered. All obstacles could be overcome but only after first collecting the necessary environmental data, and in finding solutions, if available, to technical obstacles and assessing environmental concerns. With the latter, this includes collisions with birds, noise and increased Project footprint.

Wind energy would only supplement power generated at the site. It could not serve as base load and, thereby, 30 MW of power would still be required for a continuous power for the Meliadine site. Wind turbines would nonetheless contribute to a small saving in diesel usage. Operations and

[22] Diavik Diamond Mine has installed four wind turbines. AEM will closely follow the Diavik's experiences in employing wind turbines.

maintenance of both the power plant and wind turbines would lead to more specialized employment.

A scoping study is anticipated to further the possibility of installing wind turbines at Meliadine.

5.11.6 Solar, Thermal Energy and Hydroelectricity

Solar is impractical given the high latitude of the mine site. Electrical power is most needed during winter when solar collectors will not provide much energy due to the long nights, shorts daylight hours and low angle of the sun.

There is no geothermal source of energy at the Meliadine site.

The cost of building dams and installing hydroelectric generators in Kivalliq would be prohibitive and not without potential significant environmental effects. The lack of a power line from Manitoba prevents the purchase of hydroelectric power.

5.12 Alternatives for Site Water Treatment

The Project consists of several gold-bearing deposits in relatively close proximity to one another that will be mined sequentially from five sets of open pits[23]. Mining the ore at these deposits will require a number of waterbodies to have their water levels lowered or be completely dewatered to allow for mining operation. Water management will be guided by the mining sequence, the location of dikes/berms required to isolate open pit mining activities from neighbouring waterbodies, and associated attenuation ponds where water can be pumped to and stored[24]. Necessary water diversion infrastructure will be constructed to avoid the contact of clean runoff water with areas affected by the mine or mining activities.

Water management for the Meliadine Project is multifaceted with alternatives vetted before final decisions were made. Flexibility has been built into water management and adaptive management will be used to make adjustments in diverting clean water away from facilities, and to dewatering and treatment protocols should it prove necessary. Nonetheless, the overall objective of water management is to control all waters on site and flowing off the mine site. All contact water not required in the process plant will be contained, analysed, and treated (if required) before being discharged to the receiving aquatic environment. The uncontrolled release of contact water to neighbouring waterbodies is not anticipated.

Four major sources of water will be treated, each requiring different treatment methods:

[23] Excepting the Discovery deposit, this will have a single open pit. Tiriganiaq, Wesmeg, Pump and F Zone deposits will have more than one open pit each.

[24] All attenuation ponds will be operated in a manner to minimize the amount of water stored within the facility during the open water period. This will limit water storage over the winter period, thereby maximizing the storage capacity available for the spring freshet.

- A sewage treatment plant will treat domestic waste water generated at the Meliadine site prior to discharge to the reclaim pond in the Tailings Storage Facility;
- Groundwater from below the permafrost layer is anticipated to be saline and treatment will require a "salt plant". This will treat the water before it is directed to attenuation pond AP-01[25];
- Water to be directed from the TSF to AP-01 will pass through a treatment plant first. It is assumed treatment for arsenic and total cyanide will be required and conventional, proven protocols will be employed; and
- Water from the dewatering of waterbodies and from surface drainage of mine areas can on occasion be high in total suspended solids (TSS). Alternatives in reducing TSS may be achieved by reducing the pumping rates, installing silt curtains and/or baffles in the vicinity of exposed beaches to increase the flow path and residency time within each basin, and/or using proven, dedicated TSS treatment systems[26]. For the latter, this typically requires the use chemical flocculants and fine sand to seed flocculent growth followed by high capacity clarification.

The process plant will be the largest water user on site and will have three (3) alternate sources of water to meet its demand:

- Reclaim water from the TSF will be the primary source;
- Contact water from AP-01[27] will be a secondary source[28]; and
- Freshwater from Meliadine Lake.

As much as possible contact water and reclaim water will be used in the process plant thereby reducing the freshwater make-up water from Meliadine Lake.

Complete details on water management can be found in SD 2-6 Surface Water Management Plan.

5.13 Alternatives to the Discovery Haul Road

Attributes of the Discovery road route largely mirror those of the AWAR. The routing was selected to minimize possible effects of construction and operation on the environment, and facilitate maintenance of the road, particularly during winter. Other considerations included the overall length of the road, the route's proximity to the ore body and water bodies, a desire to minimize the number of stream crossings, the availability of quarries along the route, geomorphology, avoidance of archaeological resources, and avoidance of raptor nesting sites. One design consideration was to

[25] Site contact water from the mine area and treated water from the salt removal plant will be collected in AP-01 located north of the main infrastructure site.
[26] Since the waterbodies on the Project site are typically shallow, it is expected that TSS treatment will be required during initial dewatering using treatment systems previously employed at Meadowbank and Diavik.
[27] If water in excess of process plant make-up requirements has been collected within AP-01, the excess water can be directed to the receiving aquatic environment or to the reclaim pond in the TSF. This will be dependent on the site water balance and water quality into AP-01 at the time as the goal is to not to exceed 2.9 million cubic metres of water in the reclaim pond in the TSF.
[28] Modelling results indicate that during the summer, AP-01 should have enough water to satisfy mill demands.

remain on the height of land as much as possible to allow for drainage in the summer and for wind to assist in clearing snow off the road in winter. Considerations pertaining to acid rock drainage/metal leaching (ARD/ML) potential of borrow materials will be further considered when borrow pits/quarries will be selected prior to construction.

The preferred option for the Discovery haul road was to combine the Discovery access (spur) road and the haul road as one. The driving surface for access road would remain two lanes, eight metres wide, while that for the haul road would be a single lane, 16 metres wide with a pull out lane every 250 metres where the width of the road would increase to approximately 26 metres. The two driving surfaces would be separated by a continuous safety berm isolate traffic on the access road from that on the haul road.

Two other alternatives for the Discovery road were also considered:

- a haul road independent of the Discovery access road; and
- a winter road to transport ore to the mill.

A haul road independent of the access road and AWAR was rejected as it would create a second road corridor, disturbing more surface area. As well, this secondary route lacked geomorphological information, archaeological information, rock and borrow pit availability, water crossing studies, and a wildlife survey. While the route was slightly shorter, it did cross uncertain ground, which could have required additional road fill to protect the permafrost.

A winter haul road was also considered. It had the benefit of not having to construct a haul road and little to no reclamation once mining was complete. However, winter road would have had to be built every year mining is ongoing at Discovery. Also, the ore transport would only have been possible during the winter months, thereby not allowing for year round employment for transporting the ore to the main mine site.

The routing of the access road to Discovery was in part selected to allow for a boat launch to be built on Meliadine Lake for community use. This boat launch is planned to be located just off the road. Nunavummuit and others in the community saw the utility of the access road to Discovery in providing easy access to Meliadine Lake where community members have a number of cottages and camps. The lake and surrounding area are extensively used for traditional pursuits.

5.14 Mine Dewatering Alternatives

Mining the ore at the different gold deposits and locating mine infrastructure will require a number of waterbodies having alterations of water levels or complete dewatering[29] to allow for mine operation. Water in these instances would be pumped downstream. As an example, Lake B7 will be

[29]It has been assumed that small/shallow ponds will not need to be dewatered if covered by infrastructure, or if the majority of their watershed area is diverted. As an example, small ponds to be covered by infrastructure pads and WRSF would not be dewatered.

partially dewatered to allow the establishment of the TSF, and this will be accomplished by pumping water from Lake B7 to Lake B6, the first lake downstream. The water would then flow through a series of six small waterbodies before reaching Meliadine Lake.

Mine dewatering will also consist of removing water from active open pits and underground mine when it extends below the bottom of the permafrost layer. None of the planned open pits will intersect the deep groundwater regime below the permafrost or from through taliks below large lakes. However, some open pits will intersect small waterbodies anticipated to present a closed talik. This water will drain into the pits and be managed as contact water. For example, pits intersecting Lakes B5, A6 and A8 are expected to yield water to the associated open pits. Another source of water will be from precipitation, which is slightly over 400 mm per annum in the form of snow and rain.

As discussed in Section 7.2 of Volume 7 (Hydrogeology and Groundwater), the few samples collected to date from below the permafrost horizon indicate relatively high total dissolved solids content. Studies (see SD 2-4A 2011 Geotechnical Field Investigation Report) indicated that the potential groundwater inflows below the permafrost could range from approximately 420 m^3/day to 640 m^3/day with total dissolved solids from 56,000 to 59,000 mg/l. Some of the water will be used for underground drilling but the majority will be pumped to the surface via the underground water piping system. Once on surface, it will be temporary stored before treatment, after which it will be pumped to a contact water holding pond for possible use as reclaim water in the mill. Water from underground will be kept separate from other dewatering sources and be treated separately.

The alternatives to dewater open pits and the underground are limited. Waterbodies intersected by open pits will be fully dewatered and groundwater collected underground will be pumped to surface.

The use of the contact and water from the underground water does however offer alternatives, these being:

- Contact water is treated and subsequently discharge to the receiving aquatic environment;
- Contact water is treated and used as reclaim water in the mill;
- Water from the underground would be treated and used as reclaim water in the mill.

5.15 Closure and Reclamation Alternatives

The Meliadine Project's reclamation objectives are to avoid or minimize negative environmental effects wherever practicable, practice progressive reclamation, and, upon closure, return negatively impacted areas to productive and lasting use by wildlife and humans. Reclaimed areas will be chemically and physically stable, and should ultimately support the same functions as the surrounding undisturbed land. The intent of reclamation is to produce a final landscape that reflects the surrounding land features and land forms. Because of the proximity to Rankin Inlet, particular attention will be paid to ensuring that reclaimed areas are safe for future traditional use.

Mine closure has been integral to the mine design and could be modified as operations progress. Planning for permanent closure is an active and iterative process with the plan being updated on a regular basis. The intent of the process is to develop a final plan using adaptive management. The process begins in the mine design phase and continues through to closure implementation. Adaptive management enables the plan to evolve as new information becomes available through analyses, testing, monitoring, and progressive reclamation.

Reclamation will be a progressive process that will continue throughout the life of the mine as soon as opportunities to reclaim decommissioned facilities present themselves. This will apply in areas or at facilities that are no longer actively required for the current or future mining operation. AEM will opt to pursue progressive reclamation wherever possible rather than leaving all reclamation and closure to the end of mine life.

Reclamation cannot totally remove the disturbance caused by the development and operation of the mine: certain features, such as the TSF, pit lakes and WRSF will become permanent parts of the future landscape. Certain facilities could be reclaimed progressively during the life of the mine, such as the TSF, camps, temporary workspace, marshalling yards, and storage areas. Other facilities will be reclaimed during the closure phase of the Project, such as accommodation complex, mill, access and haul roads.

The general strategy for the closure and reclamation includes:

- Comply with applicable standards and guidelines requirements and objectives;
- Give preference to closure solutions that do not require subsequent maintenance or solutions that minimize maintenance (passive care); and
- Whenever possible, the closure of facilities would be progressive, spaced out over the operational life of the mine.

There are limited opportunities for alternatives to well established procedures in reclaiming and closing northern mines. At this early stage, one can only surmise what improvements to mine reclamation and closure changes may eventuate.

Alternatives at the conceptual stage of the reclamation and closure plan tend to be those where community preferences may come into play. AEM remains committed to reclaiming and closing all Project components at the end of the mine life. This will remain unchanged unless a competent third party(s) assumes responsibility for select parts of the infrastructure. Some obvious examples are the AWAR, community bypass road, boat launch at Meliadine Lake, and laydown yard at Itivia.

AEM closure and reclamation plan for the AWAR includes scarification of the road surface, removal of culverts and bridges, restoration of drainage patterns, and stabilization of slopes. An alternative would be for a third party to assume responsibility for the AWAR. However, for a third party to take over the road, that third party would have to complete its own arrangements with the land owner

(KIA) and then complete its own environmental assessment and permitting process covering future use. AEM does not own the land on which the road is constructed on and, thus, cannot transfer future ownership or use privileges to any third party. AEM must complete its obligation to reclaim and close the AWAR unless directed otherwise by a combination of the land owner and regulatory agencies who issued permits/authorizations for the road. If there is widespread and continuous use of the AWAR and the Meliadine boat launch by residents of Rankin Inlet over time, they may prefer to retain the AWAR and request authorizing agencies to transfer it to a competent third party.

Likewise, AEM at present will be reclaiming and closing its infrastructure in Rankin Inlet. As with land for the AWAR being leased, AEM will lease land from Nunavut Airports for the laydown yard and tank farm. If all or part of the facilities at Itivia are to be taken over by a third party, that third party would have to complete its own arrangements with the land owner and complete its own environmental assessment and permitting process covering future use. However, AEM is obligated to reclaim and close its facilities within Rankin Inlet, including bypass road.

Salvageable buildings and surface structures will be dismantled upon final closure and demobilized, if possible, from the site to a southern location. Another alternative would be to transfer or sell salvageable buildings to local businesses. The same holds for vehicles and possibly the diesel generators from the power plant. An alternative for the local sale of mine buildings and equipment is expected to be included in future iterations of the Plan.

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