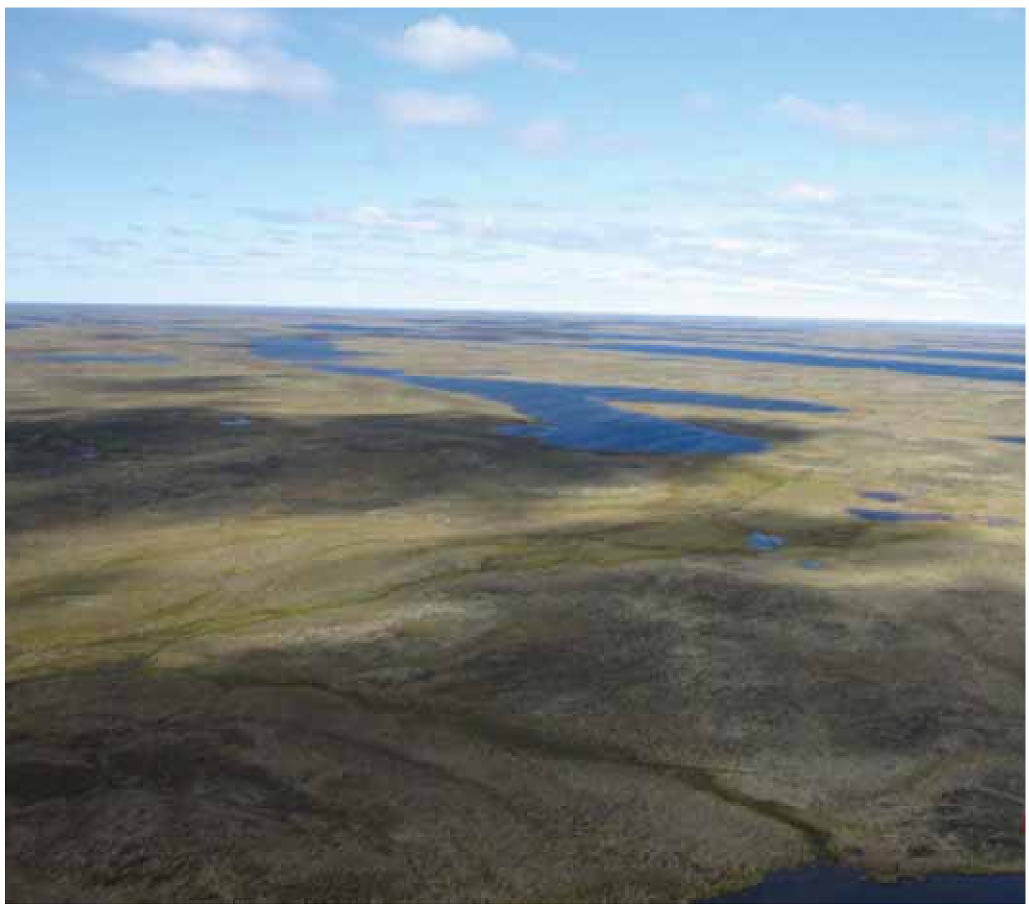
September 2011

REPORT:

Phase 1 - Meliadine All-weather Access Road Project Description and Environmental Assessment



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REPORT

Executive Summary

Introduction

The Meliadine Gold Project is located approximately 25 kilometres northwest of the Municipality of Rankin Inlet, Nunavut.

In late 2010, Agnico-Eagle Mines Limited (AEM) announced that it planned to accelerate the pace of advanced exploration at the Meliadine West site given the encouraging drilling results achieved to date. AEM has subsequently re-opened the underground decline, increased the number of operating diamond drills, and modified and expanded the exploration camp and associated facilities (sewage treatment, potable water treatment, power generation, etc.) to allow exploration to continue year round.

AEM is currently taking a new bulk sample from the underground decline at the Tiriganiaq deposit and will extend the decline to allow for more drilling of the deposit at depth. The objective is to more fully delineate the Tiriganiaq deposit both at depth and on strike and convert the mineral resource into a proven ore reserve through completion of a feasibility study by the end of 2012. AEM also plans to better delineate the other 4 deposits at the Meliadine West site (Wolf, Pump, F-Zone, and the newly found Westmeg deposits) and to convert these resources into reserves.

The main obstacle to advancing the pace of exploration at Meliadine is the amount of on-site fuel storage, currently at 1.8 million litres, which is not sufficient to allow year round exploration activity or to allow AEM to expand its pace of development at this site.

Consequently, to allow year-round delivery of fuel to the site and reduce transportation of materials and staff to the exploration site, AEM plans to construct a single lane gravel surfaced road to provide all-weather access between Rankin Inlet and the Meliadine Project site. The all-weather access road (AWAR) for the advanced exploration project would be constructed as Phase 1 and would have controlled non-project related access.

Phase 1 – All-weather Access Road Advanced Exploration Phase

The Phase 1 AWAR will involve the construction of a 23.8 kilometres long road between the Char River bridge turn-off and the Meliadine West Advanced Exploration site, with access controlled by a manned gate located just after the Char River bridge turn-off. The Phase 1 AWAR will allow AEM to safely and efficiently support advanced exploration of the Meliadine West deposits through the feasibility and environmental assessment phase of the proposed Meliadine Gold Project. The Phase 1 AWAR will be decommissioned and reclaimed by AEM if the proposed Meliadine Gold Project fails to pass either the Feasibility stage or the Nunavut Impact Review Board Environmental Assessment phase, or other permitting requirement.

AEM feels that the most cost-effective and best overall alternative (from an environmental and socio-economic impact perspective) is to construct the AWAR in 2 phases. Hence, AEM has prepared this application to seek authorization to construct the Phase 1 AWAR as a pre-development activity as provided for under Sections 12.10.2 and 13.5.5 of the Nunavut Land Claims Agreement under the Part 5 review of the full proposed Meliadine Gold Project development.

Routing of the All-weather Access Road

The routing of the AWAR was selected to minimize possible effects on the environment, minimize the number of water crossings, and facilitate maintenance of the road, particularly during winter. The selection of the route was based on a number of considerations including the overall length of the road, a desire to minimize the number of stream crossings, avoidance of archaeological sites, and avoidance of the Iqaluqaarjuup Nunanga Territorial Park.

Road and Bridge Configuration and Design

The Phase 1 AWAR will be a nominal single lane road with a running surface of 6.5 metres in width. There will be passing turnouts of 30 metres in length set at intervals of approximately every 350 metres distance along the road. The nominal running surface at each passing turnout will be 9.5 metres in width. The minimum road depth will be 1.0 metres for areas over non-thaw susceptible soil (well-drained soil over bedrock) and 1.3 metres for areas over thaw susceptible soil (poorly drained, ice-rich, organic or bog over bedrock). In both cases, the side slope of the road would be 2.5H:1V. Thus the maximum nominal base width of the road will be 13.0 metres wide, increasing to 16.0 metres wide at each passing turnout, for a road thickness of 1.3 metres.

There will be a total of 10 water crossings along the road route. Two of these crossings will be achieved using clear-span bridges, at the Meliadine River and an unnamed stream at KM 5.0. The other stream crossings will be achieved using culverts. AEM will install a new clear-span bridge immediately adjacent to the existing Char River Bridge that is located on the existing Municipal owned and operated road to the Iqaluqaarjuup Nunanga Territorial Park. The installation of the new clear-span bridge will be on Municipal land, and will proceed upon Hamlet approval and only after all approvals are received for the AWAR. This bridge will be installed by AEM, at AEM's, expense to accommodate the heavier and wider loads that will be transported to the Meliadine Exploration Site. The new Char River Bridge is required because the existing bridge is too narrow, its maximum load is only 50 tonnes, and its abutments are at risk of being undermined by the river at certain times of the year, most notably during the spring freshet. The new Char River Bridge will be a 29.5 metre single-span steel bridge. The new bridge will be immediately west of the current bridge, but its abutments will be set back farther from the river and have substantially more armouring to protect them.

A new 66.3 metre single-span steel bridge will be built across the Meliadine River. The height of the bridge above the water will be approximately 3 metres, which meets the requirements for navigable waters. For stream crossing M5.0, a single-span steel bridge of 23.5 metres will be built so that the natural channel of the stream remains unaffected and fish habitat is not disturbed.

Environmental Assessment Approach

Several steps were completed to evaluate the potential effects from the AWAR Project on valued components of the environment. Valued components represent physical, biological, cultural, social, and economic properties of the environment that are considered to be important by society. Assessment endpoints represent the key properties of the valued component that should be protected for their use by future human generations (e.g., persistence of soil capability to support natural plant communities and wildlife).

Pathway analysis was used to identify and assess the linkages between AWAR Project components or activities, and potential residual effects (i.e., effects after mitigation) to valued components. Pathways were determined to be primary, secondary, or as having no linkage using scientific and traditional knowledge, logic, and experience with similar developments and environmental design features. Each potential pathway is assessed and described as follows:

- no linkage – pathway is removed by environmental design features so that the AWAR Project results in no detectable (measurable) environmental change and residual effects to a VC relative to baseline or guideline values;
- secondary - pathway could result in a minor environmental change, but would have a negligible residual effect on a VC relative to baseline or guideline values; or
- primary - pathway is likely to result in a measurable environmental change that could contribute to residual effects on a VC relative to baseline or guideline values.

Primary pathways underwent further effects analysis to determine the environmental significance of the AWAR Project on the assessment endpoints of valued components. Pathways with no linkage to a VC or that are considered secondary are not analyzed further or classified in the EA because environmental design features will remove the pathway (no linkage) or residual effects to the VC can be determined to be negligible through a simple qualitative evaluation of the pathway (minor). Pathways determined to have no linkage to a VC or those that are considered secondary are not predicted to result in environmentally significant effects on VCs. It should be noted that the pathway analysis approach allows for concentration on the most important issues.

Residual Impact Classification and Significance

Effects statements are used to focus the analysis of changes to VCs that are associated with one or more valid pathways. The residual effects summary presents a numerical and/or qualitative description of magnitude, geographic extent, duration, and frequency of residual effects from each pathway. From the summary of residual effects, each pathway that is linked to an assessment endpoint is classified using categorical scales for each impact criterion (e.g., low magnitude, regional geographic extent, long-term duration, high likelihood).

Effects From the Phase 1 All-weather Access Road Project on the Environment

Atmospheric and Acoustic Environment

Six pathways were identified as having a potential affect to air quality and noise. Of the 6 pathways identified, 5 were determined to be primary; therefore, they were carried through the effect analysis. A number of environmental design features included in the AWAR Project design (e.g., regular maintenance for equipment and vehicles, maintenance of the road surface, and enforcing speed limits) are anticipated to limit the increase of air, dust, and noise emissions from the AWAR Project. No significant adverse environmental effects on the atmospheric and acoustic environment are expected for the AWAR Project.

Aquatic Environment

Twenty-one pathways were indentified as having the potential to affect surface water quantity (hydrology), water quality, and fish and fish habitat. Six of these pathways were considered to have no linkage to effects of the persistence of fish populations and the protection of surface water quality for aquatic ecosystems. Fifteen pathways were determined to be secondary; therefore, residual effects to the protection of surface water for aquatic ecosystems use and the persistence of fish populations are anticipated to be negligible. No pathways were identified as being primary for residual effects to the aquatic environment. A number of environmental design features included in the AWAR Project design (e.g., in-stream work to be completed in winter, use of non-acid generating material at watercourse crossings, and mitigating dust generation) are anticipated to limit the effect on the aquatic environment. No significant adverse environmental effects on the aquatic environment are expected from the AWAR Project.

Terrestrial Environment

Fourteen pathways were identified as having potential effects to the persistence of plant populations and communities, wildlife populations, and continued opportunity for traditional and non-traditional use of wildlife. Four of these pathways were considered to have no linkage to the assessment endpoints. Five pathways were determined to be secondary; therefore, residual effects to the persistence of plant populations and communities, and wildlife populations are anticipated to be negligible. Five pathways were verified as being primary for residual effects to affect plant communities and population, and wildlife and wildlife habitat.

Vegetation

The results indicate that the AWAR Project should not result in significant adverse impacts to the persistence of plant populations and communities, including listed plant species. Changes from the AWAR Project are predicted to result in negligible to moderate local-scale impacts to plant populations and communities, and should be reversible in the long-term.

Wildlife

The magnitude of effects from incremental changes in sensory disturbances from the AWAR on the persistence of the local raptor population is determined to be within baseline variation. It is predicted that the majority of effects will be limited to the construction stage of the Phase 1 AWAR. The magnitude of cumulative effects from the AWAR on the persistence of the local raptor population is determined to be within baseline variation.

The magnitude of the incremental and cumulative decrease in habitat quality for upland birds adjacent to the AWAR is predicted to be within the range of baseline values. The majority of effects will be restricted to the construction phase, and during peak periods of truck activity.

The effects of incremental and cumulative changes in sensory disturbances are predicted to be either undetectable or detectable but within the range of baseline values for the regional caribou population. The effects of incremental and cumulative changes in sensory disturbances are predicted to be undetectable for wolf.

Socio-Economic Environment

Impacts to economics in the area are expected to be positive and are not expected to bring social change. Twelve pathways were determined to be secondary; therefore, residual effects are anticipated to be negligible. The construction period for the road will be short, but the completed road will lead to increased economic activity at the Meliadine site. The positive and negative impacts to local businesses are expected to be minimal. Impacts to employment are expected to be positive, for individuals and local community partners.

Cultural Resources

Two pathways were identified as having a potential affect to archaeological sites, one determined to have no linkage, the other secondary. Each pathway was evaluated to determine if it could lead to a change in environment (ground disturbance) that could affect an archaeological site. Environmental effects from some pathways may be reduced or eliminated through mitigation. No significant residual effects are anticipated and no significant cumulate effects are anticipated. The AWAR Project will have a limited effect on the local archaeological sites.

Cumulative Effects

Not every valued component requires an analysis of cumulative effects. The key is to determine if the incremental effects from the AWAR Project and one or more additional developments/activities overlap (or interact) with the temporal or spatial distribution of the valued component. For some valued components, there is little or no potential for cumulative effects, because there is little or no overlap with other developments, particularly when effects occur at the local scale (e.g., hydrology, soils, plants, and archaeology). For other valued components that are distributed, or travel, over large areas and can be influenced by a number of developments (e.g., caribou), the analysis of cumulative effects can be necessary and important.

There are no predicted significant cumulative effects from the AWAR Project on the following valued components:

- air quality;
- surface water quality and quantity, and fish and fish habitat;
- soils, and plant and wildlife populations; and
- archaeological sites.

The cumulative effects from the AWAR Project and other previous and existing developments on the socio-economic environment are predicted to be similar to the incremental changes from the AWAR, no cumulative effects from the AWAR Project on quality of life are anticipated.

Closure and Reclamation

The Phase 1 AWAR will be decommissioned and reclaimed by AEM if the proposed Meliadine Gold Project fails to pass either the Feasibility stage or Environmental Assessment phase. This would take place within a year of the road no longer being required to complete the reclamation of the Meliadine West Advanced Exploration site. It is AEM's responsibility to decommission and reclaim the road once its activity in the area is complete.

Decommissioning of the AWAR will be accomplished by loosening compacted surfaces, flattening side slopes, and removing all culverts and bridges (not including the Char River Bridge as this would become the property of the Municipality), and other potential obstructions to drainages paths. The objective is to make the road surface impassable by vehicular traffic by ripping the entire road bed and removing all bridges and culverts along the route.

Monitoring and Follow-up

Once the necessary permits and licences are issued and construction of the Phase 1 AWAR Project begins, several inspection and monitoring programs will be implemented.

Compliance inspection will check that project components are built to approved design standards that include the required environmental controls. Compliance monitoring will be repeated throughout the life of the AWAR Project.

Follow-up monitoring activities are expected to include water sampling in and around the AWAR to make sure that the predictions used to assess the effects were accurate. Follow-up monitoring will also assess the potential for success of the proposed closure and reclamation plan.

Environmental monitoring programs will include, but not limited to, wildlife monitoring program, as well as a water quality monitoring program. The scope of these programs will be developed in consultation with regulators, local HTO, and with the KIA.

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ᑕᓯᕐᔪᐊᕐᒥ ᑯᓗᒧᑦ ᐅᔭᕋᒃᑕᕆᐊᕕᒃᓴᖅ ᐱᓕᕆᐊᖑᕙᓕᐊᔪᖅ, ᐅᖓᓯᒃᑎᒋᔪᖅ ᑲᖏᖅᖠᓂᕐᒥᑦ 25 ᑭᓚᒥᑐᑦ, ᓄᓇᕗᒥ.

ᐅᑭᐅᖅ 2010 ᐱᐊᓂᕐᖅᑎᓗᒍ, ᐅᔭᕋᒃᑕᕆᐊᑦ ᐊᒡᓂᑯ ᐃᑯ ᑐᓴᖅᑎᑦᓯᓚᐅᖅᑐᑦ, ᐅᔭᕋᒃᑕᕐᕕᒃᓴᖅ ᑕᓯᕐᔪᐊᕐᒥ ᐱᓕᕆᐊᕆᐊᓴᓚᓂᐊᓕᕐᒪᔪᒃ. ᑕᒻᓇ ᓇᓂᓯᕕᐅᓯᒪᒪᑦ ᑯᓗᒥᒃ ᐃᑯᑕᖅᑎᓗᒋᑦ ᒪᓇᒧᑦ. ᓄᓇᐅᑉ ᐊᑕᓂ ᐊᑦᓯᓕᖅᐸᓕᐊᔪᖅ ᑯᓗᓕᒃ ᖃᐅᔨᒪᔭᐅᔪᖅ, ᐃᑯᑕᑲᓂᕐᓂᐊᖅᓱᑎᒃ, ᐊᒪᓗ ᐅᒪᓗ ᐅᔭᕋᒃᓴᖅᓯᐅᕐᕕᒃ ᐊᖏᓕᓂᐊᖅᑕᐅᐸᓗᓂ. (ᐅᑯᐊᓗ ᐅᔭᕋᒃᑕᕐᕕᐅᓂᐊᕐᑐᒥ ᓴᓇᔭᐅᓯᒪᔪᑦ, ᐃᒪᐃᔭᕐᕕᒃ, ᐃᒥᖅᑕᕐᕕᒃ, ᐃᑯᒪᖃᕐᕕᒃ, ᐊᓯᖏᑦᓗ.) ᑕᑯᐊ ᓴᓇᔭᐅᓯᒪᓕᕐᒪᑕ ᐅᑭᐅᓗᒃᑕᖅ ᐱᓕᕆᕕᐅᑕᕐᓂᐊᓕᖅᑐᖅ.

ᑯᓗᒥᒃ ᓇᓂᓯᕕᐅᓯᒪᔪᖅ ᑕᓯᕐᔪᐊᕐᒥ ᐊᑎᖃᖅᑎᑕᐅᔪᖅ ᑎᓇᖕᒐᓂᐊᖅ, ᐃᑯᑕᕐᕕᐅᑲᓂᕐᓂᐊᖅᑐᖅ ᑯᓗᖃᕐᓂᖓ ᓄᓇᐅᑉ ᐃᓗᐊᓄᑦ ᐃᖕᒋᕋᒪᑦ, ᑯᓗᑲᕐᓂᖓ ᐃᓱᐊᓄᑦ ᑎᑭᓗᒍ ᐃᑯᑕᕐᓂᐊᖅᑐᑦ. ᐃᑯᑕᕈᑎᒋᓗᐊᖅᑕᖕᒐᑦ ᑐᑭᓯᓂᐊᕐᒪᑕ ᖃᓄᖅ ᑯᓗ ᐊᖏᑎᒋᒪᖕᒐᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂ, ᑐᑭᓯᒍᒥᒃ ᖃᐅᔨᓴᕈᑕᐅᔪᒧᑦ ᑎᑎᕋᓗᒍ ᐃᓕᔭᐅᓂᐊᕐᒪᑦ, ᐅᑭᐅᖅ 2012 ᐱᐊᓂᖅᑎᓇᒍ. ᑕᓯᕐᔪᐊᕐᒥ ᓯᑕᒪᑦ (4) ᑯᓗᒥᒃ ᓇᓂᓯᕕᐅᓯᒪᔪᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂ, ᐊᑎᖃᖅᑎᑕᐅᔪᑦ (Wolf, Pump, F-Zone, Westmeg) ᑕᑯᐊ ᐃᑯᑕᑲᓂᕐᓗᒋᑦ, ᖃᓄᖅ ᑯᓗᖃᕐᔪᐊᕐᒪᖔᑕ ᐱᓕᕆᐊᕆᔭᐅᓂᐊᖅᑐᑦ, ᑐᑭᓯᓂᐊᕐᒪᑕ.

ᑕᓯᕐᔪᐊᕐᒥ ᐅᔭᕋᒃᑕᕐᕕᒃ ᐱᓕᕆᐊᕆᔭᐅᑲᓂᕋᔭᖅᑐᖅ ᐊᖏᓕᕐᓗᓂᓗ ᑭᓯᐊᓂ ᐱᐊᓚᐃᔪᑕᐅᔪᖅ ᐅᖅᓱᐊᓗᒃ ᒥᑭᓗᐊᕐᒪᑦ. ᐅᖅᓱᐊᓗᖃᑲᓂᕈᒥᒃ ᑕᓯᕐᔪᐊᕐᒥ ᐱᓕᕆᓗᐊᑲᓂᕋᔭᖅᑐᑦ, ᒪᓇ 1.8 ᒥᓕᐊᓂᒃ ᓚᑐᓂᒃ, ᐅᖅᐊᓗᖃᕈᓇᖅᑐᒥᒃ ᑲᑕᐅᔭᕐᔪᐊᖃᕐᒪᑦ, ᐊᑐᖅᑕᑲᒥᓂᒃ, ᑲᖏᖅᖠᓂᕐᒥ. ᑕᒻᓇ ᑕᓯᕐᔪᐊᕐᒥ ᐱᐊᓚᐃᔪᑕᐅᔪᖅ.

ᑕᓯᕐᔪᐊᕐᒥ ᐅᖅᓱᐊᓗᖃᕐᓇᖅᐸᑕ ᐅᑭᐅᓗᒃᑕᖅ ᐅᖅᓱᐊᓗᒥᒃ ᐊᔭᖅᑐᐃᑕᕋᔭᖅᑐᑦ ᐊᒪᓗ ᑕᒪᑯᐊ ᐱᖁᑎᕐᔪᐊᑦ ᐊᔭᖅᑐᖅᑕᐅᑕᕋᔭᖅᑐᑦ, ᐱᓕᕆᔨᑦᓗ ᑕᐃᑯᖕᒪᑕᔭᖅᑐᑦ. ᑕᐃᒪ ᑕᒪᓇ ᐃᓱᒪᒥᑉᓗᒍ ᐊᒡᓂᑯ ᐃᑯ ᐅᔭᕋᒃᑕᕆᐊᑦ ᐊᑉᖁᑎᓕᐅᕈᐊᖅᑐᑦ ᑲᖏᖅᖠᓂᕐᒥᑦ ᑕᓯᕐᔪᐊᕐᒧᑦ. ᑕᒻᓇ ᐊᑉᖁᑦ ᐊᑐᓚᐅᑕᕋᔭᖅᑐᖅ ᐅᑭᐅᓗᒃᑕᖅ ᓴᓇᔭᐅᒍᒥ. ᓯᕗᓂᒥᒃ ᑕᒪᓇ ᐊᑉᖁᑦ ᓴᓇᔭᐅᓇᔭᖅᑐᖅ, ᐊᒪᓗ ᐊᓯᖏᓂᑦ ᐊᑐᖅᑕᐅᑕᕋᔭᖅᓱᓂ.

ᓯᕗᓕᖅ 1, ᐅᑭᐅᓗᒃᑕᒥ ᐊᑐᕈᓇᖅᑐᖅ ᐊᑉᖁᑦ, ᐱᓕᕆᐊᕆᔭᐅᓂᖓ

ᓯᕗᓕᕐᒥᒃ 1, ᐊᑉᖁᑦ ᓴᓇᔭᐅᔪᒪᔪᖅ ᑲᖏᖅᖠᓂᕐᒥᑦ ᑕᓯᕐᔪᐊᕐᒧᑦ ᑕᑭᓂᖃᕋᔭᖅᑐᖅ 23.8 ᑭᓚᒥᑐᓂᒃ. ᓴᓇᔭᐅᒥᐊᖃᔭᖅᓱᓂ ᐊᑯᕐᔪᒍᐊᕐᑐᒧᑦ ᐃᑲᕐᕕᖕᓂᑦ, ᑕᓯᕐᔪᐊᕐᒧᑦ. ᐊᒪᓗ ᐃᑲᕐᕕᖁᒍ, ᓴᓂᐊᓂ ᐊᕐᑐ ᓄᓇᑯᖅᑎᓄᑦ ᖃᐅᔨᓴᕐᕕᒃ ᓴᓇᔭᐅᓇᔭᖅᑐᖅ. ᐊᑉᖁᑎᖁᑦ ᓄᓇᑯᖅᑎᓄᑦ ᐱᓕᕆᐊᕆᔭᐅᓂᐊᖅᑐᑦ, ᑕᐃᒪ ᐊᑉᖁᑎᒃᑯᑦ ᐊᐅᓚᑕᐅᓂᐊᖅᑐᑦ. ᑕᓯᕐᔪᐊᕐᒥ ᐅᔭᕋᒃᑕᕆᐊᕕᒃ ᐱᓕᕆᐊᕆᔭᐅᓯᐊᔭᖅᑐᖅ, ᐊᑐᖅᑕᐅᓂᐊᕐᒪᑦ ᐃᓄᓐᓄᑦ ᐊᒪᓗ ᐱᓕᕆᔨᓄᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᑕᒪᓇ.

ᐊᒡᓂᑯ ᐃᑯ ᐅᔭᕋᒃᑕᕆᐊᑦ ᐃᓱᒪᔪᑦ ᐱᓕᕆᓂᕐᒧᑦ ᐊᑭᖅᑐᓂᖅᓴᐅᔭᖅᑐᖅ ᒪᑭᓂᒃ ᐱᓕᕆᓂᐅᔪᓂᒃ ᐊᐅᓚᑎᑦᓯᒪᓂᕐᒧᑦ ᐊᑭᓯᐸᑕ. ᐊᐅᓚᑎᓕᐅᕐᓂᑦ ᒪᕈᐃᓕᖕᒐᓄᑦ ᐱᓕᕆᐊᕆᕙᐅᑎᓂᒃ ᐊᑭᐸᑦ, ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᒪᓗ ᐃᓄᓕᕆᓂᕐᒧᑦ ᐱᕙᓕᐊᑦ ᐸᕐᓇᖕᒍᑕᐅᑉᐸᓕᐊᑦ, ᐱᓕᕆᐊᕆᔭᐅᓯᐊᔭᖅᑐᑦ. ᐊᒡᓂᑯ ᐃᑯ ᐅᔭᕋᒃᑕᕆᐊᑦ ᓚᐃᓴᓐᓯᓕᐅᕐᑎᐅᓂᕐᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᓯᐅᑦ, ᐊᐅᓚᑎᓕᐅᕐᓂᑦ ᓯᕗᓕᕐᒥᒃ ᐱᓕᕆᐊᕆᔭᐅᓯᐊᔭᖅᑐᑦ ᓚᐃᓴᓐᓯᓕᐅᕐᑎᒃ. ᑕᒪᓇ ᐱᓕᕆᐊᕆᔭᐅᓯᐊᔭᖅᑐᖅ, ᑐᖕᒐᕕᖓᑦ ᐊᖏᕈᑎᖏᓐᓂ ᐊᑕᒪᑦ ᐊᑐᕐᓯᐊᔭᖅᑐᑦ, ᐊᖏᕈᑎᒥ ᓇᓴᐅᑎᖓ 12.10.2 ᐊᒪᓗ 13.5.5. ᑕᓯᕐᔪᐊᕐᒥ ᐅᔭᕋᒃᑕᕐᕕᒃ ᓄᓇᕗᑦ ᐊᐅᓚᑎᓕᕆᐃᑦ ᑲᑎᒪᔨᖏᓐᓄᑦ ᐱᓕᕆᐊᕆᔭᐅᓯᐊᔭᖅᑐᑦ, ᓇᓴᐅᑎᖓ 5 ᐊᑐᕐᓂᐊᖅᑐᖅ ᖃᐅᔨᓴᕐᓂᕐᓂᑦ. ᑕᒪᓇ ᑕᓯᕐᔪᐊᕐᒥ ᐅᔭᕋᒃᑕᕆᐊᕕᐅᓂᐊᕐᑐᖅ ᖃᐅᔨᓴᕐᓂᐊᕐᑐᖅ ᐱᓕᕆᐊᕆᔭᐅᓂᐊᕐᒪᑦ, ᓄᓇᕗᑦ ᐊᐅᓚᑎᓕᕆᐃᑦ ᑲᑎᒪᔨᖏᓐᓄᑦ ᐱᕙᓕᐊᑎᓗᒍ.

ᒃᐅᑭᐅᓗᒃᑕᒥ ᐊᑉᖁᑦ ᐊᑐᕈᓇᖅᑐᖅ, ᐊᕿᓯᒪᓂᖕᒐ

ᑲᖕᒋᖅᓱᓂᕐᒥᑦ ᑕᓯᕐᔪᐊᕐᒪᑦ ᐊᑉᖁᑦ ᐊᕿᓯᒪᓂᖕᒐ ᐸᕐᓇᒍᑕᐅᓯᒪᔪᖅ ᐊᕙᑎᓗᒃᑕᖅ, ᓄᓇ, ᑯᑲᓂᓗ ᐃᑲᕐᕕᐅᓇᔭᖅᑐᑦ, ᐊᑉᖁᑦᓗ ᐃᓕᓇᐊᓇᔭᐅᔭᓇᐊᖃᕐᓂᖕᒐ ᐅᑭᐅᒥ ᐃᓱᒪᒋᑉᓗᒋᑦ. ᓄᓇᓗ ᐊᓯᕈᓗᐊᖁᓇᖕᒍ. ᐊᑉᖁᑦ ᐸᕐᓇᒍᑕᐅᑎᓗᒍ ᐅᑯᐊ ᐃᓱᒪᒋᔭᐅᓯᒪᔪᑦ, ᑯᒐᐃᑦ ᐃᑲᕐᕕᒃᓴᖕᒋᑦ ᐊᒥᓱᓗᐊᖁᓇᒋᑦ, ᐃᓄᐃᑦ ᑭᖕᒍᓂᕐᒥ ᓄᓇᒥ ᐃᓂᕕᓂᖕᒋᑦ, ᐊᑉᖁᓗ ᑕᑭᓂᖕᒐ. ᐃᓱᒪᒋᔭᐅᓯᒪᒥᔪᖅ ᐃᖃᓗᒐᕐᔪᑉ ᓄᓇᖕᒐᓂ ᒥᖕᒍᐃᓯᕐᕕᒃ, ᑕᒻᓇ ᐊᒃᑐᖅᑕᐅᑕᐃᓕᖁᑉᓗᒍ.

ᐊᑉᖁᑦ ᐊᒪᓗ ᐃᑲᕐᕕᒃ ᐊᕿᓯᒪᓂᖕᒐ, ᐊᒪᓗ ᓴᓇᔭᐅᓂᐊᕐᓂᖕᒋᑦ

ᐊᑉᖁᑦ ᐅᑭᐅᓗᒃᑕᑯᑦ ᐊᑐᕈᓇᖅᑐᖅ ᓯᕗᓕᕐᒥᒃ ᓴᓇᔭᐅᓕᖅᐸᑦ ᑐᐊᑐᓂᐊᖅᑐᖅ, ᓯᓕᓂᖃᕐᓗᓂ 6,5 ᒥᑐᒥᒃ. ᐊᑉᖁᒥ ᓄᓇᑯᕈᓂᒃ ᓴᓂᕙᕐᕕᒃᒥᒃ ᓴᓇᓂᐊᕐᑐᑦ, ᐊᑯᑐᑎᒥᓗᑎᒃ 350 ᒥᑐᓂᒃ, ᓄᓇᑯᕈᑎᑦ ᖃᖕᒋᖅᑕᕐᓂᐊᕐᒪᑕ ᐅᐊᔭᖅᑐᑦ. ᓄᓇᑯᕈᑎᑦ ᑲᖕᒋᕐᕕᒃᒥ ᓄᖃᕈᒥᒃ, ᐊᑉᖁᑦ ᑲᖕᒋᕐᓂᖕᒐ ᓯᓕᒃᑎᒋᓇᔭᖅᑐᖅ 9.5 ᒥᑐᓂᒃ. ᐊᑉᖁᑦ ᓴᓇᔭᐅᑎᓗᒍ ᖁᓚᓂᑦ ᐊᑕᓄᑦ ᐃᑉᔪᑎᒥᓂᐊᖅᑐᖅ 1.0 ᒥᑐᒥᒃ, ᐸᓂᖅᑐᓂ ᓄᓇᒥ ᐅᒪᓗ ᖃᐃᖅᑐᓂ. ᓄᓇᒥᓕ ᐊᐅᒃᐸᑐᓂ, ᑭᓂᐸᓂᖃᖅᑐᓗᓂᑦ, ᐊᑉᖁᑦ ᖁᓚᓂᑦ ᐊᑕᓄᑦ, ᐃᑉᔪᑎᒥᓂᐊᖅᑐᖅ 1.3 ᒥᑐᓂᒃ. ᐊᑉᖁᑦ ᐅᕕᖕᒐᓂᖃᕋᔭᖅᑐᖅ 2.5H: 1V. ᐊᑉᖁᑦ ᐅᕕᖕᒐᓂᖕᒐ ᑕᐅᑐᓗᒍ ᓯᓕᓂᖅᐸᖕᒐ 13.0 ᒥᑐᖕᒍᓇᔭᖅᑐᖅ ᐊᒪᓗ ᓄᓇᑯᕈᑎᑦ ᖃᖕᒋᕐᕕᖕᒐᓂ ᓯᓕᓂᖅᐸᖕᒐ 16.0 ᒥᑐᑦ. ᐊᑉᖁᑦ ᖁᓚᓂᑦ ᐊᑕᓄᑦ ᐃᑉᔪᓂᖃᕐᓗᓂ 1.3 ᒥᑐᓂᒃ.

ᐊᑉᖁᑦ ᓴᓇᔭᐅᒐᓂᑯᒥ, ᑯᒐᕐᓂᓗᓂᑦ 10 ᓱᑉᓗᓕᖃᕐᕕᐅᓂᐊᕐᑐᑦ. ᒪᕈᓂᒃ ᐃᑲᕐᕕᖃᓂᐊᕐᑐᖅ ᐊᑉᖁᒥ, ᑕᓯᕐᔪᐊᑉ ᑯᖕᒐᓂ ᐊᒪᓗ ᑯᒐᑲᓂᕐᒥ ᐅᖕᒐᓯᓂᖕᒐᓂ Km. 5.0ᒥ. ᐊᓯᖕᒋᑦ ᐃᑲᕐᕕᖕᒋᑦ ᓴᓇᔭᐅᓂᐊᕐᑐᑦ ᓱᑉᓗᓕᖃᕐᓗᑎᒃ. ᐊᑯᒐᕐᔪᑉ ᑯᖕᒐᓂ ᐃᑲᕐᕕᐅᑉ ᓴᓂᐊᓂ, ᐃᑲᕐᕕᒃ ᓴᓇᔭᐅᓂᐊᕐᑐᖅ, ᑕᒻᓇ ᓄᓇ ᑲᒪᒋᔭᐅᔪᖅ ᑲᖕᒋᖅᓱᓂᐅᑉ ᕼᐊᒻᓚᖕᒐᓂᑦ. ᑭᓯᐊᓂ ᑲᖕᒋᖅᓱᓂᐅᑉ ᕼᐊᒻᓚᖕᒐᑦ ᐊᖕᒋᕈᒥ ᐃᑲᕐᕕᒃ ᓴᓇᔭᐅᓂᐊᖅᑐᖅ. ᑭᓯᐊᓂ ᐊᓯᖕᒋᑦ ᐱᓕᓇᐊᖕᒍᔪᑦ ᐊᖕᒋᒐᐅᓗᒃᑕᕐᐸᑕ, ᐃᑲᕐᕕᒃ ᓴᓇᔭᐅᒥᐊᕋᔭᖅᑐᖅ. ᑕᒻᓇ ᐃᑲᕐᕕᒃ ᓴᓇᔭᐅᓂᖃᖅᑐᖅ ᐊᒻᓂᑯ ᐃᑯ ᐅᔭᕋᒃᑕᓇᐊᓂᑦ, ᐊᐅᓚᑕᐅᓗᓂᓗ, ᐊᖕᒋᓂᖅᓴᐅᓗᓂᓗ. ᐊᖕᒋᓂᖅᓴᐅᓂᐊᕐᑐᖅ ᐱᖁᑎᕐᔪᐊᑦ ᐅᖁᒪᐃᒪᑕ ᐊᔭᖅᑐᒐᐅᓂᐊᖅᑐᑦ ᑕᓯᕐᒍᐊᕐᒍᑦ. ᓄᑕᖅ ᐃᑲᕐᕕᒃ ᓴᓇᔭᐅᓂᐊᖅᑐᖅ, ᑕᐃᒻᓇ ᐃᑲᕐᕕᒃ ᐊᑯᒐᕐᔪᑉ ᑯᖕᒐᓂᑐᖅ ᒥᑭᓗᐊᕐᒪᑦ, ᑐᐊᓗᐊᖅᓗᓂᓗ, ᐅᖁᒪᐃᓂᖅᐸᕐᓗ 50 tonnes ᖃᖕᒐᒍᕈᓇᖅᓗᑎᒃ. ᐊᒪᓗ ᓴᓇᓯᒪᓂᖕᒐᓂᑦ ᐃᑲᕐᕕᒃ ᐊᑐᒐᐅᔪᒃᓇᕐᒪᑦ ᓯᑯᒥᑦ ᐊᐅᒃᐸᓕᐊᓕᕋᒐᑦ. ᓄᑕᖅ ᐃᑲᕐᕕᒃ ᓴᓇᔭᐅᓂᐊᖅᑐᖅ ᐊᖕᒋᓂᖅᓴᐅᓂᐊᖅᑐᖅ ᑐᖕᒐᐱᒥᒃᓗ ᐊᑯᑐᓂᖅᓴᐅᓗᑎᒃ, ᓯᓕᓂᖅᓴᐅᓗᓂᓗ. ᑕᒻᓇ ᐃᑲᕐᕕᒃ ᑕᑭᓂᖃᕐᓂᐊᖅᑐᖅ 29.5 ᒥᑐᓂᒃ, ᑯᒐᕐᓗ ᐊᒃᑐᒐᐅᓕᖕᒋᑐᖅ ᐃᑲᕐᕕᒃᒥᑦ. ᓴᔭᐅᓗᓂ ᐊᑯᒐᕐᔪᑉ ᐃᑲᕐᕕᖕᒐᑕ ᐊᑦᒍᐊᓂ.

ᐊᕙᑎᐅᑉ ᖃᐅᔨᓴᕐᓂᖕᒐ

ᐅᑭᐅᓗᒃᑕᒥ ᐊᑐᕈᓇᖅᑐᖅ ᐊᑉᖁᑦ ᐱᕐᓇᒍᑕᐅᑎᓗᒍ, ᓄᓇᓗ ᐃᒪᕐᓗᑉ, ᐊᕙᑎᓗᒃᑕᖅ ᐃᓱᒪᒋᔭᐅᓚᐅᖅᑐᖅ ᐊᓯᕈᖁᖕᒋᓗᒍ, ᓄᓇᓗ ᐃᒪᕐᓗ ᐃᑉᓕᓇᔭᐅᒪᑦ ᑭᑐᓗᒃᑕᓂᑦ. ᐊᕙᑎᐅᑉ ᐃᑉᓕᕐᓇᕐᓂᖕᒋᑦ ᐅᑯᐊ, ᓄᓇ, ᐃᓄᐃᑦ ᐃᓕᖁᓯᖕᒋᑦ ᓄᓇᒥ, ᐃᓄᓗᒃᑕᑦ ᐃᓕᖁᓯᖕᒋᑦ, ᐊᒪᓗ ᓄᓇᐅᑉ ᐱᒐᓕᐊᓂᖕᒐ ᐊᑐᕐᓂᖃᒪᑦ ᑭᑐᓗᒃᑕᓄᑦ. ᑕᒪᓇ ᐊᕙᑎ ᖃᐅᔨᓴᒐᐅᓯᒪᔪᖅ ᐊᓯᕈᖁᓇᒍ, ᐊᑐᒐᐅᑕᕐᓂᐊᕐᒪᑕ ᓯᕗᓂᕐᒥ ᐃᓄᓗᒃᑕᓂᑦ. (ᓄᓇ ᐱᕈᒃᓕᐊᑦᓯᐊᖁᓗᒍ, ᐊᑐᕐᓂᖃᒪᑕ ᐃᓄᓗᒃᑕᓄᑦ, ᓂᕐᔪᑎᓄᑦᓗ).

ᐊᑉᖁᑦ ᐸᕐᓇᒍᑕᐅᑎᓗᒍ ᖃᐅᔨᓴᒐᐅᓯᒪᔪᖅ ᖃᓄᖅ ᐊᒃᑐᕐᓂᖃᐊᕐᒪᖕᒐᑦ ᓄᓇᒥᒃᓗ ᐃᒪᕐᒥᒃᓗ, ᐊᕙᑎᓗᒃᑕᒥᒃ. ᐊᒪᓗ ᖃᐅᔨᓴᒐᐅᓯᒪᒥᔪᖅ ᐊᑉᖁᑦ ᐊᑐᐊᓂᒃᐸᑦ, ᓄᓇ ᑕᐅᑐᓚᐅᒥᓄᑦ ᐊᕿᓯᒐᐅᓯᒪᓕᖅᐸᑦ. ᐊᑉᖁᑦ ᐃᓂᒥᓂᐊᖅᑕᖕᒐ ᐸᕐᓇᒍᑕᐅᑎᓗᒍ, ᐃᓱᒪᓕᐅᕈᑕᐅᓚᐅᖅᑐᑦ, ᐊᒥᓱᑦ ᐃᑲᔪᐊᓂᖃᕈᓇᖅᑐᑦ, ᐃᓂᖕᒐ, ᐃᓄᐃᑐᖃᐃᑦ ᖃᐅᔨᒪᓂᖕᒋᑦ, ᖃᐅᔨᓴᖅᑎᑦ ᐊᑐᖅᓗᒥᑦ, ᐱᕙᓕᐊᓂᖕᒐ, ᐊᕙᑎᓗ ᐊᑐᖅᑕᐅᕙᓕᐊᓂᖕᒐ, ᖃᓄᕐᓗ ᓴᓇᔭᐅᓯᒪᓂᐊᕐᒪᖕᒐᑦ.

ᐊᑉᕐᑯᑦ ᓴᓇᔭᐅᓂᐊᕐᓂᖓ ᐸᕐᓇᒍᑕᐅᑎᓗᒍ, ᑕᒪᑯᐊ ᐸᕐᓇᒍᑕᐅᔪᑦ ᖃᐅᔨᓴᐅᓯᒪᒥᔪᑦ ᐊᒪᓗ ᖃᐅᔨᓴᐅᓂᖏᑦ ᑎᑎᕋᒐᐅᓯᒪᔪᑦ ᐅᑯᐊᖑᑉᓗᑎᒃ:

- ᐊᑉᕐᑯᑦ ᐃᓂᒋᓂᐊᖅᑕᖓ ᖃᐅᔨᓇᒐᐅᑎᓗᒍ, ᖃᐅᔨᓇᓚᐅᕐᒥᔪᑦ ᐊᒃᑐᓂᖃᖏᑯᒥ ᓄᓇᒥᒃᓗ ᐃᒪᕐᒥᒃᓗ, ᑭᓯᐊᓂ ᑕᒪᓇ ᐃᑲᔪᕈᑕᐅᓗᑉᓗᓂ ᐸᕐᓇᒍᑕᐅᓚᐅᖅᑐᖅ, ᐊᑉᕐᑯᑦ ᓴᓇᔭᐅᓂᖓ ᐸᕐᓇᒃᓯᒪᑦᓯᐊᕐᑯᑉᓗᒍ. ᐊᑉᕐᑯᑦ ᐃᓂᒋᓂᐊᖅᑕᖓ ᖃᓄᓗᒃᑕᖅ ᖃᐅᔨᓴᐅᓯᒪᔪᖅ, ᐊᒃᑐᕐᓂᖃᓂᐊᖅᑐᔭᖏᑲᓗᐊᕐᐸᑦ.

- ᐊᑉᕐᑯᑦ ᐊᒃᑐᓂᖃᓇᖅᑐᖅ, ᐊᑉᕐᑯᑦ ᓴᓇᔭᐅᓂᖓ ᐊᒃᑐᕐᓂᖃᓇᖅᐸᑦ ᑕᒪᓇ ᖃᐅᔨᓴᐅᓯᒪᒥᔪᖅ, ᓄᓇᓗ ᐃᒪᕐᓗ ᐊᕙᑎᓗᒃᑕᖅ ᐊᑐᓚᐅᓂᖃᕐᓇᖅᐸᑦ, ᐅᕙᓗᓂᑦ

- ᐊᑉᕐᑯᑦ ᓴᓇᔭᐅᓂᖓ ᐊᒃᑐᕐᓂᖃᕐᓂᐊᕐᑐᖅ, ᓴᓇᔭᐅᓂᖓ ᓄᓇᒥᒃᓗ ᐃᒪᕐᒥᒃᓗ ᐊᒃᑐᕐᓂᖃᕐᓂᐊᖅᑐᖅ, ᖃᐅᔨᓴᐅᓂᕐᒥᓗ, ᒪᓕᒐᓂᓗ ᑎᑎᕋᒐᐅᓯᒪᔪᖅ ᖃᐅᔨᓴᕐᓂᖓ.

ᐊᑉᕐᑯᑦ ᓴᓇᔭᐅᓂᖓ ᐊᒃᑐᓂᖃᕐᓂᐊᕐᒪᑦ ᐊᕙᑎᒥᒃ ᑕᒪᓇ ᑐᑭᓯᔭᐅᓯᒪᔪᖅ ᐸᕐᓇᒍᑕᐅᓯᒪᑉᓗᓂᓗ. ᑕᒪᑯᐊ ᓄᓇᒥᒃᓗ ᐃᒪᕐᒥᒃᓗ ᐊᒃᑐᒐᐅᓂᖏᑦ ᖃᐅᔨᓴᐅᓯᒪᔪᑦ ᖁᓄᖅ ᐊᒃᑐᓂᖃᕐᓂᐊᕐᒪᖔᑦ. ᓄᓇᐃᑦᓗ ᐃᖕᓕᓇᔭᐅᔪᑦ ᑕᐅᑦᑕᐅᓯ ᖃᓄᕐᓗ ᐊᒃᑐᒐᐅᓂᖃᕐᓂᐊᕐᒪᖔᑦ. ᐊᑉᕐᑯᑦ ᓴᓇᔭᐅᓂᐊᕐᓂᖓᓂ ᑕᐅᑐᒐᐅᓯᒪᓂᖓ, ᐱᖓᓯᒪᑕ, ᑭᓯᐊᓂ ᐊᑐᕐᓂᖃᕐᓂᐊᖅᑐᔭᖏᑉᐸᑦ ᑕᐅᑐᒐᐅᓯᒪᒥᔪᖅ. ᑕᒪᑯᐊ ᐊᕐᑐᕐᓂᖃᓂᐊᖏᑦᑐᑦ ᐃᑲᔪᕐᓂᖃᕐᒥᒪᑕ ᑐᑭᓯᔪᑕᐅᒪᑕ. ᑭᓯᐊᓂ ᑕᒪᓇ ᓄᓇ ᐊᒃᑐᕐᓂᖃᕐᓂᐊᖅᑐᖅ ᐊᑉᕐᑯᑦ ᓴᓇᔭᐅᓕᖅᐸᑦ, ᑕᐃᑯᐊᓗ ᓄᓇᑦ ᐊᒃᑐᒐᐅᓂᐊᖅᑐᑦ ᑕᐅᑐᒐᐅᓗᐊᓕᖅᓱᑎᒃ ᖃᓄᖅ ᐊᕿᒐᐅᔪᖃᕐᓇᕐᒪᖔᑦ.

ᐊᑉᕐᑯᑦ ᓴᓇᔭᐅᓂᖓᓄᑦ, ᐊᒃᑐᒐᐅᓂᖓ

ᓄᓇᐅᑉᓗ ᐃᒪᐅᑉᓗ ᐊᕙᑎᓗᒃᑕᑉᓗ ᐊᒃᑐᕐᓂᖏᑦ ᖃᐅᔨᓴᐅᓂᖏᑦ ᑐᑭᓯᔪᑕᐅᔪᒪᔪᑦ, ᐊᕙᑎ ᐊᓯᕈᕐᑯᓇᒍ. ᑕᒪᓇ ᐊᒃᑐᕐᓂᐅᔪᖅ ᓄᓇᒥᒃᓗ ᐊᕙᑎᓗᒃᑕᒥᒃ, ᑎᑎᖃᒃᑕᐅᓯᒪᔪᖅ ᑐᑭᓯᔪᑕᐅᓂᐊᕐᒪᑦ, ᓇᓴᐅᑎᑦ ᐊᑐᖅᑯᕐᓂᑦ, ᐊᖏᓂᖓ ᑐᑭᓯᓇᕐᓂᐊᕐᒪᑦ. ᑕᒪᓇ ᖃᐅᔨᓴᕐᓂᖓ ᑐᑭᓯᓇᕐᓂᐊᖅᑐᖅ, ᐊᖏᓂᖓᓂᒃ, ᓄᓇᒥ ᐊᑐᒐᐅᓂᖓ, ᐊᑐᒐᐅᓯᒪᖃᓐᓂᖓ, ᐊᑎᖏᖅᑐᑦ ᐊᑐᒐᐅᓂᐅᔪᑦ. ᑕᒪᑯᐊ ᖃᐅᔨᓴᕐᓂᐅᔪᑦ ᐊᕙᑎᐅᑉ ᐊᑐᒐᐅᓂᖓᓂᒃ ᑐᑭᓯᔪᑕᐅᓂᐊᕐᒪᑦ, ᖃᓄᖅ ᐊᑐᕐᓂᖓ ᐊᖏᑎᒋᒪᖔᑦ. ᐊᒃᑐᕐᓂᖓ ᐊᕙᑎᒧᑦ ᒥᑭᔫᒃᓴᖅᑐᖅ, ᓄᓇ ᐊᖏᔫᖅ ᐊᑐᒐᐅᔫᒃᑲᓐᓂᖅᑐᖅ, ᐊᑐᒐᐅᓂᖓᓗ ᐅᑭᐅᓄᑦ ᐊᒥᓱᓄᑦ ᐃᖏᕐᕋᔫᑲᓐᓂᖅᑐᖅ, ᐊᑐᒐᐅᓂᖃᕐᔪᐊᕆᓇᖅᑐᖅ. ᑕᒪᓇ ᑐᑭᓯᓇᕐᓂᐊᕐᒪᑦ ᖃᐅᔨᓴᐅᔪᖅ, ᓄᓇᓗ ᐃᒪᕐᓗ ᓇᒪᕐᑯᒐᕐᓂᑦ, ᓯᕗᓂᕐᒥ.

ᐊᑉᕐᑯᑦ ᓴᓇᔭᐅᓂᖓᓄᑦ ᓯᕗᓕᕐᒥᒃ, ᐊᒃᑐᕐᓂᐅᔪᑦ ᐊᕙᑎᒥᒃ

ᐊᓄᕆᐅᑉ ᐊᒃᑐᕐᓂᖓ

ᐊᑉᕐᑯᑦ ᓴᓇᔭᐅᓂᐊᕐᓂᖓ ᑕᐅᑐᒃᓗᒍ ᐊᒃᐱᓂᓕᑦ (6) ᐊᒃᑐᒐᐅᓂᐅᔪᑦ ᑐᑭᓯᓇᖅᑐᑦ, ᐊᓄᕆᒥᐊᖅᑐᑦᓗ ᐊᒪᓗ ᐊᕐᑯᑦ ᐊᑐᒐᐅᓂᖓᓄᑦ ᑐᓴᕐᓂᖓ. ᑕᑯᐊ 6ᖑᔪᑦ ᐊᒃᑐᓂᐅᔪᑦ, 5 ᐊᒃᑐᓂᐅᓗᐊᖅᑐᑦ ᐸᕐᓇᒍᑕᐅᔪᑦ, ᖃᓄᖅ ᐊᕐᑭᒍᓇᕐᒪᖓᑕ ᖃᐅᔨᓴᐅᑲᓂᕐᓂᐊᖅᑐᑦ. ᓄᓇᓗ ᐃᒪᕐᓗ ᐊᓄᕆᓗ ᐃᓯᒪᕆᑉᓗᕆᑦ, ᐊᑉᕐᑯᑦ ᐊᑐᒐᐅᓂᖓ ᐱᓕᕆᐊᔭᐅᑦᕐᓂᐊᖅᑐᖅ (ᐊᕐᑭᓯᒐᐅᑦᕐᓗᓂ, ᐊᑉᕐᑯᑦ ᖃᖓ ᒪᓂᒃᓴᒐᐅᑦᕐᓗᓂ, ᐊᒪᓗ ᓄᓇᕐᑯᕈᑎᑦ ᓇᕿᕐᓂᖓ ᐊᑉᕐᑯᒥ) ᑕᒪᑯᐊ ᐸᕐᓇᒍᑕᐅᒥᔪᑦ ᐊᓄᕆᓗ, ᐳᔪᕐᓂᕐᓗ, ᓄᓇᑯᕈᑎᑦᓗ ᑐᓴᕐᓂᕐᓂᖓᑦ, ᐊᒃᑐᕐᓂᖃᕐᓂᐊᕐᒪᑕ ᐊᕙᑎᒥᒃ. ᑭᓯᐊᓂ ᐊᑉᕐᑯᑦ ᐊᕙᑎᒃ ᐊᑐᓂᖃᕐᓂᐊᖅᑐᐊᕐᓗᓂ, ᐊᑐᕐᓂᖓ ᓯᓂᓗᐊᓕᖓᑐᑦ ᐊᕙᑎᒃ.

ᐃᒪᐅᑉ ᐊᒃᑐᕐᓂᖓ

21ᖑᔪᑦ ᐊᒃᑐᕐᓂᐅᔪᑦ ᐃᒪᕐᒥᒃ ᐃᓕᑕᕆᔭᐅᓚᐅᖅᑐᑦ, ᐊᑉᕐᑯᑎᐅᑉ ᓴᓇᔭᐅᓂᖓᓄᑦ, ᐊᒪᓗ ᐃᖃᓗᐃᑦᓗ, ᐃᖃᓗᖃᕐᓂᐅᔪᑦᓗ ᐃᓚᐅᖃᑕᐅᑉᓗᑎᒃ. 6ᖑᔪᑦ ᐃᒪᕐᒥᒃ ᐊᒃᑐᕐᓂᐅᔪᑦ, ᐃᖃᓗᐃᑦ ᐊᒥᓱᓂᖏᓂᒃ ᐊᑐᕐᓂᖃᓗᐊᓕᖏᑐᑦ, ᐊᒪᓗ ᑕᓯᕐᓂᒃ ᐊᑐᕐᓂᖃᓗᐊᖏᓗᑎᒃ. 15ᖑᔪᑦ ᐃᒪᕐᒥᒃ ᐊᒃᑐᕐᓂᐅᔪᑦ, ᐃᓗᐃᔪᑐᐊᓕᖏᑐᑦ. ᐊᒪᓗ ᐃᒪᕐᒥᒃ ᐊᒃᑐᕐᓂᐅᔪᑦ, ᐃᓗᐃᔪᑕᐅᖏᑐᑦ. ᐊᑉᕐᑯᑦ ᓴᓇᔭᐅᓂᐊᕐᑎᓗᒍ ᑕᒪᑯᐊ ᓄᓇᒥᒃᓗ ᐃᒪᕐᒥᒃᓗ ᐊᒃᑐᕐᓂᐅᔪᑦ, ᐃᓗᐃᔪᑕᐅᓕᖏᑐᑦ.

ᐊᑉᖁᑦ ᓴᓇᔭᐅᑎᓗᒍ ᑲᖏᖅᖠᓂᕐᒥᑦ ᑕᓯᕐᔪᐊᕐᒧᑦ, ᐃᒪᓗᒃᑕᓄᑦ ᐊᒃᑐᕐᓂᖓ ᓱᓂᓗᐊᓚᖏᒪᑦ, ᑕᒪᓇ ᓇᒪᒃᑐᖅ. ᐊᒪᓗ ᐊᑉᖁᑦ ᖃᐅᔨᓴᐅᑕᕐᓂᐊᖅᑐᖅ ᐅᑭᐅᓗᒃᑕᖅ.

ᓄᓇᐅᑉ ᐊᒃᑐᕐᓂᖓ

14ᖑᔪᑦ ᓄᓇᒥᒃ ᐊᒃᑐᕐᓂᐅᔪᑦ ᐃᓕᑕᕆᔭᐅᓯᒪᔪᑦ, ᐊᑉᖁᑦ ᓴᓇᔭᐅᓂᖓᓄᑦ, ᐅᑯᐊ, ᓄᓇᒥ ᐱᕈᒃᑐᑦ, ᐃᓄᖃᕐᓂᑦ, ᓂᕐᔪᑎᖃᕐᓂᑦ, ᐊᒪᓗ ᐃᓄᐃᑦ ᒪᖃᐃᕙᒋᕙᒃᑕᖏᑦ. ᓯᑕᒪᑦ ᐊᒃᑐᕐᓂᐅᔪᑦ, ᐃᓱᒪᒋᔭᐅᓗᐊᖏᑦᑐᑦ ᐊᒃᑐᓂᖃᓗᐊᖏᒪᑦ. ᑕᓕᒪᑦ ᐊᒃᑐᕐᓂᐅᔪᑦ ᐃᓘᔪᑕᐅᖏᒪᑦ ᐃᓱᒪᒋᔭᐅᓗᐊᓚᖏᑦᑐᑦ. ᐊᒪᓗ ᑕᓕᒪᑲᓂᑦ ᐊᒃᑐᕐᓂᐅᔪᑦ ᐱᓕᕆᐊᕆᔭᐅᑲᓂᕐᓂᐊᖅᑐᑦ ᐊᒃᑐᕐᓂᖃᓗᐊᒪᑦ, ᐅᑯᓂᖓ, ᓄᓇᒥ ᐱᕈᒃᑐᓂᒃ ᐊᒥᓱᓂᖏᓂᒃᓗ, ᐊᒪᓗ ᓂᕐᔪᑎᓄᑦ, ᓂᕐᔪᑎᖃᕐᓂᐅᔪᑦᓗ.

ᓄᓇᒥ ᐱᕈᒃᓯᒪᔪᑦ

ᐊᑉᖁᑦ ᓴᓇᔭᐅᓂᐊᕐᓂᖓ ᖃᐅᔨᒐᐅᑎᓗᒍ, ᓄᓇᒥ ᐱᕈᒃᓯᒪᔪᑦ ᖃᓄᖅ ᐊᒃᒐᐅᓇᔭᕐᒪᖓᑕ ᐱᓕᕆᔭᐅᓚᐅᕐᒥᔪᑦ. ᑐᑭᓯᓚᐅᖅᑐᑦ ᑕᒪᑯᐊ ᓇᒪᒃᓂᐊᕐᒪᑦ. ᐱᕈᒃᑐᓗ ᖃᐅᔨᒪᔭᐅᔪᑦ ᐊᑎᒋᖏᑦᑐᑦ ᓱᓂᓗᐊᓚᖏᑦᑐᑦ. ᐊᑉᖁᑦ ᓴᓇᔭᐅᓂᖓᓄᑦ ᐱᕈᒃᑐᑦ, ᐃᓚᖏᑦ ᐱᕈᕈᓂᖅᓂᐊᖅᑐᒐᓗᐃᑦ ᐊᑉᖁᑦ ᐊᑕᓂ, ᑭᓯᐊᓂ ᑕᒪᓇ ᓇᒪᒃᓂᐊᕐᑐᖅ.

ᓂᕐᔪᑎᑦ

ᐊᑉᖁᑦ ᓴᓇᔭᐅᓂᖓᓄᑦ ᖃᐅᔨᓴᕐᓂᐅᓚᐅᖅᑐᒥ ᑐᑭᓯᓇᖅᑐᖅ, ᑕᒪᑯᐊ ᑎᖕᒥᓱᖅᑐᑦ ᓂᕐᔪᑎᓂᒃ ᓂᕆᓱᖅᑐᑦ ᐊᑐᒐᐅᓂᖃᕐᓂᐊᖅᑐᑦ, ᑎᑎᕋᒃᓯᒪᑉᓗᑎᒃᓗ ᖃᐅᔨᓴᕈᑕᐅᓚᐅᖅᑐᓂ. ᑭᓯᐊᓂ ᐊᑉᖁᑦ ᓴᓇᔭᐅᓕᖅᐸᑦ ᑕᒪᑯᐊ ᐊᒃᑐᒐᐅᓂᐅᔪᑦ ᑕᑯᒃᓴᐅᓗᐊᕐᓂᐊᖅᑐᑦ, ᓴᓇᓂᒃᐸᑕᓗ ᓇᒪᒃᓯᓂᖅᓴᐅᓗᑎᒃ. ᑭᓯᐊᓂᓕ ᑕᒪᑯᐊ ᑎᖕᒥᓱᖅᑐᑦ, ᓂᕐᔪᑎᑦ ᐊᓯᖏᓂᒃ ᓂᕆᓱᖅᑐᑦ, ᖃᐅᔨᓴᒐᐅᓂᖓᓂ ᑎᑎᕋᐅᓯᐅᓯᒪᑦ, ᖃᐅᔨᒪᔭᐅᔪᑦ.

ᑕᒪᑯᐊᓕ ᑎᖕᒥᓱᖅᑐᑦ ᓄᓇᒥ, ᐅᔭᕋᒃᑕᕐᕕᐅᑉ ᐅᖓᕙᓇᖓᓂ, ᐊᒃᑐᕐᓂᖏᑦ ᑎᑎᕋᐅᓯᐅᓯᒪᒥᔪᑦ, ᖃᐅᔨᓴᕐᓂᐅᓚᐅᖅᑐᒥ. ᑭᓯᐊᓂᓕ ᐊᑉᖁᑦ ᓴᓇᔭᐅᓕᖅᐸᑦ, ᑕᒪᑯᐊ ᓂᕐᔪᑎᓄᑦ ᐊᒃᑐᓂᐅᓗᐊᖅᑐᑦ ᑕᑯᒃᓴᐅᓗᐊᕐᓂᐊᖅᑐᑦ, ᐊᑐᕐᓂᖃᓗᐊᕐᓂᖅᐸᑕ. ᑕᒪᑯᐊᓕ ᑎᖕᒥᓱᖅᑐᑦ ᐅᔭᕋᒃᑕᕐᕕᐅᑉ ᐊᖓᕙᖓᓂᑦ, ᓱᓂᓗᐊᓚᖏᑦᑐᑦ ᐊᒪᓗ ᐊᑉᖁᑦ ᐊᑐᒐᐅᓗᐊᓕᕈᒥ ᓄᓇᑯᕈᑎᓂᑦ ᓱᓂᓗᐊᓇᖏᑦᑐᑦ.

ᑐᒃᑐᓄᑦᓕ ᑕᒪᓇ ᐊᒃᑐᕐᓂᐅᔪᖅ ᑐᑭᓯᓇᕋᔭᖅᑐᖅ ᑐᒃᑐᑦ ᖃᓂᑯᒥᒃ, ᑭᓯᐊᓂᓕ ᐅᖓᓯᑯᒥᒃ ᓱᓂᓚᖏᑦᑐᑦ. ᐊᒪᓗ ᐊᒪᕈᓄᑦᓕ ᐊᑉᖁᑦ ᐃᓘᐃᔪᑕᐅᓚᖏᑦᑐᖅ, ᓱᓂᓗᐊᓚᖏᑦᑐᖅ. ᑕᒪᑯᐊ ᖃᐅᔨᓴᕐᓂᐅᔪᑦ ᑐᑭᓯᔪᑕᐅᔪᑦ ᓂᕐᔪᑎᓄᑦ, ᐊᑉᖁᑦ ᓴᓇᔭᐅᓕᖅᐸᑦ ᐊᒃᑐᕐᓂᖏᓂᒃ.

ᐃᓄᓕᕆᓂᕐᒧᑦ ᐱᕙᓕᐊᓂᕐᒧᑦᓗ

ᐅᔭᕿᒃᑕᕆᐊᕐᓂᖅ ᐱᕙᓕᐊᑎᓗᒍ ᑲᖏᖅᖠᓂᐅᑉ ᓴᓂᐊᓂ ᑕᒪᓇ ᐃᑲᔪᕐᓂᖃᕐᓂᐊᖅᑐᖅ ᐃᓄᓕᕆᓂᕐᒧᑦ ᐊᒥᓱᑦ ᐱᓕᕆᓂᐊᕐᒪᑦ. 12ᖑᔪᑦ ᐊᒃᑕᕐᓂᐅᔪᑦ ᐱᕙᓕᐊᓂᕐᒧᑦ ᖃᐅᔨᒪᔭᐅᔪᑦ, ᑕᑯᐊᓗ ᓱᓂᕈᑕᐅᓗᐊᓚᖏᓗᑎᒃ. ᐊᑉᖁᑦ ᓴᓇᔭᐅᓕᓴᖅᐸᑦ ᐱᐊᓂᑲᒃᓂᐊᕐᑐᑦ, ᑭᓯᐊᓂ ᐅᑯᐃᖅᓯᒪᓕᖅᐸᑦ ᑕᒪᓇ ᐱᕙᓕᐊᓂᖅ ᓴᕿᓂᐊᖅᑐᖅ, ᐃᑲᔪᕐᓂᖃᕐᓂᖅᓴᐅᓗᓂ. ᑕᑯᐊᓗ ᓇᒥᓂᕆᔭᐅᔪᑦ ᐱᓕᕆᕕᑦ ᑲᖏᖅᖠᓂᒥ, ᐊᒥᓱᑦ ᐃᑲᔪᓚᐅᓂᖃᕐᓂᐊᖅᑐᑦ, ᐊᓯᖏᑦᓗ ᐃᑲᔪᓚᐅᓂᖃᖏᕆᓇᓇᐊᖅᑐᑦ, ᑭᓯᐊᓂᑦ ᑕᒪᓇ ᐊᒥᓱᓄᑦ ᐃᑲᔪᕐᓂᖃᕐᓂᐊᖅᑐᖅ. ᐊᒥᓱᑦ ᐱᓕᕆᓂᐊᕐᒪᑦ ᐊᒪᓗ ᓇᒥᓂᕆᔭᐅᔪᑦ ᐱᓕᕆᕕᑦ ᐱᓕᕆᑎᑕᐅᓂᐊᕐᒪᑦ, ᑕᒪᓇ ᐃᑲᔪᕐᓂᖃᕐᓂᐊᖅᑐᖅ ᑭᑐᓗᒃᑕᓄᑦ.

ᐃᓕᕐᑯᓯᓕᕆᓂᕐᒧᑦ ᐃᑲᔪᕈᑎᑦ

ᒪᕈᒃ ᐊᒃᑐᕐᓂᐅᔪᒃ ᐱᕙᓕᐊᓂᕐᒧᑦ, ᐊᒃᑐᕐᓂᖃᕐᓂᐊᕐᑐᒃ, ᓄᓇᒥ ᐃᓄᐃᑦ ᐃᓂᑯᓂᖏᓂ, ᑕᑯᐊᒃᓗ ᐃᓘᐃᔪᑎᖃᓚᖏᓗᑎᒃ. ᑕᑯᐊᒃᓗ ᖃᐅᔨᓴᒐᐅᓯᒪᑉᓗᑎᒃ ᐃᓄᐃᑦ ᐃᑦᓴᓂᑕᖃᕕᖓᓂ ᓄᓇᒥ, ᐊᓚᖑᖅᑎᑦᓯᓂᐊᕐᒪᖓᒥᒃ. ᑭᓯᐊᓂ ᑕᒪᑯᐊ ᐃᓄᐃᑦ ᓄᓇᕕᓂᖏᑦ ᑭᖑᓂᕐᒥ ᐊᕿᒐᐅᔪᓗᐊᕐᒥᔪᑦ ᓇᒪᓂᖅᓴᒥᒃ. ᑕᐃᒪ ᑕᒪᑯᐊ ᐊᒃᑐᕐᓂᐅᔪᑦ, ᐃᓄᐃᑦ ᓄᓇᕕᓂᖏᓂ ᓱᓂᓗᐊᓚᖏᑦᑐᑦ, ᑕᒪᓇ ᖃᐅᔨᓴᖅᑕᐅᓯᒪᔪᖅ.

ᑕᒪ ᐊᑉᓱᑦ ᐅᑭᐅᓂᒃᑕᒥ ᐊᑐᕈᓇᖅᑐᖅ ᐃᖢᐃᔪᑕᐅᓚᖕᒋᑐᖅ, ᐃᓄᐃᑦ ᒪᖃᐃᕕᕕᓂᖕᒋᓂ ᓄᓇᒥ, ᐊᒃᑐᕐᓂᖃᓇᕐᓂᐊᖅᑐᒐᓗᐊᖅ ᑭᓯᐊᓂ ᓇᒪᒃᑐᖅ.

ᐊᒃᑐᕐᓂᐅᔪᑦ ᑲᑎᓗᒃᑕᕐᓗᒋᑦ

ᑕᒪᒃᑯᐊ ᐊᒃᑐᕐᓂᐅᔪᓗᒃᑕᑦ ᑕᐅᑐᒃᓗᒋᑦ, ᐃᓚᖕᒋᑦ ᖃᐅᔨᓴᒐᐅᓴᓇᐊᖃᖕᒋᑐᑦ, ᑐᑭᓯᓴᐅᒪᑕ. ᑭᓯᐊᓂᓕ ᑕᒪᕐᒥᒃ ᐊᒃᑐᕐᓂᐅᔪᑦ ᐊᒪᓗ ᐱᓕᕆᐊᕆᓴᐅᔪᓗᑕᑦ ᖃᐅᔨᓴᖅᑕᕐᓗᒋᑦ ᐱᓕᕆᑎᓗᒋᑦ, ᑕᒪᒃᑯᐊ ᐃᖢᐃᔪᑕᐅᔪᒃᓇᕐᑐᑦ ᐱᓕᕆᐊᕆᓴᐅᓇᓴᖅᑐᑦ, ᐃᓗᐱᔪᑕᐅᔪᑦᓗ ᐊᕿᒋᐊᕐᑕᕐᓗᒋᑦ. ᑕᒪᒃᑯᐊᓕ ᓄᓇᐃᑦ ᐃᑉᓕᕆᓴᐅᔪᑦ, ᐸᕐᓇᒐᑕᐅᓯᒪᒪᑕ ᐊᒃᑐᒐᐅᓂᖕᒋᑦ, ᐊᔨᕈᐸᓕᐊᓂᐊᕐᓂᖕᒋᑦᓗᓂᑦ, ᐱᓕᕆᐊᕆᓴᐅᓂᐊᕐᑐᑦ. ᐊᔨᖕᒋᑦ ᓄᓇᒥ ᐊᒃᑐᕐᓂᐅᔪᑦ, ᑭᓂᐸᔪᑦᓗᓂᑦ, ᐃᒪᖃᕐᓂᐅᔪᑦᓗᓂᑦ, ᓄᓇᐃᑦᓗ ᑭᓂᐸᓂᖕᒋᑦ, ᐊᒪᓗ ᐃᓄᐃᑦ ᓄᓇᑐᖃᖕᒋᑦ ᒪᖃᐃᕕᖕᒋᑦᓗ, ᐊᒃᑐᕐᓂᖃᓗᐊᖅᐸᓕᐊᑉᐸᑕ ᐱᓕᕆᐊᕆᓴᐅᑕᕐᓂᐊᖅᑐᑦ. ᓄᓇᐃᑦᓗ, ᓂᕐᔪᑎᑦᓗ, ᐊᒃᑐᒐᐅᓂᖃᖅᐸᑕ ᐅᔭᕋᒃᑕᕐᕕᐅᑉ ᐊᖕᒐᓛᖕᒐᓂ, ᑕᒪᒃᑯᐊ ᐊᒃᑐᕐᓂᖕᒋᑦ ᖃᐅᔨᓴᐅᑕᕐᓂᐊᕐᒥᔪᑦ.

ᐊᑉᓱᑦ ᐅᑭᐅᓂᒃᑕᒥ ᐊᑐᒐᐅᔪᒃᓇᕐᑐᖅ ᐊᑐᒐᐅᓕᖅᐸᑦ, ᐊᑐᒐᐅᖃᓗᐊᓚᖕᒋᑐᖅ ᐃᖢᐃᑐᓂᒃ ᐅᑯᓇᓂ:

- ᐊᓄᕆ;
- ᐃᒪᓗᒃᑕᑦ, ᑕᓯᓕᑦᓗ, ᐃᖃᓗᐃᑦᓗ, ᐃᖃᓗᖃᕐᕕᑦᓗ;
- ᓄᓇᐃᑦ, ᐊᒪᓗ ᓄᓇᒥ ᐱᕈᒃᑐᑦ ᐊᒪᓗ ᓂᕐᔪᑎᓗᒃᑕᑦ; ᐊᒪᓗ
- ᓄᓇᒥ ᐃᑦᓴᓂᑕᖃᕐᕕᑦ.

ᑕᒪᒃᑯᐊ ᐊᒃᑐᕐᓂᐅᔪᑦ ᑲᑎᓗᒃᑕᕐᓗᒋᑦ, ᐊᑉᓱᑦ ᐅᑭᐅᓂᒃᑕᒧᑦ ᐊᑐᕈᓇᖅᑐᖅ ᐱᔪᑎᒋᑉᓗᒍ, ᐊᓚᒍᖅᑎᑦᓯᔪᐊᓚᖕᒋᑐᖅ. ᑕᒪᒃᑯᐊ ᐊᒥᓱᒐᓗᐊᑦ ᐊᒃᑐᒐᐅᓂᐅᔪᑦ, ᑭᓯᐊᓂ ᐱᕙᓕᐊᓂᖕᒋᑦ ᐊᒃᑐᕐᓂᖕᒋᑦᓗ ᓱᓂᖅᑎᑦᓯᓗᐊᓚᖕᒋᑐᑦ, ᐃᓄᓯᕐᒧᑦ, ᓄᓇᒧᑦᓗ ᐊᔨᖕᒋᓄᑦᓗ. ᑕᒪᒃᑯᐊ ᐊᓚᖕᒍᓗᐊᖅᑐᓂᒃ ᓂᕆᓇᖅᑐᖃᓗᖕᒐᖕᒋᑐᖅ.

ᖃᐅᔨᓴᖅᑕᕐᓂᐅᔪᑦ ᐊᒪᓗ ᐱᓕᕆᐊᕆᑕᒐᐅᓂᐊᕐᑐᑦ

ᐅᔭᕋᒃᑕᕆᐊᕐᓂᕐᒧᑦ ᓚᐃᓴᓗᒃᑕᑦ ᐱᔭᐅᒐᓂᒃᐸᑕ, ᐊᑉᓱᑦ ᐅᑭᐅᓂᒃᑕᒧᑦ ᐊᑐᕈᓇᖅᑐᒧᑦ, ᐅᑉᓱᑦ ᖃᐅᔨᓴᒐᐅᑕᕐᓂᐊᖅᑐᖅ ᐊᕿᒋᐊᖅᑕᕐᓗᒍᓗ. ᑕᒪ ᐸᕐᓇᒍᑕᐅᓯᒪᒐᒥ ᐊᕿᓯᒪᔪᖅ, ᐱᓕᕆᐊᕆᓴᐅᓂᐊᖅᖢᓂᓗ.

ᒪᓕᒐᐃᑦ ᒪᓕᓗᒋᑦ ᖃᐅᔨᓴᖅᑕᕐᓂᐊᖅᑐᑦ ᑕᒪᒃᑯᐊᓗᒃᑕᑦᓗ ᐱᓕᕆᐊᖑᔪᑦ ᒪᓕᒐᖅᒪᑕ ᒪᓕᒐᐅᓂᐊᖅᑐᑦ. ᓄᓇᓗ ᐃᒪᕐᓗ, ᐊᕙᑎᓗᒃᑕᕐᓗ ᐱᓕᕆᐊᕆᓂᖕᒋᑦ ᒪᓕᒐᖅᒪᑕ ᒪᓕᒐᐅᓂᐊᕐᒥᔪᑦ. ᑕᓯᕐᔪᐊᕐᒥ ᐅᔭᕋᒃᑕᕆᐊᕕᐅᑉ ᐃᖕᒋᕋᓂᓗᒃᑕᖕᒐᓂ, ᑕᒪᒃᑯᐊ ᖃᐅᔨᓴᕆᐊᓕᑦ ᖃᐅᔨᓴᐅᑕᕐᓂᐊᖅᑐᑦ, ᒪᓕᒐᓗᒃᑕᑦ ᒪᓕᒃᓗᒋᑦ.

ᐱᓕᕆᓕᖅᑎᓗᒋᑦ ᐅᔭᕋᒃᑕᕕᓗᒃᑕᒥ ᖃᐅᔨᓴᖅᑕᕐᓂᐊᖅᑐᑦ ᑕᒪ ᖃᐅᔨᓴᕐᓂᐅᔪᒥ ᐊᑕᒪᑦ ᑭᓯᐊᓂ ᒪᓕᑦᓯᐊᕐᓗᒍ. ᑕᓯᕐᔪᐊᕐᒥ ᐅᔭᕋᒃᑕᕕᒃ ᐃᖕᒋᕋᓂᓗᒃᑕᖕᒐᓄᑦ, ᐅᑯᐊᕆᐊᖅᐸᑦᓗ ᖃᐅᔨᓴᕐᓂᐅᓴᕆᐊᖅᑐᑦ ᒪᓕᒐᐅᓂᐊᖅᑐᑦ. ᐊᒪᓗ ᐅᔭᕋᒃᑕᕕᒃ ᐅᑯᐊᒐᓂᒃᐸᑦ ᖃᐅᔨᓴᕐᓂᐅᔪᑦ ᐸᕐᓇᒐᑕᐅᓯᒪᒪᑕ, ᒪᓕᒐᐅᓂᐊᕐᑐᑦ.

ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐅᓂᖅ ᐸᕐᓇᒍᑕᐅᓯᒪᒪᑦ ᒪᓕᒐᐅᓂᐊᕐᑐᖅ, ᐊᒪᓗ ᒪᑯᐊ ᖃᐅᔨᓴᐅᑕᕐᓗᑎᒃ, ᓂᕐᔪᑎᓗᒃᑕᑦ, ᐃᒪᓗᒃᑕᑦ, ᑕᓯᓗᒃᑕᑦ, ᓄᓇᓗᒃᑕᑦᓗ. ᑕᒪᒃᑯᐊ ᖃᐅᔨᓴᕐᓂᐅᓂᐊᖅᑐᑦ ᐸᕐᓇᒍᑕᐅᑎᓗᒋᑦ, ᒪᓕᒐᓕᓇᔨᑦ, ᑲᖕᒋᖅᖤᓂᕐᒥ ᐊᖕᒍᓇᓱᒃᑎᑦ ᑎᑎᕋᕕᖕᒐ, ᑭᕙᓕᕐᒥᓗ ᐃᓄᐃᑦ ᑲᑐᔨᖃᑎᒋᑦ, ᐃᑲᔪᕐᓂᐊᖅᑐᑦ.

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Abbreviation, Acronym, and Unit List

List of Abbreviations and Acronyms

AANDC	Aboriginal Affairs and Northern Development Canada
AEM	Agnico-Eagle Mining Limited
ARD	Acid Rock Drainage
Asamera	Asamera Minerals Ltd.
ATV	All-terrain Vehicle
AWAR	All-weather Access Road
the AWAR Project	Phase 1 – Meliadine All-weather Access Road
B.P.	Before Present
CALM	Circumpolar Active Layer Monitoring
CCME	Canadian Council of Ministers of the Environment
CO	Carbon monoxide
CO_2	Carbon dioxide
Comaplex	Comaplex Minerals Corp.
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWQG	Canadian Water Quality Guidelines
DFO	Fisheries and Oceans Canada
DoE	Nunavut Department of Environment
EA	Environmental Assessment
ELC	Ecological Landscape Classification
GCDWQ	Guidelines for Canadian Drinking Water Quality
GIS	Geographical Information System
GHG	Greenhouse Gas Emissions
GNT	Government of Nunavut
Golder	Golder Associates Ltd.
HTO	Hunter and Trappers Organization
INAC	Indian and Northern Affairs Canada (currently Aboriginal Affairs and Northern Development Canada)
IQ	Inuit Qaujimajatuqangit
KIA	Kivalliq Inuit Association
LSA	Local Study Area
NIRB	Nunavut Impact Review Board
NLCA	Nunavut Land Claims Agreement
NO_2	nitrogen dioxide gas
NO_X	nitrogen oxides
NPC	Nunavut Planning Commission
NWB	Nunavut Water Board
NWT	Northwest Territories

PM_{10}	particulate matter of particle diameter less than 10 µm
$PM^{2.5}$	particulate matter of particle diameter less than 2.5 µm
QA/QC	Quality Assurance / Quality Control
RCMP	Royal Canadian Mounted Police
ROW	Right-Of-Way
RSA	Regional Study Area
SARA	*Species at Risk Act*
SO_2	sulphur dioxide gas
TLU	Traditional Land Use
TSP	Total Suspended Particulate
VCs	Valued Components
WMC	WMC International Ltd.
ZOI	Zone of Influence

List of Units

%	percent
±	plus or minus
°	degree
°C	degree Celsius
<	less than
>	greater than
cm	centimetre
dB	decibel
dBA	A-weighted decibel
h	hour
ha	hectare
km	kilometre
km^2	square kilometre
km/h	kilometre per hour
L_{eq}	equivalent continuous sound and noise level
m	metre
m^3/s	cubic metre per second
mg/L	milligram per litre
mm	millimetre
µS/cm	microsiemens per centimetre
µg/L	micrograms per litre

The scientific style and format used in this report follows the recommendations outlined in the "Scientific Style and Format – The CSE Manual for Authors, Editors, and Publishers" 7th Edition prepared by the Council of

Scientific Editors. The 2006 publication recommends the preferred format for the use of numbers in the text (i.e., use of numerals for numbers with the exception of zero and one, depending on the usage, or use of a number at the beginning of a sentence), as well as many other style and format conventions.

This report also uses the National Standard of Canada SI Metric Units as identified in the CAN/CSA-Z234.1-00 Metric Practice Guide (Reaffirmed 2006) prepared by the Canadian Standards Association.

Although it is recommended by societies like American Fisheries Society and the American Ornithological Union to use capitals for fish and bird common names, this report does not use that convention to maintain consistency across all of the species common names (e.g., fish, birds, wildlife, vegetation).

1.0 PROPONENT INFORMATION

The Meliadine Gold Project is owned and managed by Agnico-Eagle Mines Limited (AEM), a Canadian publicly traded mining company listed on the Toronto and New York Stock Exchanges, trading symbol AEM, with head offices in Toronto, Ontario.

AEM began exploring for minerals in Canada in 1953 and has been active in the Kivalliq Region of Nunavut since 1990. AEM owns and operates the Meadowbank Gold Mine, located north of Baker Lake, Nunavut.

The Project's official mailing address is:

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AEM maintains a Project support office in Rankin Inlet. The address for this office is as follows:

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1.1 Brief History of the Meliadine Gold Project

The Hamlet of Rankin Inlet was established as a mining community in the early to mid-1950s with the discovery and subsequent development of a nickel mine. North Rankin Nickel Mines identified gold mineralization in the area of Meliadine Lake during an exploration program for nickel and copper in the early 1960s. The first mineral claims in the Meliadine Gold Project area were staked by Comaplex Minerals Corp. (Comaplex) and Asamera Minerals Ltd. (Asamera) in 1987, with the Discovery deposit being found on the eastern half of the property in late 1989.

Successive exploration programs by Asamera, Rio Algom Ltd., and Comaplex from 1990 to 1994 identified gold mineralization along the 80 kilometre (km) long east-west trending Pyke Fault, with the first holes drilled into the Tiriganiaq, F-Zone, and Pump deposits by Comaplex in 1993 and 1994. From 1995 to 2000, exploration by WMC International Ltd. (WMC), through an option on the west half of the Meliadine property, substantially expanded the Tiriganiaq gold deposit, led to the discovery of the Wolf deposit, and expanded the F-Zone and Pump gold deposits. Work by Comaplex in 1996 and 1997 concentrated on the Discovery gold deposit on the Meliadine East property.

For the ensuing years and until late 2003, exploration continued by Comaplex and its partners on the eastern half of the Meliadine property, known as Meliadine East, while little field work was completed by WMC on Meliadine West. In late 2003, Comaplex acquired WMC's interest in the Meliadine West property. The majority of Comaplex's efforts from 2004 onwards were devoted to outlining new, higher-grade gold resources in the deeper parts of the Tiriganiaq deposit, as well as reconnaissance work on outlying targets. Sporadic exploration was conducted on the eastern half of the property.

In July of 2010, AEM completed the purchase of Comaplex to make Comaplex a wholly owned subsidiary of AEM. AEM has subsequently amalgamated with Comaplex making the Meliadine Gold Project a wholly owned part of AEM. The Meliadine Gold Project is located primarily on Inuit Owned Lands administered by the Kivalliq Inuit Association (surface rights) and by Nunavut Tunngavik Inc. (sub-surface rights), although many of the claims are grandfathered under the Nunavut Land Claims Agreement, as they pre-date the Nunavut Land Claims Agreement.

The Meliadine Gold Project moved from being an exploration project to being an advanced exploration project starting in 2007 when the underground exploration and bulk sample program was carried out for a first time. This was a necessary incremental step in proving that the Tiriganiaq ore body, found earlier through surface drilling and geophysics, could become a viable mine. While diamond drilling from the surface gives one glimpses of the ore body below, it does not provide the assurance necessary to invest large sums of money in the development of a mine. Many prospective ore bodies, therefore, are explored in more detail by means of underground exploration and bulk sample programs. Such a program provides detailed information on the grade of the ore body, its variability over distance, its structure, and allows different mining methods to be investigated. The more that is learned in an underground program, the more risk is dispelled and, if what is learned is favourable, the greater the confidence in continuing with the development of a mine. This is a necessary step to allow a company to move a mineral resource into a proven ore reserve and to complete a feasibility level study.

In 2007 and 2008, Comaplex safely conducted an underground exploration and bulk sample program on the Tiriganiaq deposit to gain information on the ore body at depth. There were no lost-time accidents and no health and safety, environmental, regulatory, or personnel-related problems. This program was successful in bringing ore to the surface, testing different mining methods, and confirming earlier drilling from surface.

A portal to the underground was developed and a decline excavated 940 metres (m) in length. The program accessed and bulk sampled the upper portions of the deposit, these being within 120 m of surface. Diamond drilling following the underground program delineated a number of very high grade gold bearing units at depth in a part of the Tiriganiaq deposit called the Western Deeps, at depths of 200 to 400 m below surface. This gold mineralization is critical to the potential of the Meliadine property to develop into an economic mine. Extension of the present decline down to the Western Deeps is required to confirm the surface drill results through more underground drilling and bulk sampling, particularly at depths of up to 400 m below the surface.

2.0 PROJECT PROPOSAL

The Meliadine Gold Project is located approximately 25 kilometres (km) northwest of the Municipality of Rankin Inlet, Nunavut.

In late 2010, Agnico-Eagle Mines Limited (AEM) announced that it planned to accelerate the pace of advanced exploration at the Meliadine West site given the encouraging drilling results achieved to date. AEM has subsequently re-opened the underground decline, increased the number of operating diamond drills, and modified and expanded the exploration camp and associated facilities (sewage treatment, potable water treatment, power generation, etc.) to allow exploration to continue year round.

AEM is currently taking a new bulk sample from the underground decline at the Tiriganiaq deposit and will extend the decline over the next year and a half to allow for more drilling of the deposit at depth. The objective is to more fully delineate the Tiriganiaq deposit both at depth and on strike, and convert the mineral resource into a proven ore reserve through completion of a feasibility study by the end of 2012. AEM also plans to better delineate the other 4 deposits at the Meliadine West site (Wolf, Pump, F-Zone, and the newly found Westmeg deposits) and to covert these resources into reserves.

The main obstacle to advancing the pace of exploration at Meliadine is the amount of on-site fuel storage, currently at 1.8 million litres, which is not sufficient to allow year round exploration activity or to allow AEM to expand its pace of exploration at this site.

Consequently, to allow year-round delivery of fuel to the site and reduce costs of transportation of materials and staff to the exploration site, AEM plans to construct a single lane gravel surfaced road to provide all-weather access between Rankin Inlet and the Meliadine West Advanced Exploration site. The all-weather access road (AWAR) for the advanced exploration project would be constructed as Phase 1 and would have controlled non-project related access.

AEM plans to widen this road to 2-lanes, add a spur road to the Meliadine East site and a spur to Meliadine Lake, and open the road to non-project related access as Phase 2. Phase 2 will only occur if and when successfully permitted following the Part 5 environmental review of the proposed Meliadine Gold Project being conducted by the Nunavut Impact Review Board (NIRB) and under a future Type A Water License Application to the Nunavut Water Board. AEM feels that the most cost-effective and best overall alternative (from an environmental and socio-economic impact perspective) is to construct the AWAR in 2 phases. Therefore, AEM has prepared this application to seek authorization to construct the Phase 1 AWAR as a pre-development activity as provided for under Sections 12.10.2 and 13.5.5 of the Nunavut Land Claims Agreement (NLCA) under the Part 5 review of the full Meliadine Gold Project development.

Phase 1 – Advanced Exploration Phase

The Phase 1 AWAR will involve the construction of a 23.8 km long by 6.5 metre (m) wide running surface road between the Char River bridge turn-off and the Meliadine West Advanced Exploration site, with access controlled by a manned gate located just after the Char River bridge turn-off. The Phase 1 AWAR will allow AEM to safely and efficiently support advanced exploration of the Meliadine West deposits through the Feasibility and Environmental Assessment phase of the proposed Meliadine Gold Project. The AWAR will be decommissioned and reclaimed by AEM if the Phase 1 AWAR Project fails to pass either the Feasibility stage or the NIRB Environmental Assessment phase, or other permitting requirement.

Phase 2 – Mine Construction and Operations Phase

If approved through the regulatory process, the Phase 2 AWAR will involve the widening of the 23.8 km long Phase 1 road to an 8.0 m wide running surface. In addition, a 9.4 km long by 8.0 m wide spur road would be constructed to the Meliadine East project site. The Phase 2 AWAR will allow AEM to safely and efficiently support construction, operation, and ultimately decommissioning of the proposed Meliadine Gold Project. The Phase 2 AWAR is expected to allow open non-project related access to Meliadine Lake, but will have controlled access to both the Meliadine East and West project sites by gates.

The Phase 2 AWAR would only proceed to permitting once the Phase 1 AWAR Project successfully passes the Feasibility stage and Environmental Assessment phase, including discussion and full consideration by the NIRB of the potential environmental and socio-economic effects associated with open non-project related access created by this new road.

This road (both phases) would be a private road constructed primarily on Inuit Owned Land leased by AEM from the Kivalliq Inuit Association (KIA), with small sections of the road constructed on Commissioner's land (2.3 km) and on Crown Land (200 m) that will also be leased by AEM. Consequently, AEM has sole responsibility for the construction and ongoing inspection and maintenance of all of the components of this road, including the road bed, the bridges, the culverts, and the borrow/quarry sites used in the construction of the road. This road will not be part of any Territorial highway system. The AWAR will be decommissioned and reclaimed by AEM if the Phase 1 AWAR Project fails to pass either the Feasibility stage or the NIRB Environmental Assessment phase, or other permitting requirement.

This document has been prepared in support of an AEM application seeking authorization to construct the Phase 1 AWAR as a pre-development activity as provided for under Sections 12.10.2 and 13.5.5 of the NLCA under the Part 5 review of the full proposed Meliadine Gold Project development by the NIRB. AEM understands that, if successful, such an authorization would be in the form of a separate Type B Water License issued by the Nunavut Water Board (pending approval by the NIRB). AEM acknowledges that NIRB approval for the Phase 1 AWAR as a pre-development activity does not constitute approval of the larger proposed Meliadine Gold Project, currently subject of a Part 5 Environmental Review under the NIRB review process. The Phase 1 AWAR covered by this application is only to support ongoing advanced exploration of the Meliadine Gold Project.

Approval of the Phase 2 AWAR required to support the construction, operation, and decommissioning of the proposed Meliadine Gold Project is the subject of the ongoing Part 5 review currently being conducted by NIRB. The Phase 2 AWAR is part of the application for a Project Certificate for the proposed Meliadine Gold Project. AEM acknowledges that NIRB may decide to recommend to the Minister of Aboriginal Affairs and Northern Development Canada (AANDC) that the full Meliadine Gold Project not proceed as proposed, in which case the Phase 1 AWAR would be decommissioned and reclaimed by AEM once the exploration site has been fully reclaimed.

This document provides the planned design, construction, operating, maintenance, and decommissioning procedures that will be employed by AEM and its contractors for the Phase 1 AWAR only. The document also provides an assessment of the predicted environmental and socio-economic effects associated with the Phase 1 AWAR and provides mitigation measures that will be applied to mitigate, where possible, adverse effects and to enhance where possible positive effects.

2.1 Project Rationale and Alternatives Considered

In 2011, AEM estimated that its total fuel consumption at the Meliadine West Advanced Exploration site would be in the order of 5.4 million litres (P50 diesel + Jet A fuel) if all the exploration activity was to be completed as planned (Table 2.1-1). Site exploration activity resumed in January 2011 and was supplied by winter road through early May at which time the winter road was no longer safely usable. The on-site fuel tanks were topped up in early May 2011 using the winter access road to bring the site inventory to 1.8 million litres. AEM projected that based on actual and planned activity on-site, this inventory would be exhausted by late August, thus, AEM initiated a fuel airlift campaign (using a heavy lift helicopter) of 1.0 million litres of P50 diesel fuel and 0.15 million litres of Jet A starting in late July. This will enable AEM to complete its planned activity through late October at which time site activity will decrease, and put on a care and maintenance basis until the winter road becomes available again (projected to be late January of 2012).

In 2012, AEM estimates that its total fuel consumption at the Meliadine Advanced Exploration site will be 9.4 million litres to allow all planned activity to be completed (Table 2.1-1). This reflects the move from a seasonal exploration activity to a year-round exploration operation, increased drilling from both surface and from underground, continued decline development at the Tiriganiaq deposit, increased drilling on the Westmeg, F-Zone, Pump, and Wolf mineralized zones, increased geotechnical and condemnation drilling to support the feasibility study, and initiation of drilling at Meliadine East (Discovery site). AEM plans to have all of the site storage tanks topped up by early May 2012 using the winter road and is then counting on having an all-weather road between Rankin Inlet and the Meliadine West Advanced Exploration site available by mid-2012 to enable sufficient fuel deliveries to continue through the remainder of 2012 to enable all of the planned activity to take place.

Table 2.1-1: Estimated Fuel Consumption for Advanced Exploration Program at the Meliadine Gold Project in 2011 and 2012

	Activity	Fuel Requirements			
		For Year 2011		For 2012	
		Details of Activity	Forecasted Fuel Consumption	Details of Activity	Forecasted Fuel Consumption
	Surface Drilling Meliadine Gold Project				
Advanced Exploration Program	Electricity generation for camp	Estimate extrapolated from fuel consumption data for the genset so far in 2011 and taking into account planned level of camp activity	1.1 M litres	Estimate extrapolated from fuel consumption data for the genset so far in 2011 and taking into account planned level of camp activity in 2012	1.3 M litres
	Surface drilling	Between 70 to 90 km Condemnation drilling: 20 km; Reserves confirmation: 50 km; Exploration: 10 km; Possible geotechnical drilling: 10 km	2.06 M litres	About 90 km Condemnation drilling: 10 km; Reserves confirmation: 40 km; Exploration: 30 km; Possible geotechnical drilling: 10 km	2.5 M litres
	Helicopters	Fuel required to provide personnel access to the drill rigs and to bring supplies	0.25 M litres	Fuel required to provide personnel access to the drill rigs and to bring supplies	0.5 M litres
Underground Program	U/G mining equipment	Fuel requirements for underground equipment used in the underground program	1.5 M litres	Fuel requirements for underground equipment used in the underground program	2.5 M litres
	Surface support equipment	Fuel required for ramp genset and other surface work in support of the underground program	0.5 M litres	Fuel required for ramp genset and other surface work in support of the underground program	0.7 M litres
Regional Exploration Program	Electricity generation for camp	No activities in 2011	0	Estimate of fuel required for the genset to operate the camp	0.4 M litres
	Surface drilling	No activities in 2011	0	Exploration drilling 50 000 m	1.4 M litres
	Helicopters	No activities in 2011	0	Fuel required to provide personnel access to the drill rigs and to bring supplies	0.1 M litres
Total Fuel Consumption Estimate			**5.41 M litres**		**9.4 M litres**

km = kilometres; M = million

2.2 Alternatives Considered

Without the proposed Phase 1 AWAR, AEM would have 5 options:

1) Continue to rely on the winter road and scale back planned advanced exploration activities in 2012 (and possibly 2013);

2) Expand on-site fuel storage capacity from 1.8 to 6.8 million litres before May of 2012 so that 2012 (and 2013) fuel requirements could be met by re-supply using the winter road only;

3) Airlift approximately 5.0 million litres of fuel in the summer of 2012 (and possibly a similar amount in 2013);

4) Use a combination of increased site fuel capacity, airlift a reduced amount of fuel to site, but not scale back the advanced planned exploration activities; or

5) Use a combination of increased site fuel capacity, airlift a reduced amount of fuel to site, and scale back some of the advanced planned exploration activities.

The relative cost and potential implications to the project schedule are summarized in Table 2.2-1.

Table 2.2-1: Summary of Alternatives to Phase 1 All-weather Access Road Considered by AEM

Alternative	Financial Implication	Effect on Exploration
Continue to rely on the winter road		Exploration would continue at a seasonal scaled back pace; feasibility study delayed by 18 to 24 months, less employment in 2012 & 2013, start of mining delayed by 18 to 24 months.
Expand on-site fuel storage capacity and continue to rely on winter road	Estimate incremental cost of ~ $2 M to construct new 1.6 M litre capacity on-site fuel storage	Exploration would continue at a seasonal scaled back pace but less than for Alternative 1, feasibility study delayed by 15 to 20 months, less employment in 2012 & 2013, start of mining delayed by 15 to 20 months.
Continue to rely on winter road and airlift the additional fuel required by helicopter airlift campaign	Estimate incremental cost $5 M for heavy helicopter airlift of fuel	Exploration activity to become year-round, allows exploration and decline development activity to be increased as planned, feasibility study complete by end of 2012, and no delay in mine development. Increased environmental risk and GHG effects from large helicopter airlift. There is also an increased safety risk in relying on helicopters in the event of a medical emergency.
Combination of winter road, increased on-site fuel storage, and helicopter airlift of all other fuel required, no scale back in exploration activity	Estimate incremental cost of ~ $2 M to construct new 1.6 M litre capacity on-site fuel storage + $4 M for heavy helicopter airlift of fuel	Exploration activity to become year-round, allows exploration and decline development activity to be increased as planned, feasibility study complete by end of 2012, and no delay in mine development. Increased environmental risk and GHG effects from large helicopter airlift.

Table 2.2-1: Summary of Alternatives to Phase 1 All-weather Access Road Considered by AEM (continued)

Alternative	Financial Implication	Effect on Exploration
Combination of winter road, increased on-site fuel storage, reduced helicopter airlift of fuel and some scale back in exploration activity	Estimate incremental cost of ~ $2 M to construct new 1.6 M litre capacity on-site fuel storage + $1 M for heavy helicopter airlift of fuel	Exploration would continue at a seasonal scaled back pace but less than for Option 1 and 2; feasibility study delayed by 10 to 15 months, less employment in 2012 & 2013, start of mining delayed by 10 to 15 months.

GHG = greenhouse gas emissions; M = million

2.2.1 Continue to Rely on Winter Road

The first alternative is to do nothing and rely upon the winter road only to support the advanced exploration program. Under this alternative AEM could continue to top up its available fuel storage inventory of 1.8 million litres by early May of each year and then adjust planned site activity accordingly to live within this fuel availability. Under this scenario, AEM would continue to operate the Meliadine West Advanced Exploration camp as a seasonal camp open between mid-January and late-September of each year and then put the exploration camp on a care and maintenance basis until the winter road season starts again. Under this scenario AEM could continue to operate 3 to 5 drills each season but would have to stretch out the time required to complete all of drilling that AEM had planned to do (exploration, resource conversion, geotechnical, and condemnation type drilling) to complete the Meliadine Gold Project Feasibility study by the end of 2012. It would also delay AEM's ability to continue underground decline development to better define the Tiriganiaq deposit at depth and on strike. It is AEM's best estimate that under this scenario, the full feasibility study could be delayed by 18 to 24 months, which would likely delay the proposed Meliadine Gold Project by a similar time frame (estimated delay in mine start-up from Q1 2014 to Q1 2016).

2.2.2 Expand On-Site Fuel Storage Capacity and Continue to Rely on the Winter Road

The second alternative is to expand the on-site fuel storage capacity and rely upon the winter road only to support the advanced exploration program. The additional capacity has to be constructed and available to be filled by early April 2012 before the winter road is lost in early May. This means that the tankage and/or materials needed to construct the additional storage capacity would have to be ordered and delivered to Rankin Inlet before the end of the 2011 sealift season (late September - early October). To achieve all of the 2012 planned exploration activity, on-site storage capacity would have to be increased by 5.0 million litres from 1.8 to 6.8 million litres. Preliminary engineering work completed for AEM indicates that this is not feasible in the time required using rigid fuel storage tanks to be constructed on-site. AEM then considered bringing in additional fuel bladders and pre-fabricated Envirotanks and has found that it could realistically purchase and install an additional 1.6 million litres in storage capacity by April 2012 (8 additional fuel bladders having a capacity of 100 000 litres each + 8 Envirotanks of 100 000 litre capacity each = 1.6 million litres). This would allow AEM to increase its activity to a level similar to that seen in 2010. Under this scenario, exploration would remain seasonal; some additional drilling would be achieved but not to the level initially planned by AEM. Consequently, in AEM's opinion, but would still have to stretch out the time required to complete all of drilling that AEM had planned to do (exploration, resource conversion, geotechnical, and condemnation type drilling) to complete the Meliadine Gold Project Feasibility. It would also delay AEM's ability to continue underground decline development to better define the Tiriganiaq and Westmeg deposits at depth and on strike. It is AEM's best estimate that, under this scenario, the full feasibility study could be delayed by 15 to 20 months, which would likely delay the Meliadine Gold Project by a similar time frame.

2.2.3 Continue to Rely on the Winter Road and Make up the Additional Fuel Requirement by Helicopter Airlift Campaign

The third alternative is to continue to rely upon the winter road to support the advanced exploration program to the maximum extent possible and then make up the difference in fuel required for AEM to meet its planned new phase activity by continuing to airlift the additional fuel required by heavy lift helicopter each summer. Under this alternative, AEM could continue to top up its available fuel storage inventory of 1.8 million litres by early May of each year and then air lift in the approximately 5.0 million litres of additional fuel in the summer months in 2012. The added cost of the airlift would be in the order of $5 million in 2012. This would allow AEM to undertake all of its planned activity required to meet its planned feasibility study completion by the end of 2012. However, it would still not allow AEM to convert to a year round exploration program, because there would still be a shorter window in the late fall (4 to 6 weeks) and early spring (4 to 6 weeks), when underground development would have to be suspended because of the low probability of being able to airlift a medical emergency by helicopter to off-site medical care in the event of an accident or medical emergency.

It is AEM's view that there is an increased environmental impact (i.e., increased greenhouse gas emissions [GHG], noise) and risk (i.e., spill risk – both frequency and area of potential impact) associated with the airlifting of 5 million litres of fuel, when compared with transport of this same fuel by truck over an all-weather road.

For example, at Meadowbank in the first 3 years of operation, AEM transported approximately 100 million litres of fuel from Baker Lake to the Meadowbank Mine via truck on the 110 km long all-weather access road. In this time, there were 4 accidents resulting in the spill of fuel from a truck transporting fuel for a total estimated spill volume of 4400 litres, most of which was subsequently recovered by cleanup activity. Each truck transports approximately 40 000 litres of fuel per trip; thus, based on the Meadowbank experience, the frequency of spill incident can be estimated as follows:

- 44 litres spilled per million litres transported; or
- 0.008 litres spilled per km travelled.

In the case of the helicopter airlift of fuel, it is likely that in the event of a significant mechanical failure or severe wind condition the helicopter would release its fuel storage container to avoid a crash. One such incident would likely result in the spill of approximately 4400 litres and the spill location would not be easily accessible by ground, and therefore, cleanup would be more difficult than from a spill incident along an all-weather road.

2.2.4 Combination of Winter Road, Increased On-Site Storage Capacity, and Helicopter Fuel Lift

The fourth alternative would use a combination of continuing to rely upon the winter road for fuel resupply to the maximum extent possible, combined with increasing on-site fuel storage capacity by 1.6 million litres in early 2012 and then airlifting the remaining fuel requirement using a heavy helicopter airlift program in the summer of 2012. This alternative would reduce the amount of fuel required to be airlifted from 5 to 4 million litres, reducing the airlift cost by $1 million but this would be offset by the increased cost of constructing the on-site fuel storage capacity.

This, however, would allow AEM to undertake all of its planned activity required to meet its planned feasibility study completion by the end of 2012. It would not allow AEM to convert to a year round exploration program, because of the 2 short windows in which a medical air-evacuation could not be assured with any degree of confidence.

It is AEM's view that there would be an increased environmental risk in airlifting 4 million litres of fuel, as discussed above. There is also increased environmental impact associated with this activity (noise impacts on people and wildlife, and increased greenhouse gas emissions from the helicopter engine).

2.2.5 Combination of Winter Road, Increased On-Site Storage Capacity, Reduced Helicopter Airlift, and Some Scale Back in Exploration Activity

The fifth alternative would use a combination of continuing to rely upon the winter road for fuel resupply to the maximum extent possible combined with increasing on-site fuel storage capacity by 1.6 million litres in early 2012 and then airlifting a lesser amount of fuel (say 1 million litres) using a heavy helicopter airlift program in the summer of 2012. This option would reduce the amount of fuel required to be airlifted from 5 to 1 million litres, reducing the airlift cost by $4 million; however, this would be partly offset by the increased cost of constructing the on-site fuel storage capacity.

Under this alternative, AEM would reduce its planned activity in 2012. This would allow AEM to increase its activity to a level greater than that achieved in 2011. Exploration would remain seasonal, although some additional drilling would be achieved but not to the level initially planned by AEM. Consequently, AEM would still have to stretch out the time required to complete all of drilling that AEM had planned to do (exploration, resource conversion, geotechnical, and condemnation type drilling) to complete the Meliadine Gold Project Feasibility study. It also would delay AEM's ability to continue underground decline development to better define the Tiriganiaq deposit at depth and on strike. It is AEM's best estimate that under this scenario, the full Feasibility study could be delayed by 10 to 15 months, which would likely delay the proposed Meliadine Gold Project by a similar time frame.

2.3 Preferred Option Moving Forward

AEM's preferred option would be to construct Phase 1 of the AWAR in early 2012 (March thru August) to allow year round transport of fuel to support the increased advanced surface and underground exploration activity proposed for the Meliadine Gold Project. The 2 bridges along the AWAR and the Char River bridge will be the critical part of the construction timeline (the schedule critical path), as the bridges would be assembled on shore and then slid into place using equipment that has to pass across the ice to move the bridge structure across the stream. Because of the large spans, there are no cranes available in Rankin Inlet capable of lifting these assembled spans into place. Thus, the bridges must be in place before the ice bearing capacity is lost (expected in April).

The Phase 1 AWAR running surface will be narrower that the Phase 2 road needed to ultimately support the mine. The Phase 1 AWAR would solely be used to supply the advanced exploration and decline development activity at the Meliadine West Advanced Exploration site. The advantages to this alternative are summarized as follows:

- While the cost of constructing the road would be more expensive than building additional on-site fuel storage or paying for the heavy airlift of fuel, overall this expense will not be lost, as the Phase 1 AWAR would be used as the basis for expansion into the Phase 2 road if the overall project received regulatory approval. The heavy airlift cost to get the needed fuel to the site would be a lost one-time cost, and similarly, the expanded fuel storage capacity would not be of full value for the mine development project. The mine development project will need rigid fuel storage tanks, and while bladders and Envirotanks will have some residual value or use, they will not become a key component of the full mine development project. Consequently, overall the Phase 1 AWAR alternative is the most cost effective to AEM. This is also the only option under which AEM could move the Meliadine Advanced Exploration program from a seasonal to a year round operation, as it provides the ability of transporting a medical emergency in a timely fashion to off-site medical attention on a year-round basis.

- The environmental risk and impact of transporting fuel on an all-weather road are expected to be less than using winter road and/or helicopter air lift.
- There are other benefits that will be realized by building the Phase 1 AWAR now as part of the advanced exploration activity rather than deferring AWAR construction until after the Part 5 Environmental Assessment of the full mine development project is completed. These include the following:
  - Conversion of current employment activity at the Meliadine West Advanced Exploration Project from seasonal to a year-round basis, which would provide employment stability to both our Nunavut and southern based workers.
  - Increased early employment opportunities at the Meliadine West Advanced Exploration site for local Nunavummiut through additional advanced exploration work and in construction and maintenance of the AWAR in 2012 and 2013. Construction of the road is projected to employ 100 people for approximately 6 months, with 50% expected to be Inuit Beneficiaries from the Kivalliq Region.
  - Opportunity to use construction of the AWAR to train 50 new heavy equipment operators in 2012 (a program that was in development with a partnership of AEM, the Municipality of Rankin Inlet, and Nunavut Arctic College) so that these local residents would be in a position to gain both the skills and experience needed to obtain employment at the proposed Meliadine Gold Project at the start of mine construction. Early construction of the road will allow for this hands-on training in 2012 so that people would be ready for employment in mine construction (pit development) in 2014, if the AWAR Project moves forward.
  - Gain of opportunity for the local business community. The existence of the AWAR earlier in the mine development life would provide substantial advantage to the Rankin Inlet business community in being able to access and develop business links with the Meliadine Gold Project. This early access will help these businesses understand the project needs and to build their ability to access business opportunities earlier in the construction phase of the project. For example, the AWAR makes it much easier and more economic for the Meliadine West Advanced Exploration Project to access a welder from Rankin Inlet to affect a repair rather than have to have a welder on standby on-site.
  - Reduced safety risk. The existence of an all-weather road between the exploration site and Rankin Inlet will result in an improved ability to respond effectively in the event of an accident or emergency. A substantive safety risk remains with only helicopter and winter road access to the site. During periods of fog, such as fall, early winter, and spring, the helicopters cannot fly. At such times, and in the event of a

medical emergency, there is no means to remove an individual to medical care in Rankin Inlet or farther south to a hospital. This safety risk will grow as the advanced exploration program grows with the increase in personnel on-site.

Consequently AEM feels that the most cost-effective and best overall alternative (from an environmental and socio-economic impact perspective) is to construct the AWAR in 2 phases. Hence AEM has prepared this application to seek authorization to construct the Phase 1 AWAR as a pre-development activity as provided for under Sections 12.10.2 and 13.5.5 of the NLCA under the Part 5 review of the full proposed Meliadine Gold Project development.

3.0 ROAD CONSTRUCTION, OPERATION, AND MAINTENANCE

The Phase 1 Meliadine all-weather access road (AWAR) will be a private road constructed primarily on Inuit Owned Lands leased by Agnico-Eagle Mines Limited (AEM) from the Kivalliq Inuit Association (KIA). The AWAR will be constructed, inspected, and maintained by AEM with its primary purpose being to support advanced exploration and decline development activity at the Meliadine West Advanced Exploration site. The road will be a nominal single lane road with a running surface width of 6.5 metres (m), with 30 m long pull-offs (15 m long pull-off plus two 7.5 m long tapered at 15^o entry and exit zones) set at intervals of approximately every 350 m, which would expand the running surface to 9.5 m, thereby allowing traffic to pass.

3.1 Road and Bridge Design

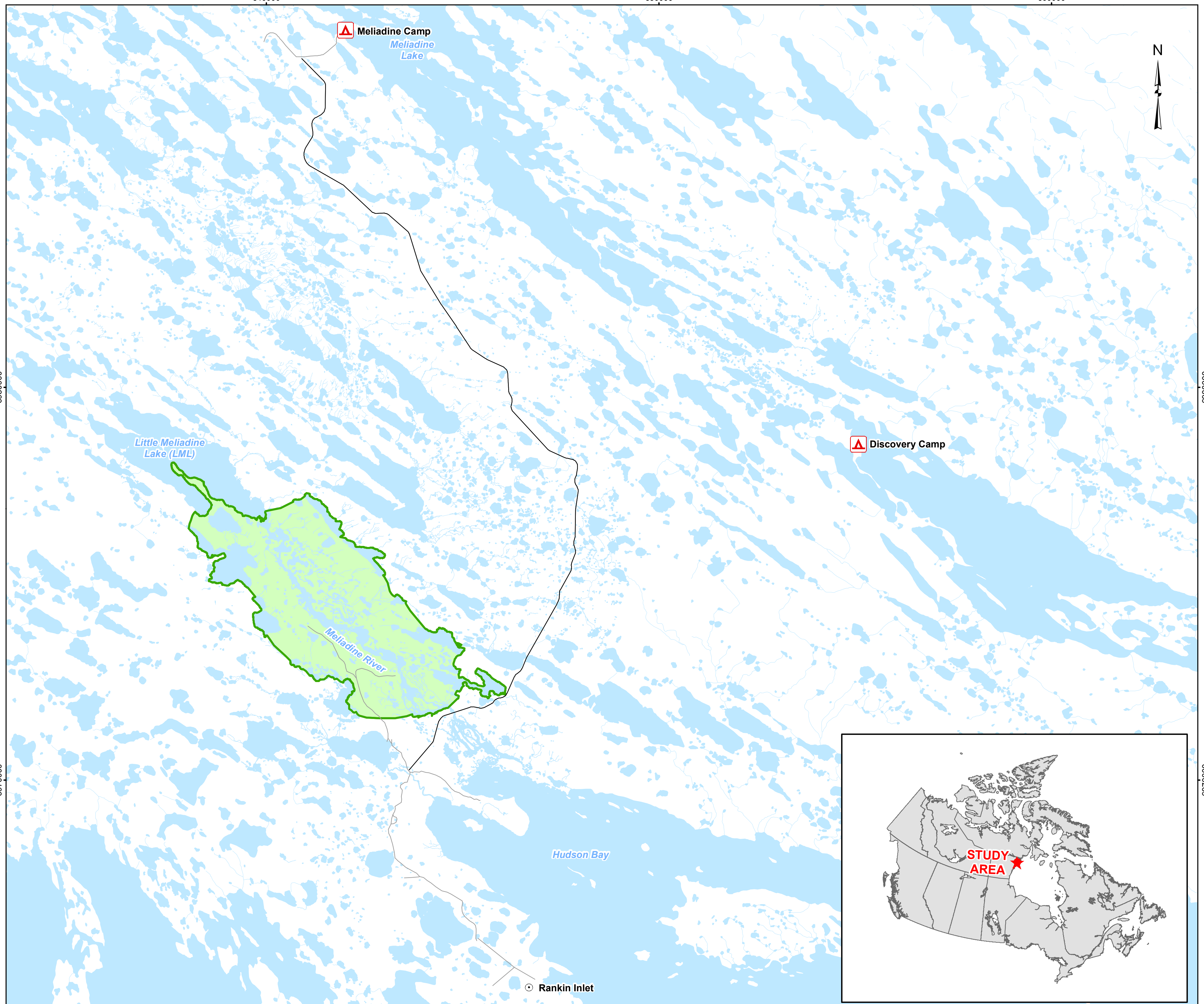
The geometric design of the road is based on the criteria included in the Transport Association of Canada Geometric Design Guide for Canadian Roads (TAC 2007). The construction of the road follows generally accepted good engineering practices for building roads in permafrost areas of the Northwest Territories (NWT) and Nunavut. The road design is detailed in the Golder Associates Ltd. (Golder) report “All Weather Access Road, Meliadine Gold Project, Feasibility Level Design, January 2011” (Golder 2011a).

3.1.1 Routing of the Road

The routing of the Phase 1 AWAR from Rankin Inlet to the Meliadine West Advanced Exploration site was selected to minimize possible effects on the environment, minimize the number of water crossings, and facilitate maintenance of the road, particularly during winter. The selection of the route was based on a number of considerations, including the overall length of the road, the route’s proximity to satellite ore bodies, a desire to minimize the number of stream crossings, the availability of quarries along the route, geomorphology, avoidance of archaeological sites, avoidance of the Iqaluqaarjuup Nunanga Territorial Park, and the goal of remaining on the height of land to allow for drainage in the summer and for wind to clear snow in the winter.

The Phase 1 AWAR routing is shown in Figure 3.1-1.

The proposed AWAR will start from the existing municipal road that provides access to the Iqaluqaarjuup Nunanga Territorial Park, just after it crosses the Char River. From there the road continues to the Meliadine River, east of the Park. The road will not enter the Park. After crossing the Meliadine River, the road will cross an area of low topography before climbing to the height of land and following the existing all-terrain vehicle (ATV) trail to the Meliadine Exploration Site.



LEGEND

- Camp
- Phase 1 AWAR Road Alignment
- Road - Existing
- Territorial Park
- Watercourse
- Waterbody

REFERENCE

Base data obtained from Agnico-Eagle Mines Ltd (AEM).
Datum: NAD 83 Projection: UTM Zone 15

2 0 2
SCALE 1:100,000 KILOMETRES

PROJECT

AGNICO-EAGLE MINES LTD.
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

PHASE 1 AWAR LOCATION AND ALIGNMENT

Golder Associates
Greater Vancouver Office, B.C.

PROJECT NO. 10-1373-0076			FILE No.	
DESIGN	JG	22 Aug. 2011	SCALE AS SHOWN	REV. 0
GIS	CDB	22 Aug. 2011		
CHECK	JG	08 Sep. 2011	**FIGURE: 3.1-1**	
REVIEW	GRA	20 Sep. 2011		

N:\Bur-Graphics\Projects\2010\1373\10-1373-0076\Mapping\MXD\General\Operations_Maintenance_Manual\Figure_3.1-1_Phase1_AWAR_Alignment.mxd

3.1.2 Road Configuration and Design

The Phase 1 AWAR will be a nominal single lane road with a running surface of 6.5 m in width. There will be passing turnouts of 30 m in length set at intervals of approximately every 350 m distance along the road (actual distance between passing turnouts will be 400 m ± 50 m to be optimized with the topography for safety purposes). The nominal running surface at each passing turnout will be 9.5 m in width. The minimum road depth will be 1.0 m for areas over non-thaw susceptible soil (well-drained soil over bedrock) and 1.3 m for areas over thaw susceptible soil (poorly drained, ice-rich, organic or bog over bedrock [Golder 2011a]). In both cases, the side slope of the road would be 2.5H:1V. Thus the maximum nominal base width of the road will be 13.0 m wide, increasing to 16.0 m wide at each passing turnout, for a road thickness of 1.3 m.

Figure 3.1-2 shows a typical road cross-section for the road to be constructed over areas of thaw susceptible soil. Figure 3.1-3 shows a typical cross-section for the road at a passing turnout to be constructed over areas of thaw susceptible soil.

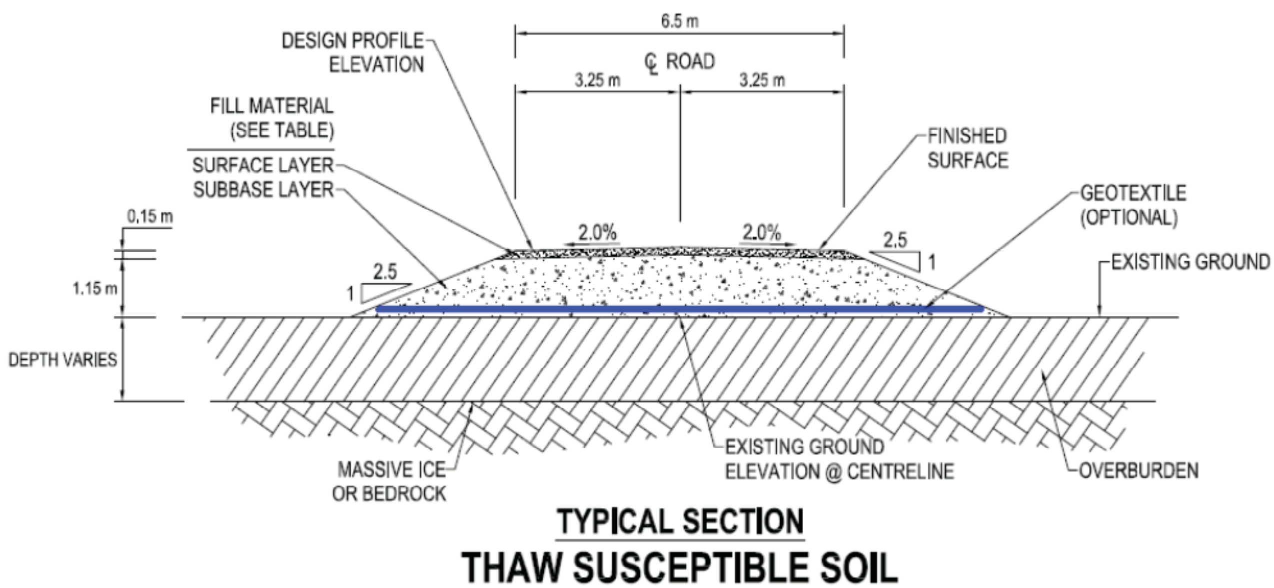


Figure 3.1-2: Typical Road Cross-section for Thaw Susceptible Soil

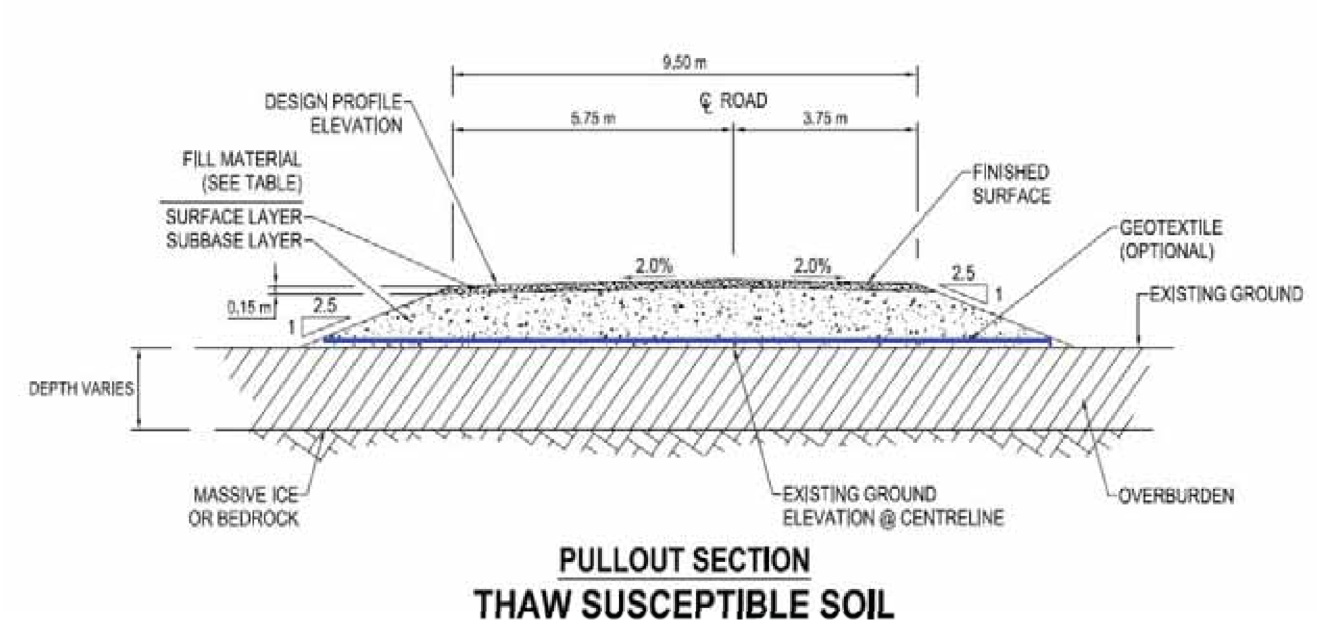


Figure 3.1-3: Typical Road Cross-section at a Passing Turnout for Areas Over Thaw Susceptible Soil

The potential impacts on the physical terrain due to the construction, operation, and reclamation of the road will include processes associated with permafrost degradation that are common to construction practices in the north, and which may include thaw-induced settlement. Typically, thaw-induced settlement can be associated with construction across poorly drained, ice-rich soils. This will be mitigated by appropriate road design, the use of appropriate construction materials, and the use of appropriate construction practices. The construction methods and trafficking on road construction materials may initially result in some degree of permafrost degradation along the road alignment until a sufficient thickness of road cross-section is developed to insulate the underlying permafrost. The road thickness is designed so that once the road has been completed; permafrost will aggrade, or rise, back into the road fill materials so that the permafrost active layer (the layer of annual freeze and thaw) will be maintained within the coarse, free draining road base materials. This will limit the degree to which thaw-induced settlement may occur. Furthermore, the AWAR alignment has been selected to avoid, where possible, the placement of fill materials across areas of poorly drained thaw-susceptible soils. Therefore, it is anticipated that the majority of potential terrain impacts on the surficial soils and bedrock along the AWAR will occur at the quarries, culverts locations, and bridge crossings.

To the greatest extent possible, the construction of the AWAR will be carried out during winter months. Initially, a rough trail would be advanced at the full base width of the Phase 1 AWAR from the southern end of the proposed road to the Meliadine West Advanced Exploration site so that the base of the road is laid down under winter frozen ground conditions, thus keeping this activity outside of the migratory bird nesting season. Under the *Migratory Birds Convention Act*, the road construction cannot disturb or destroy any active migratory bird nests.

The stream crossing culverts would also be installed in this early phase so that they can be fully completed before the start of the 1 May fisheries in-stream work exclusion window. The objective is to ensure that no construction takes place within the stream crossings during the 1 May to 15 July annual fisheries window when fish may be using the streams. Once this rough track is laid down and the stream culverts installed, then construction of the final Phase 1 AWAR would be completed by building up the rough track and placing the final topping materials.

The main road design criteria are shown in Table 3.1.2-1.

Table 3.1.2-1: Phase 1 All-weather Access Road Design Criteria

Design Element	Criteria
Rock Fill/Glacial-fluvial sand/gravel	Low to no acid generating potential and low metal leaching potential
Length of road	23.8 km
Travel surface width	6.5 m nominal single lane road with pull outs for passing
Maximum slope gradient	8% (TAC 2007 p. 2.1.3.2)
Maximum speed	50 km/h
Widest vehicle on road	2.4 m (B-train tractor trailer unit of 2.4 m wide by 25 m long) – in some circumstances there will be wider loads that extend beyond the sides of the vehicle. These will be handled as oversized loads with special travel arrangements
Longest vehicle on road	25.0 m (TAC 2007)[a]
Travel surface	Crushed material or equivalent less than 75 mm in diameter (Type 1 Fill)
Minimum stopping distance	110 m (based on trucks with conventional braking systems, TAC 2007. 1.2.5.4.)
Super-elevation	None
Minimum cross fall	2%
Minimum radius of curvature	165 m (based on 50 km/h maximum design speed and 0.12 coefficient of friction between road surface and vehicle tire, TAC 2007 p. 2.1.2.7
Minimum Sag Curve “K” value	12 (based on stopping distance, TAC 2007 p.2.1.3.8)
Minimum Crest Curve “K” Value	9 (based on stopping distance, TAC 2007 p. 2.1.3.5)
Minimum pull-out frequency	+400 m ± 50 m to be optimized with the topography for safety purposes
Pullout dimensions	30 m length (15 m full width + two 7.5 m length tapered at 15^{o} entry and exit aprons) (including tapered entrance and exits) (turnouts will increase running surface from 6.5 to 9.5 m)
Offset from archaeological site	30 m (Nunavut Archaeological and Paleontological sites Regulations (2003)
Road alignment at water crossings	Perpendicular to watercourse. 2 bridges[b] + 8 culverted stream crossings
Drainage culvert or French Drain Frequency (for planning purposes, actual number to be determined in the field)	Every 50 m for low ground; likely will not be required on high ground
Road Section Construction Method (Cuts and Fills)	Fill (no cuts to avoid permafrost disturbance)

[a] Transport Association of Canada Geometric Design Guide for Canadian Roads (2007).

[b] Only 2 bridges located along the AWAR; in addition, the existing Char River bridge will be replaced with a new bridge.

km = kilometre; km/h = kilometre per hour; m = metre

AEM will use the following construction methods to conform to the general recommendations made by Golder for the construction of the proposed AWAR in their design report:

1) To the extent possible, construction will be scheduled during the winter season so that fill is placed on frozen ground.

   Assuming all authorizations are ready for early March 2012, AEM plans to schedule construction of the Phase 1 AWAR to begin in March 2012 with the road base being essentially complete within 3 to 4 months. Work to complete the road topping, signage, etc. would continue for approximately an additional 2 to 3 months. One crew will build the road while a second will build the abutments and install the bridges. Fuel will be delivered to the stationary and mobile road-building equipment from Rankin Inlet and/or the Meliadine tank farm by mobile tank truck.

   Explosives for the quarries will be stored in magazines at the Meliadine site and at other approved locations. The magazines will be kept secure so that there cannot be any unauthorized entry.

2) Road fill material will be placed directly over the existing soil layer without cut, stripping, or grubbing to avoid disturbing the fragile subgrade soils along the proposed all weather road alignment.

   To the extent possible, AEM will place all rock/granular material from the quarries directly on the frozen ground. There will not be any disturbance of the soil excepting where culverts are to be used for stream crossings, where one culvert will be seated 300 millimetres (mm) below grade. This is to facilitate fish migration.

3) Only thick drifted snow will be removed before the road fills are placed.

   Route selection was mindful of drifting snow. Care will be taken to not disturb the soil layer should snow removal prove necessary.

3.1.3 Specifications for Bridge and Culverts Design

For the Phase 1 AWAR, there will be a total of 10 water crossings along the road route. Two of these crossings will be achieved using clear-span bridges (the Meliadine River at KM 2.3 and an unnamed stream at KM 5.0). The other stream crossings will be achieved using culverts. A list of the 10 crossings and their hydraulic characteristics is shown in Table 3.1.3-1. Their locations are shown in Figure 3.1-4.

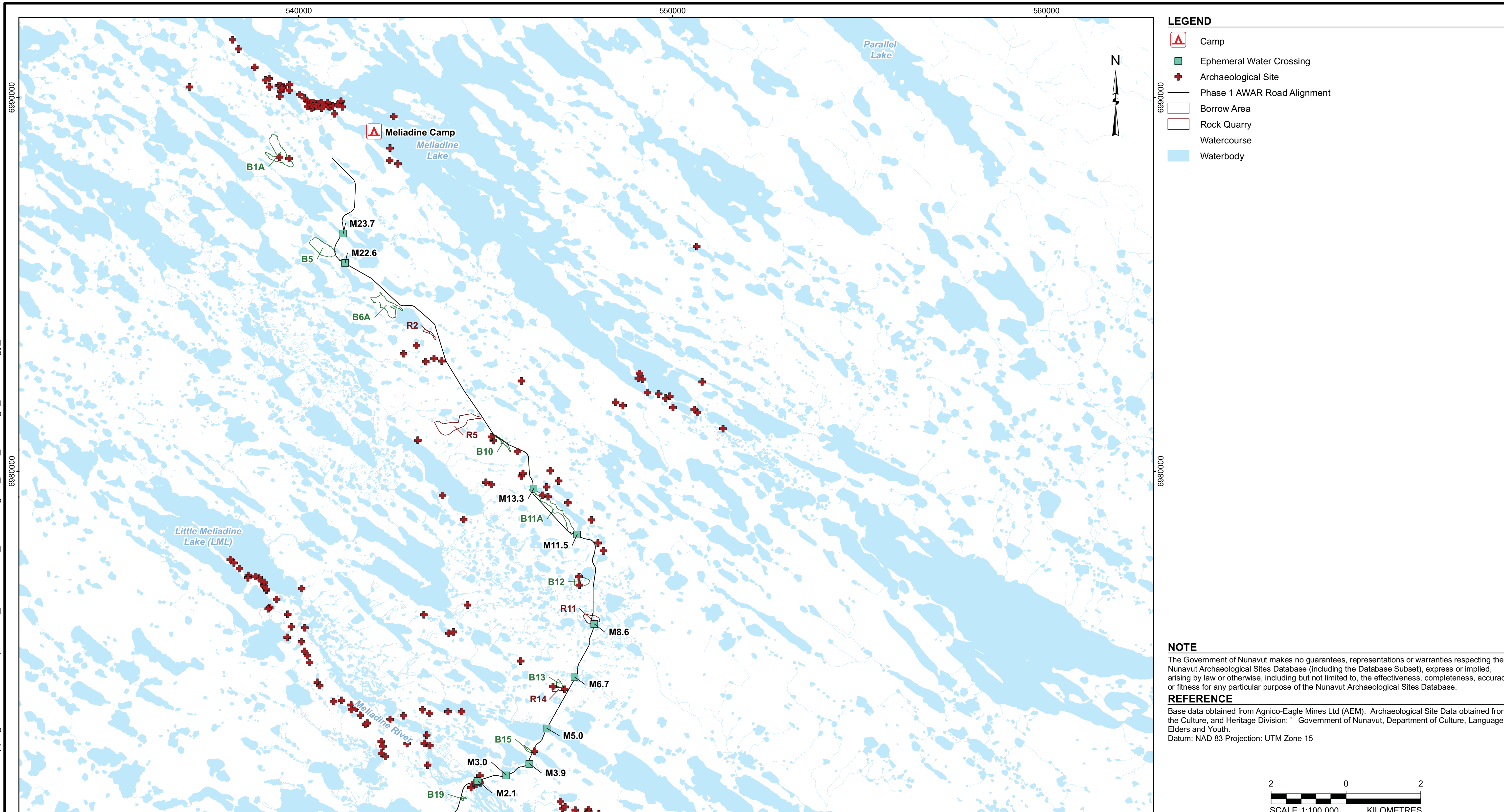
Table 3.1.3-1: Locations and Hydraulic Characteristics of Water Crossings (NAT 83)

Location	Latitude	Longitude	Drainage Area (km^2)	Design[a] Discharge (m^3/s)	Bankfull Width (m)	Bankfull Depth (m)	Design Depth (m)
Char River[b]	62° 51’ 31.8”	93° 51’ 27.9”	69	NA	NA	NA	NA
Meliadine River	62° 52' 21.8"	92° 07' 10.4"	796	81	60	1.2	1.58
M3.0	62° 52' 26.6"	92° 06' 16.6"	2.77	1.5	2.5	0.12	0.24
M3.9	62° 52' 36.2"	92° 05' 32.5"	1.82	4.7	2.5	0.1	0.62
M5.0	62° 53' 06.5"	92° 04' 58.5"	11.02	9.1	10	0.2	0.81
M6.7	62° 53' 50.4"	92° 04' 04.3"	0.82	3.1	1	0.05	0.24
M8.6	62° 54' 36.1"	92° 03' 25.3"	1.4	4	3.9	0.16	0.57
M11.5	62° 55' 53.8"	92° 03' 55.7"	1.38	1.2	1.5	0.26	0.41
M13.3	62° 56' 34.0"	92° 05' 16.6"	0.16	0.4	3.75	0.2	0.27
M22.6	62° 59' 51.2"	92° 11' 08.8"	0.97	0.5	0.9	0.13	0.21
M23.7	63° 00' 16.6"	92° 11' 12.2"	3.62	0.5	3.2	0.25	0.31

[a] 1:25 year flood

[b] The Char River bridge will not be on the proposed Phase 1 AWAR. It will be on the existing municipal road leading to the Territorial Park.

km^2 = square kilometre; m = metre; m^2 = square metre



N:\Bur-Graphics\Projects\2010\1373\10-1373-0076\Mapping\MXD\General\Operations_Maintenance_Manual\Figure_3.1-4_Crossings_Archaeology_Quarries.mxd

NOTE

The Government of Nunavut makes no guarantees, representations or warranties respecting the Nunavut Archaeological Sites Database (including the Database Subset), express or implied, arising by law or otherwise, including but not limited to, the effectiveness, completeness, accuracy or fitness for any particular purpose of the Nunavut Archaeological Sites Database.

REFERENCE

Base data obtained from Agnico-Eagle Mines Ltd (AEM). Archaeological Site Data obtained from the Culture, and Heritage Division; ' Government of Nunavut, Department of Culture, Language, Elders and Youth.
Datum: NAD 83 Projection: UTM Zone 15

PROJECT

AGNICO-EAGLE MINES LTD.
MELIADINE GOLD PROJECT
NUNAVUT

TITLE

LOCATION OF WATER CROSSINGS, ARCHAEOLOGICAL SITES, AND POTENTIAL QUARRIES (PHASE 1 AWAR ALIGNMENT)

Golder Associates
Greater Vancouver Office, B.C.

PROJECT NO. 10-1373-0076			FILE No.	
DESIGN	JG	22 Aug. 2011	SCALE AS SHOWN	REV. 0
GIS	CDB	22 Aug. 2011	FIGURE: 3.1-4	
CHECK	JG	08 Sep. 2011		
REVIEW	GRA	20 Sep. 2011		

Based on assessments carried out for AEM by a hydrologist from Golder, AEM believes that 8 of the 10 stream crossings along the proposed Phase 1 AWAR will not be considered as being navigable under the *Navigable Waters Protection Act.* The one exception is the Meliadine River crossing, which will be crossed with a clear-span bridge set to avoid any interference with boats navigated on this river. (Transport Canada has subsequently confirmed to AEM that the unnamed stream crossing at KM 5.0, as well as all of the other 8 stream crossings along the proposed Phase 1 AWAR are not navigable under the *Navigable Waters Protection Act*).

Similarly, Golder (on behalf of AEM) completed fish habitat surveys at each of these crossings. Due to the poor quality fish habitat documented at most crossings during these surveys and that the crossing structures (bridges and culverts) would represent low risk to the fish populations, Fisheries and Oceans Canada (DFO) have subsequently advised AEM that the road is unlikely to result in impacts on fish and fish habitat if the operational statement for Clear Span Bridges is followed. AEM will conform with all of the applicable DFO Operational Statements for protecting fish and fish habitat in constructing and operating these crossings.

AEM notes that in accordance with DFO and Environment Canada guidance, the following constraints/guidance will be applied during the proposed construction of the AWAR whenever near a waterbody or stream:

- no in-water work can take place from 1 May to 15 July, to protect fish spawning and nursery periods of local fish populations, this would apply to all stream crossings;
- sediment and erosion control measures must be implemented prior to the start of work and maintained during the work phase, to prevent entry of sediment into the water or the movement of re-suspended sediment into the stream crossings;
- sediment and erosion control measure will be left in place until all disturbed areas have been stabilized;
- all disturbed areas are to be physically stabilized as soon as possible following construction and to the greatest extent possible re-vegetated with native species from the area, assuming that an appropriate source of vegetation can be found (seed or transplants);
- machinery used near stream crossings should arrive on-site in a clean condition and be maintained free of fluid leaks to keep contaminants out of the water;
- the equipment must be re-fuelled, serviced, and washed away from the stream crossings to prevent deleterious substances from entering the water. Fuel, lubricants, hydraulic fluids, etc., must not be stored within 31 m of the high water mark of any waterbody and should be kept in an area where spillage can be contained, and in a manner inaccessible to all wildlife; and
- an emergency spill kit should be kept at the work site in case of fluid leaks or spills from machinery.

In addition to the above, AEM will install a new clear-span bridge immediately adjacent to the existing Char River bridge that is located on the existing Municipal owned and operated road to the Iqaluqaarjuup Nunanga Territorial Park. The installation of the new clear-span bridge will be on Municipal land, and will proceed upon Hamlet approval and only after all approvals are received for the AWAR. This bridge will be installed by AEM, at AEM's, expense to accommodate the heavier and wider loads that will be transported to the Meliadine Exploration Site. The new Char River bridge is required because the existing bridge is too narrow, its maximum load is only 50 tonnes, and its abutments are at risk of being undermined by the river at certain times of the year, most notably during the spring freshet. The new Char River bridge will be a 29.5 m single-span steel bridge. The new bridge will be immediately west of the current bridge, but its abutments will be set back farther from the river and have substantially more armouring to protect them. The existing Char River bridge belongs to the Municipality of Rankin Inlet, and to date, they have not made a decision on whether they will want AEM to remove or leave the existing bridge. The proposed location of the Char River bridge is shown in Figure 3.1-4 and Plate 3.1-1.

Plate 3.1-1: View of the Char River bridge and future location of the new bridge

As indicated earlier, a new 66.3 m single span steel bridge will be built across the Meliadine River. The height of the bridge above the water will be approximately 3 m, which meets the requirements for navigable waters. The location of the proposed Meliadine River bridge crossing is shown in Figure 3.1-4 and Plate 3.1-2.

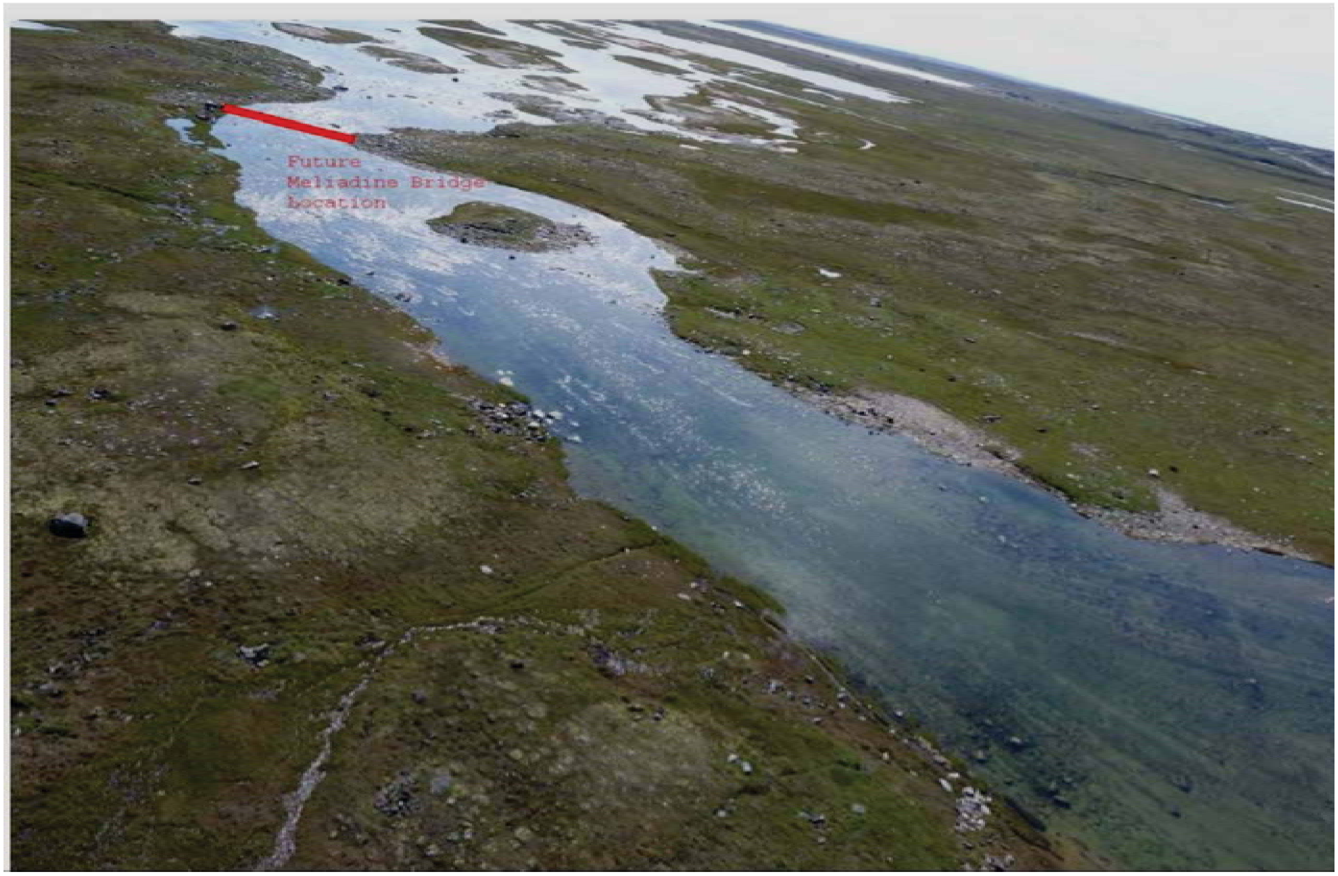


Plate 3.1-2: Location of the proposed Meliadine River bridge

Figure 3.1-5 provides plan and cross-section views of the proposed Meliadine River bridge. Figure 3.1-6 shows a close up view of the proposed abutment of the bridge on the north shore. The south abutment is of similar design.

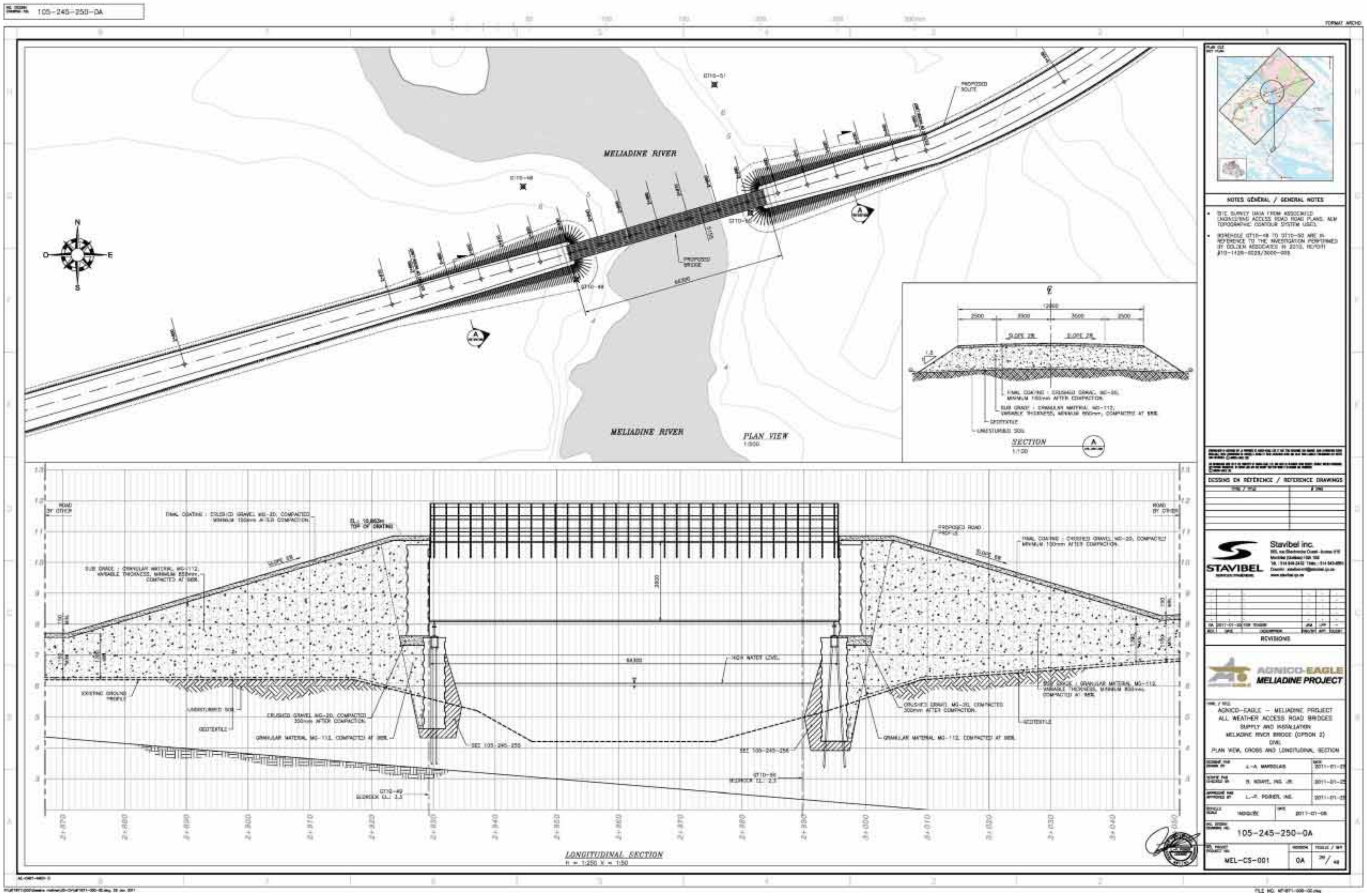


Figure 3.1-5: Proposed Meliadine River Bridge Design

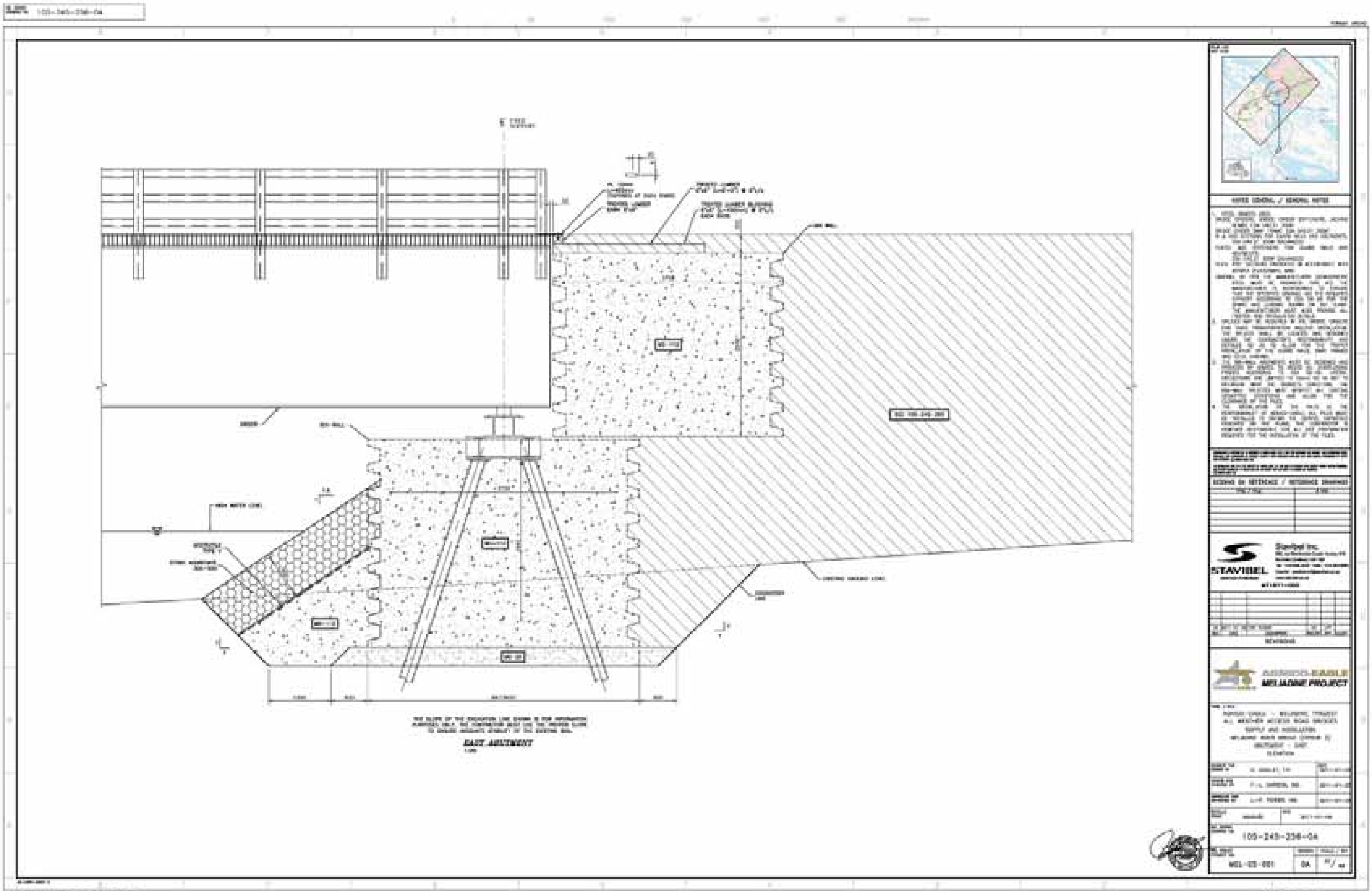


Figure 3.1-6: Detail of Meliadine River Bridge Abutment

Stream crossing M5.0 will have a 23.5 m single span steel bridge, with the characteristics as shown in Table 3.1.3-2. Figure 3.1-4 shows the location of this crossing.

Table 3.1.3-2: Details of M5.0 Bridge Crossing over Ephemeral Stream

River Crossing	Drainage Area (ha)	Peak Flow (m^3/s)	Span (m)	Base Width (m)	Width at Top of Water (m)	Bridge Height including 1 m Freeboard (m)
M5.0	1102	9.1	18	15.0	16.22	1.81

ha = hectare; m = metre; m^3/s = cubic metres per second

The span of the bridge will be built so that the natural channel of the stream remains unaffected and fish habitat is not disturbed.

The design for the 3 bridges, included in the Phase 1 AWAR, is based on the Canadian Highway Code where the design is CSA, S6-06, CL-625, specifically:

- for a design stress load based on two 25 m long vehicles of gross vehicle weight of 62 500 kilograms (kg), both considered travelling simultaneously on a bridge;
- the loading is factored by 40% dynamic allowance and another 60% safety factor; and
- the ultimate bridge design load capacity is around 280 000 kg.

The bridge abutment construction materials will be clean, non-acid generating, low metal leaching potential rock, and will not be gathered from below the high water mark of any watercourse.

The Meliadine and Char bridges will both be single-span, steel bridges with abutments and any ancillary facilities located above the ordinary high-water mark, thereby avoiding any impingement on the river and allowing construction under a Type B Water License. The bridge decks for the bridges will be installed when the streams are ice covered using a combination of a crane and dollys to move the pre-assembled span into place across the ice. This technique is necessary because there is no crane of sufficient lifting capacity to swing the pre-assembled bridges into place available in Rankin Inlet.

Crossings over Ephemeral Streams

Eight ephemeral streams will be crossed using culverts and one stream will be crossed with a bridge (M5.0 as referenced above), all the while keeping in mind Arctic conditions and the necessity for fish migration. The choice of culverts rather than bridges was based on the results of hydraulic analyses, preliminary observations of the channel characteristics at each watercourse crossing, and economic considerations.

Plates 3.1-3 and 3.1-4 provide aerial views of typical ephemeral stream crossings, the first being M3.9 and the second, M5.0. The proposed location of each can be found in Figure 3.1-4.

Plate 3.1-3: Water crossing M3.9 looking north. Note existing rutting from all-terrain vehicles.

Plate 3.1-4: Water crossing M5.0 looking north

For non-navigable stream crossing locations, it is initially assumed that multiple full-rounded corrugated steel pipe culverts with nominal sizes of 0.7, 1.0, and 1.3 m (internal diameter) will be used to pass the design flow. A minimum of 2 culverts placed in an "offset stacked" configuration will be used to enable flow conveyance before complete ice break-up within the watercourse. As part of the "offset stacked" configuration, the lowest culvert will be embedded into the watercourse to provide low water fish passage. For each fish bearing crossing, a hydraulic analysis was conducted to confirm that the estimated culvert flow velocities will not exceed 0.8 m per second during the 1:10 year, 3-day event.

Figure 3.1-7 shows the typical designs for the culverts that will be used for these ephemeral stream crossings.

3.1.4 Rock and Granular Material Quarries

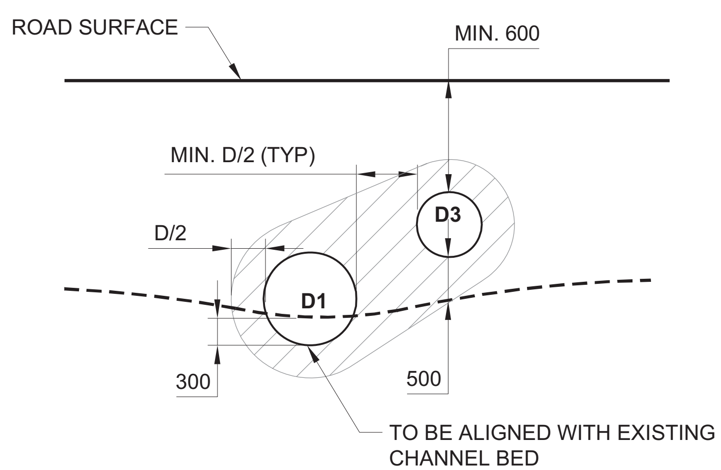
The road will be constructed from glacial-fluvial material and quarry rock.

The minimum thickness, or depth, of the road will vary from 1.0 to 1.3 m, depending on whether the underlying soil is thaw-stable (1.0 m) or thaw-susceptible (1.3 m). Two types of structural fill are proposed for construction. The first is 75 mm in particle size or smaller, and is known as Type 1 fill. This material will be used as a top dressing for the road and will form the running surface. Type 2 fill is coarse run-of-quarry rock, and will form the base of the road.

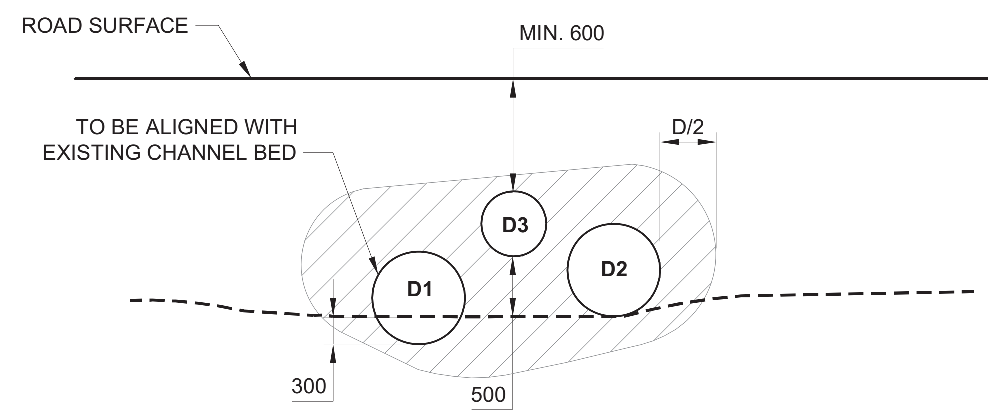
The construction material required for the AWAR is estimated to be 325 000 cubic metres (m^3), sub-divided as follows:

- 103 000 m^3 of quarried rock fill will come from 5 proposed quarry sites (R19, R11, R14, R2, and R5); and
- 222 000 m^3 of glacial-fluvial sand, till, and gravel will come from 10 borrow sites (B19, B15, B13, B12, B11A, B10, R350, B6A, B5, and B1A).

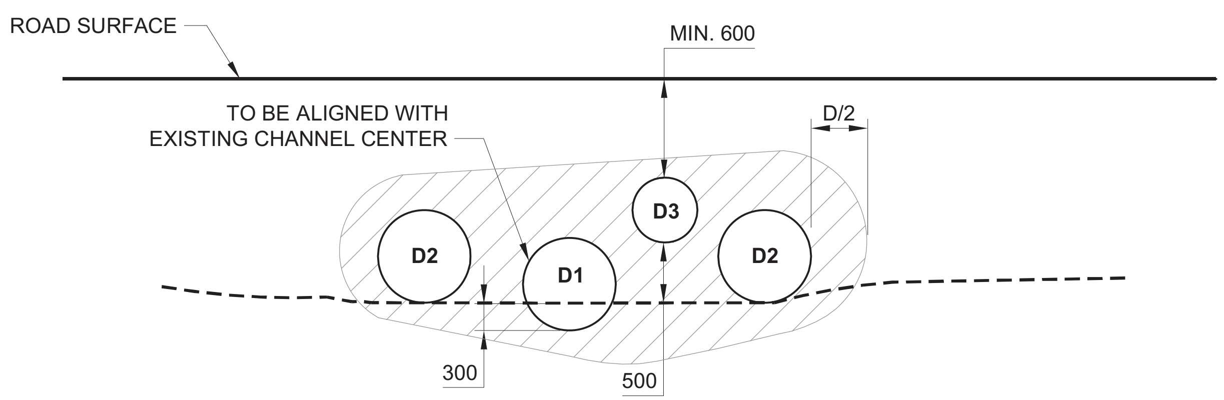
The proposed location of these quarry and borrow areas are shown on Figure 3.1-4. The estimated volumes of material to be extracted from each rock quarry and glacial-fluvial borrow site are presented in Table 3.1.4-1, along with the estimated distance between the centerline of the AWAR and the quarry/borrow area.



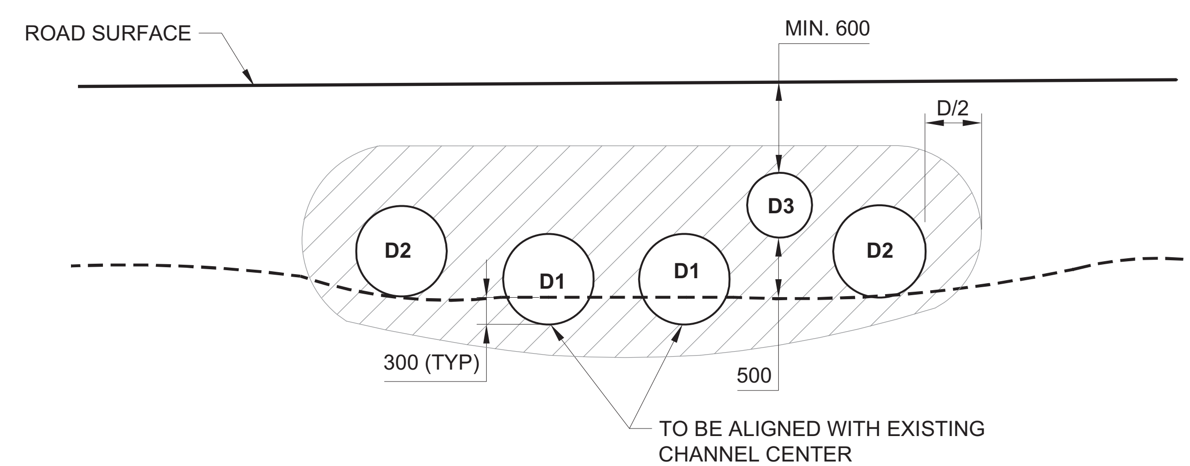
TYPICAL SECTION DESIGN A
NTS



TYPICAL SECTION DESIGN B
NTS



TYPICAL SECTION DESIGN C
NTS



TYPICAL SECTION DESIGN D
NTS

LEGEND

ROAD SURFACE (solid line)
EXISTING GROUND (dashed line)
WELL COMPACTED TYPE 1 FILL 75mm MINUS (hatched)

NOTES

1. ALL DIMENSIONS IN mm UNLESS OTHERWISE NOTED.

NOT FOR CONSTRUCTION

PROJECT	AGNICO-EAGLE MINES LIMITED MELIADINE GOLD PROJECT NUNAVUT
TITLE	TYPICAL CULVERT DESIGN CROSS SECTIONS

Golder Associates
Greater Vancouver Office, BC

PROJECT No. 09-1426-0015		PHASE No. 4700
DESIGN	MLP	10NOV10
CADD	SRR	10NOV10
CHECK	CJC	19JAN11
REVIEW	JAH	19JAN11
SCALE AS SHOWN		REV. 1

Figure 3.1-7

Table 3.1.4-1: Proposed Source and Estimate of Volume of Rock and Granular Material Used to Construct the Phase 1 All-weather Access Road

Quarry	Estimated Phase 1 Road Building Requirements (m^3)	Distance of Quarry/Borrow from Center Line of Road (m)
Rock Quarries		
R19	13 000	100
R11	17 000	0
R14	13 000	100
R2	17 000	120
R5	43 000	20
Glacial-fluvial/Till/Gravel Pits		
B19	4000	0
B15	9000	0
B13	11 000	170
B12	17 000	120
B11A	17 000	0
B10	65 000	0
R350	22 000	150
B6A	22 000	110
B5	33 000	0
B1A	22 000	accessible by existing road
Total	**325 000**	**890**

m^3 = cubic metre

The stated quantities are AEM's best estimates based on the known topography along the AWAR alignment. Actual quantities will vary somewhat based on actual topographic and ground conditions encountered. The actual quantity of material used will be determined by surveys of the quarry and borrow areas conducted following completion of the road and compared against the pre-development surveys. These data will be used in paying the road contractor and in paying the KIA and the Government of Nunavut (GN) for the royalties due on the extracted rock, sand, till, and gravel materials.

With the exception of rock quarry R19 and glacial-fluvial borrow area B19, all of the other quarry and borrow areas are on Inuit Owned Land administered by the KIA. Rock quarry R19 and glacial-fluvial borrow B19 are both located on Municipal Land administered by the Municipality of Rankin Inlet. The royalties on the materials extracted from these sources will be paid by AEM to the Municipality via the GN.

AEM will keep all active rock quarrying and glacial-fluvial borrows development activity a distance of at least 100 m from any waterbody. While the locations shown in Figure 3.1-4 may appear to be in closer proximity to existing waterbodies, these show the extent of the exposed outcrop or glacial-fluvial borrow areas. AEM will develop these quarry and borrow areas in a manner that maintains a minimum buffer of at least 100 m of undisturbed ground between the active quarry/borrow area and the waterbody.

Potential rock quarry and glacial-fluvial borrow sites along the proposed road alignment were tested for acid rock drainage and metal leaching before final selection. Seventy samples were collected from 17 potential rock quarries and 35 samples from 12 potential granular material quarries (glacial-fluvial type materials) along the proposed AWAR. The results of this testing and the potential environmental implications are presented in Section 5.2. Based on this sampling and assessment, AEM has only selected rock quarries and glacial-fluvial borrow areas with low to no acid generating potential and low metal leaching potential.

Archaeological assessments were also completed along the AWAR alignment. The results of this assessment are presented and discussed in Section 6.1. Where possible, AEM has selected rock quarry and glacial-fluvial borrow areas that have no impact on any identified archaeological site. There is one site at borrow area B11A that will be protected. This borrow is large in areal extent and thus AEM can develop a borrow pit that will leave this site undisturbed. There were sites identified at borrow site B12 and quarry R14 that could not be realistically avoided and these are being mitigated under a permit issued by the GN Department of Culture, Language, Elders, and Youth by an archaeologist hired by AEM. Mitigation means that these 2 sites are being photo documented with any artifacts discovered being removed (artifacts are made available to the GN under the permit).

Granular construction material will come largely from glaciofluvial deposits and weathered bedrock deposits located in well-drained areas. The removal of granular material causes a shift in the active layer of earth. These types of granular deposits have been selected because they are largely free of ground ice, thereby minimizing possible thaw settlement. The melting of ground ice can result in erosion, slumping of side slopes, and an altered landscape that extends beyond the quarry. Should this happen, the area will be monitored and if necessary, stabilized, by covering the affected land with 1.0 to 1.5 m of rock or other granular material. This mitigation effort will allow the permafrost to move up into the material covering the area, and stop any remaining ground ice from melting.

The potential impacts to permafrost in the rock quarries will be similar to those for granular material quarries. The permafrost active layer, which is the thin (typically 1.5 to 2.0 m deep) surface layer within permafrost terrain that experiences annual freeze and thaw, will migrate downward over time into the base of the quarries until equilibrium is re-established. The depth to which the active layer will develop in the quarry bases will depend to a large degree on whether the quarries remain drained (dry) or become flooded, but may be on the order of 1.5 m to potentially several metres. Since the rock quarries are expected to be relatively shallow localized excavations into bedrock, the ground stability challenges associated with permafrost degradation in soils, such as thaw settlement, slumping of side slopes, and erosion, are not anticipated. Nevertheless, the exposed rock will be subjected to annual freeze thaw cycles, and some spalling or loosening of rock material should be expected. The degree to which this will occur will depend largely on the rock type, rock mass quality, and structure within the individual quarries. Since the rock between Meliadine and Rankin Inlet is generally strong, annual freeze-thaw is not expected to pose significant operational challenges within the quarries. Any loosening of materials can be mitigated by operational efforts, such as machine scaling of loose materials.

3.2 Road and Bridge Maintenance

The Phase 1 AWAR will be a private road constructed primarily on Inuit Owned Land leased by AEM from the KIA, although there are short sections of this road that will be constructed on Commissioner's land and on Crown Land that are also leased by AEM. Consequently AEM has sole responsibility for the ongoing inspection and maintenance of all of the components of this road, including the road bed, the bridges, the culverts, and the borrow/quarry sites used in the construction of the road.

AEM will apply the experience that it has gained from the construction and ongoing operation of the Meadowbank All-Weather Road, which has now been in operation for 3 years. This experience will be applied in the planning of the day-to-day operation, inspection, and maintenance of the Meliadine AWAR.

AEM will have a road supervisor who will be responsible for the ongoing road inspection and maintenance of the AWAR. The following is a summary of the procedures that will be applied.

3.2.1 Road Surface Inspection and Maintenance

Inspection precedes maintenance. AEM recognizes that a good inspection program will lead to the early identification of areas of the road where improvements are necessary. The early resolution of any deficiencies will result in less ongoing maintenance and repair of the driving surface.

The road and its shoulders will be inspected weekly (at a minimum) during the summer period for evidence of seasonal freeze and thaw adjacent to the toe of the road embankment. Such movements are expected and may lead to longitudinal cracking and thaw settlement especially for portions of the road founded on thaw susceptible (ice rich) soil. When such areas are discovered, the affected area would be repaired using granular material and/or crushed rock. AEM will maintain stockpiles of such material in select borrow/quarry areas along the road.

The road will be inspected for signs of accumulation of ponded water either on the road surface or along the sides of the road. Where observed, the AEM road supervisor will evaluate and monitor the accumulation to determine the cause of ponded water. Based on these evaluations, the road supervisor will take remedial action where and when necessary to correct the cause of the ponding, such as grading of the road surface to remove areas of ponding or installation of additional culverts if the road is causing excessive water ponding adjacent to the road.

The quarry and borrow locations along the AWAR will also be inspected weekly (at a minimum) to monitor wall conditions, ponding of water, and snow accumulations. Remedial actions will be taken in a reasonable time when problems are noted. These could include remedial actions, such as re-shaping of borrow/quarry area walls and/or grading of quarry floors.

The road supervisor will conduct periodic inspections (minimum of weekly) of the road to verify that the road is maintained for safe travel of personnel, equipment, and supplies. These inspections will be recorded and any deficiency reported and followed by a corrective plan. These periodic inspections will include an inspection of the bridge abutments and a visual observation of the road surface to assess the status of road foundation.

During the summer period, the road surface will be maintained with gravel spread as required and regular grading of the road. In the fall, winter, and spring, the maintenance will be adjusted according to the weather conditions. Snow clearing along the road will be done to verify that the road can be operated safely. The manner in which the snow is cleared will also take into account the road configuration to ensure that snow accumulation will not cause any particular problem during the freshet.

Inspection frequency will be increased during the following critical time periods:

- just prior to spring freshet to verify that the culverts and stream crossings are in good state to pass flows from the rapid spring thaw that occurs in the north;
- during the spring freshet to verify that the culverts and bridges are not impeding spring freshet and to initiate action when and where required to prevent road wash outs; and
- just after heavy rainfall events to monitor water accumulation along the road, to verify that culverts are passing precipitation as planned and to initiate action when and where required to prevent erosion and road wash outs.

The amount of dust generated along the road is dependent on the dryness of the road surface, the number of vehicles, weight and speed, and maintenance of the driving surface. Regular grading of the road combined with the addition of granular material to the driving surface will be needed. This will improve road safety and also reduce the amount of dust. Dust will also be mitigated by maintaining posted speed limits. In areas or times identified by the AEM road supervisor as being prone to high dust levels or areas where safe road visibility is impaired or in areas where dust deposition is impacting fish habitat and/or water quality, the road supervisor will arrange mitigation measures as appropriate. This could involve actions such as grading of the road surface, placement of new coarser topping, and/or watering of the road surface. Use of chemical dust suppressants will be used only as a last resort and only in accordance with the Environmental Guidance for Dust Suppression published by the Government of Nunavut Department of Environment (January 2002) (available online at the following web site: http://env.gov.nu.ca/sites/default/files/Guideline%20Dust%20Suppression.pdf), and appended to this document as Attachment A of Appendix A.

All road users are requested to report any road maintenance problem or hazardous road conditions to the Meliadine gatehouse, which will be sited at the southern end of the road, or to the Meliadine West Advanced Exploration site, or to the Meliadine office in Rankin Inlet.

3.2.2 Watercourse Crossings Inspections and Maintenance

The watercourse crossing inspection and maintenance program will have 3 main components:

i) A regular inspection program to identify issues relating to watercourse crossings, such as impaired structural integrity and hydraulic function;

ii) An event inspection program to track the effects of large storm events on watercourse crossings, such as effects on structural integrity and hydraulic function; and

iii) A culvert location inspection program to verify that culverts have been installed in the right location with respect to the watercourse and that culvert capacity is adequate for passing water under all hydraulic conditions. In most cases, there are multiple culverts installed at different elevations at each stream crossing so that these culverts can adequately pass normal summer, spring freshet, and heavy rainfall flows.

Regular Crossing Inspection and Maintenance

During the freshet period, crossings inspections will be performed twice a week (mid-May to June) and weekly during the remainder of the ice-free period prior to fall freeze-up (July through October). These inspection activities for each watercourse crossing will consist of the following:

- Visual inspection of its infrastructure to identify defects, cracks, or any other risks to structural integrity. Particular attention will be paid to the inlet and outlet structures of culverts, and to bridge abutments and their foundations, as required.
- Visual inspection to identify sediment or other debris accumulation impeding the free flow of water through the crossings. Maintenance operations will consist of hand removal of accumulated debris and repairing damages as soon as possible.
- Visual inspection of the upstream and downstream channel to identify bed erosion or scour around the watercourse crossing structure. Particular attention will be paid to bridge abutments and abutment foundations as they will be vulnerable to scour and erosion during flood events. Particular attention will also be paid to potential sources of sediment transport at the crossing. Inspection results will be recorded by AEM to help track change in conditions over time. Maintenance operations will consist of undertaking remediation of any detected problems and repairing damage as soon as possible.

Event Crossing Inspection and Maintenance

Following heavy or prolonged rainfall storm events, visual inspection of each watercourse crossing will be completed to identify potential risks to the crossing's structural integrity, debris accumulation, and whether erosion and scour have occurred. Results will be recorded by AEM to help track changes in condition over time. The remediation of any detected problem and any necessary damage repairs will be undertaken as soon as possible, under the direction of AEM's road supervisor.

Culvert Location Inspection

Following their installation, the culvert crossings will be visually inspected to confirm they have been properly executed and installed. These culverts will initially be installed during winter conditions and thus it is possible that a culvert will not be sited correctly to pass all ponding of water through the road. The intent is to check for such conditions during the first snow melt and after rain events so that adjustments can be made accordingly. Additional culverts will be installed, if necessary, should the inspection indicate that the culverts were installed in a location that does not optimally route water flows.

3.2.3 Snow Clearing

Sections of the AWAR are expected to experience snow drifts because of strong winds over the winter period. Where possible, this snow will be cleared to the downwind side of the AWAR to limit the wind re-depositing the same snow on the cleared road. Routine spring snow management will include the removal of any snow that accumulates at culverts and bridges so that water at freshet can move freely through the culverts and under bridges. In the case of culverts, snow is removed from both ends but not from the inside.

The report, "Preliminary Snow Drift Assessment of the Meliadine All Weather Road from Rankin Inlet to the Meliadine Site, Nunavut" (Golder 2011b) provides an assessment where snow drifts can be expected. It states:

> *"Observations seem to indicate that snow drifts can be expected on the lee of short, steep slopes and along lake shores." and*

> *"Maintenance will be required during operations to manage snow accumulation along the road alignment; however, most of the alignment appears to be located along the windward slopes and ridge crests where there should be a limited tendency for snow to build up."*

The design of the road has factored in snow accumulation, and this is one of the reasons the AWAR is located along the height of land as much as possible and in a northerly alignment.

AEM will install an emergency shelter, similar to those used along the Meadowbank road, at a suitable site somewhere near the mid-point of the Phase 1 AWAR. This will be a shelter made from a 20 foot long shipping container set-up to allow a stranded traveller to get out of blizzard type weather and shelter out the storm in safety. The shelter will be equipped with a source of emergency heat and survival supplies, and will be maintained on a regular basis by AEM during winter months.

3.3 Traffic Management

The Phase 1 AWAR will be operated as a privately operated road, with access controlled by a gate located at the southern end of the road, just after the turnoff onto the Phase 1 AWAR (junction with existing municipal road just after the Char River bridge). The gate will be staffed by AEM on a 24/7 basis when weather permits (for personnel safety the gate will not be staffed during winter blizzard conditions in which case the road will be closed to all traffic). The gate will only control traffic turning onto the AWAR and will have no effect or control over traffic driving on the existing municipal road that continues on past the Char River. Responsibility for traffic management on the Phase 1 AWAR is the sole responsibility of AEM.

3.3.1 Management of AEM Traffic on the Road

All of the required fuel and supplies for the advanced surface and underground exploration activity at the Meliadine West Advanced Exploration site will be transported to the site via the AWAR. All drivers transporting these materials will either be AEM employees or employees of contractors directly hired by AEM and must possess a valid driver's license from a Canadian province or territory, for the appropriate class of vehicle, in order for them to be allowed to operate vehicles on the access road.

As a privately operated road, responsibility for “policing” on this road does not come under the Royal Canadian Mounted Police (RCMP). AEM security personnel, along with AEM’s road supervisor will monitor activity on the road through radio contact with both the staff at the gatehouse and with driver’s operating on the road and through periodic patrols of the road. All AEM vehicles that travel routinely on the AWAR will be equipped with a radio set to the requisite road frequency. Similarly contractor’s vehicles that travel routinely on the AWAR will be equipped with a radio set to the requisite road frequency. Consequently AEM traffic on the road will always have radio contact with the gatehouse, security, and other AEM and AEM contractor traffic. This system will be used to report any unusual conditions along the road, such as location of other vehicles, presence of wildlife on the roadway, presence of non-AEM traffic such as ATVs, snowmobiles, or other vehicles, any special road conditions, and any special weather conditions.

All northbound AEM and AEM contractor vehicles will be required to stop at the southern gatehouse. The personnel at the gate will record the name of the driver and the names of all passengers who are travelling in the vehicle, the vehicle type and the vehicle ID number, time that the vehicle passes through the gate, and will verify that the vehicles have all appropriate safety equipment (such as a functioning radio set to the road frequency, survival kit in winter months). Signage in both English and Inuktitut on the side of the road at the gatehouse will be posted so that the driver is reminded of the following basic safety requirements:

- posted road speed limit is 50 km/h;
- wildlife on the road has the right-of-way and must not be harassed; and

- drivers are required to report their location and direction over the radio at periodic intervals, such as when approaching bridges, blind hills and curves, and when approaching the Meliadine West Advanced Exploration site.

It should be noted that AEM will educate all of its employees and all of its contractor's employees on road safety rules during the safety indoctrination training that occurs when an employee first starts work at the Meliadine site.

A similar sign will be installed at the northern end of the road to remind all drivers of the same information when they are heading back towards Rankin Inlet. Drivers leaving the Meliadine West Advanced Exploration site and entering the AWAR heading south towards Rankin Inlet will be required to report by radio to the personnel in the gatehouse. The information that must be provided by radio is as follows:

- the vehicle type and ID number;
- the names of the driver and any passengers; and
- the time of departure from the Meliadine West Advanced Exploration site.

All AEM drivers using the road are required to monitor and report to the gatehouse by radio any observed unauthorized or unsafe use of the road.

3.3.2 Management of Non-AEM Traffic on the Road

The Phase 1 AWAR is a nominal single lane road built to solely support the advanced surface and underground exploration activity at the Meliadine West Advanced Exploration site.

AEM will work with the KIA and the Municipality of Rankin Inlet to devise a system for controlling access by non-AEM traffic and will have this in place before construction starts. AEM will also consult with the local Hunter and Trapper Organization's (HTO) on this issue. Based AEM's experience in Baker Lake, AEM believes the system should take the following factors into account:

- The road is too narrow to safely allow for uncontrolled non-project related access by any and all vehicles in Rankin Inlet;
- ATVs and snowmobiles can and will access the road from anywhere along the road and can bypass any security controls to be imposed by AEM. Such ATV and snowmobile traffic in this area does and will continue to occur whether the Phase 1 AWAR is there or not and, thus, AEM must find ways to safely operate with these vehicles;
- There are existing trails that are used by the citizens of Rankin Inlet and surrounding area to access traditional use, hunting, fishing, and recreation locations in the Meliadine Lake area. There are numerous cabins around Meliadine Lake that are used year round by residents of Rankin Inlet. The construction of the Phase 1 AWAR cannot block or alter the current access that residents of Rankin Inlet have to this area, so it would be better to devise systems to enhance safe use of the AWAR by both AEM and non-AEM traffic;
- All Inuit have rights of access to these Inuit Owned Lands, and, thus, the construction of the Phase 1 AWAR cannot block or alter this type of access, so it would be better to devise systems to enhance safe use of the AWAR by both AEM and Inuit Beneficiaries; and

- Public safety is key and must be given full consideration. Because of the narrow width of the road, it is undesirable to have unlimited access by cars and trucks belonging to the public. AEM will focus on providing controlled access in a safe manner to those who have a legitimate need to use the road to access cabins, or carry out traditional use. AEM will focus on preventing spur of the moment, sightseeing or "joy ride" type of access.

AEM proposes that the system used to control non-project related access should be as follows:

- Any member of the public wishing to obtain authorization to use the Phase 1 AWAR with a personal vehicle that is larger than a standard ATV or snowmobile will be required to obtain a vehicle pass (referenced to one or 2 authorized drivers who will be identified on the pass) from the KIA as the primary land owner. The KIA will determine suitable criteria for granting such access. The pass, once issued, will be good for multiple travels by that vehicle provided that the driver is referenced on the pass.
- The vehicle will be required to stop at the gatehouse at the southern end of the road. The AEM personnel at the gate will confirm that the pass is valid for that specific vehicle and driver, will record the name of the driver and any passengers in the vehicle, and the time that the vehicle passed through the gate. The AEM gatehouse personnel will then give the driver a short safety briefing on the rules of the road, provide a written copy of the safety rules to the driver (will be available in both English and Inuktitut) and have the driver confirm his/her understanding of the rules by signing a release. The AEM gatehouse person will also inform the driver of current road and weather conditions. The rules will point out that violation of the road safety rules could lead to revocation of future access privileges. If the AEM gatehouse suspects that a driver is intoxicated, then access will be denied.
- Safety rules will include the following:
  - maximum speed limit on this road is 50 km/h;
  - use of seat belts by all drivers and passengers is mandatory;
  - driving under the influence of alcohol or intoxicating drugs is prohibited;
  - wildlife has right-of-way on the road and no harassment of wildlife is allowed (drivers should not leave their vehicle to look at or photograph caribou as this may constitute harassment);
  - all hunting activity must avoid shooting across the road and should respect a safe shooting distance from the road (suggested at 1 km);
  - hunting is not allowed within 1 km of the Meliadine West Advanced Exploration site;
  - all traffic should give way to oncoming transport truck traffic (i.e., use the passing turnouts to allow the oncoming truck to safely pass);
  - vehicles should not park on the travelling surface of the road but should pull off the road in a turnout to park to prevent accidents;
  - no non-project related traffic is allowed within the Meliadine West Advanced Exploration site. This is an industrial work site, and, thus, non-project related vehicles should not go beyond KM 23 without prior special arrangement with AEM. Signs will be posted at KM 23 advising drivers of this rule; and

- the road is closed to all traffic whenever the gatehouse is not staffed. At that time, the gate across the road will be closed. Typically this means that weather is too bad to safely travel on the road or some activity is occurring on the road that makes travel unsafe. No traffic should proceed up the road during these times.

These are the same safety rules that will apply to all users of the road, including AEM employees, AEM contractor employees, and non-project related users of the road. It is worth noting that the Criminal Code of Canada applies to private roads. For example, if an accident were to occur on the road and alcohol was involved, that person could be charged by the RCMP.

AEM will hold public information sessions in Rankin Inlet for users of the AWAR prior to the road opening and on a regular basis thereafter (minimum of twice per year). A copy of the road safety rules will be presented at these sessions.

AEM also will use other communication tools to get the AWAR access procedures and road safety rules out to the residents in Rankin Inlet. These will include community radio, community TV, and postings around town, through the Meliadine project office in Rankin Inlet, and via an AEM project website. The communication will be in both English and Inuktitut.

All non-AEM road users will also be encouraged to monitor and report any observed unsafe use of the road to AEM via the gatehouse.

3.3.3 Other Access Control Procedures

There will be occasions when access to the Phase 1 AWAR needs to be curtailed for short time periods for special reasons, such as bad weather, unsafe road conditions, maintenance activity on the road, heavy project related truck traffic, movement of oversized loads, and presence of large numbers of caribou on or adjacent to the road. Typically these short-term closures will be required safety reasons.

In communicating such short-term closures, AEM will take the following actions:

Weather and Road Conditions:

- AEM will issue a daily road condition bulletin by means of email to a subscriber list, through a project related web site, and through community radio. The bulletin will provide information on current road and weather conditions and of special activity on the road planned for that day;
- AEM will limit access and in certain conditions close the road to all traffic during bad winter weather (blizzard or white out conditions). In the worst weather, the gatehouse personnel will be brought into Rankin Inlet and the gate closed and signed accordingly;
- AEM will limit access when the road is not safe as a result of an accident, a road maintenance problem, or major road traffic going to and from the site;
- AEM will limit access to the road when large numbers of caribou are crossing the road. This will occur in consultation with the local HTO;

- AEM will work with the KIA and HTO to establish of an appropriate no shooting zone along the road to prevent AWAR Project workers and all other road travelers from inadvertent exposure to risk of accidental shooting; and
- AEM reserves the right to refuse access to individuals who do not respect the rules on safety, speed, and the no shooting zone when using the road.

3.3.4 Road Signage

AEM will post appropriate road signs along the road in both English and Inuktitut. Typically signs will advise drivers of the posted speed limit of 50 km/h, approaching bridges, approaching curves, and/or areas of lower visibility (blind hills or obstructed curves).

English and Inuktitut signs will be posted at the southern and northern ends of the road and at an appropriate mid-point to advise any public travelling by snowmobile or ATV along the road that they are entering an area that may be potentially hazardous due to the presence of heavy truck traffic on the road. This is to recognize that, despite the gatehouse at the southern end of the road, unauthorized snowmobiles and ATVs can enter and leave the road from any point along the road. Signs will also be posted at the northern end of the road to advise the non-AEM users that they are approaching the Meliadine West Advanced Exploration site and that this is an area of heavy industrial activity that is potentially hazardous due to heavy traffic.

Speed limit signs (50 km/h) will be posted at approximately 5 km intervals along the AWAR. Reflective flags will be installed along the one side of the road to help drivers identify the road shoulder during blizzard or white-out conditions. Typically these flags will be black in colour to help them stand out in white-out conditions and are nominally set at intervals of 100 to 200 m apart. Kilometre markers will be posted at intervals of a maximum of 1 km along the road.

With the consent of the Municipality of Rankin Inlet, AEM will set-up and maintain a sign board on the Municipal road leading to the Char River in a suitable location near Rankin Inlet, which will advise all people driving out of town on whether the AWAR is “open” or “closed” to all traffic at that time.

A list of road signage is presented in Table 3.3.4-1.

Table 3.3.4-1: Road Signage

Element	Location
Safety precautions and users advice	At the southern and northern ends of the road and at an appropriate mid-point along the road.
Blind hill	200 m ahead of the beginning of a blind hill
Speed limit	Nominally at 5 km intervals
Curve	200 m ahead of a curve
Bridge announcement	200 m ahead of a bridge
Bridge side sign	On each side of the bridge
Flexible delineators (flags)	Nominally at 100 to 200 m intervals
Kilometres markers	Nominally at 1 km intervals

km = kilometre; m = metre

3.3.5 Policing of Road Safety Rules

As indicated earlier, the Phase 1 AWAR is a private road, and, thus, policing does not fall under the RCMP. Responsibility for all operating and maintenance activity on this road solely lies with AEM. AEM will concentrate on raising public awareness and commitment to road safety, and improving communication, cooperation, and collaboration among all stakeholders on the safe use of the road.

AEM will use its gatehouse staff, road supervisor, and site security to monitor what is occurring on the road. AEM will also rely on radio contact with all AEM and AEM contractor vehicles on the road to monitor unsafe conditions or activity on the road. AEM does not have any special policing powers. AEM staff cannot issue tickets or use other methods to address unsafe operation. AEM can record unsafe practices, warn the person causing the infraction, and in severe or repeated cases of violation, remove all privileges for future access to the road by an offending driver.

AEM will monitor speed limit infractions using 2 methods:

- direct observation of drivers seen to be driving too fast; and
- travel time for a vehicle between when they enter the road and when they leave the road as recorded by the AEM gatehouse staff (through radio reporting of when AEM and AEM contractor vehicles report to the gatehouse when entering and leaving the road).

AEM will have the right to remove future road access privileges for drivers who repeatedly operate in an unsafe manner and ignore verbal warnings previously given.

Regulatory inspectors can inspect the road and any associated infrastructure at will. AEM will abide with the recommendations and directives provided by the inspectors.

3.3.6 Estimate of Road Traffic

AEM expects to see the following projected related road usage pattern during the advanced exploration program:

- road usage by AEM and its contractors is not expected to vary much between summer and winter; and
- AEM and contractor vehicles expected to use the road will include but not be limited to pick-up trucks, cube vans, buses, fuel trucks, tractor trailers, snowplows, and graders.

Winter months

- Week days – between 8 and 10 pick-up trucks, 2 cube vans, 2 passenger vans, 2 fuel trucks daily, and 1 transport truck, dropping to zero when the weather is bad. Should the flights not get into Rankin Inlet, the number of passenger van trips will drop in half.
- Weekend days – between 2 and 4 pick-up trucks, 1 cube van, 1 passenger van, and 1 transport truck, dropping to zero when the weather is bad. Should the flights not get into Rankin Inlet, the number of passenger van trips will drop in half.

Summer months

- Week days – between 10 and 14 pick-up trucks, 3 cube vans, 2 passenger vans, 2 fuel trucks, and 1 transport truck, dropping to zero when the weather is bad. Should the flights not get into Rankin Inlet, the number of passenger van trips will drop in half.
- Weekend days – between 4 and 8 pick-up trucks, 1 cube van, 1 passenger van, and 1 transport truck, dropping to zero when the weather is bad. Should the flights not get into Rankin Inlet, the number of passenger van trips will drop to half.

During the summer sealift period and for one month after the departure of the last barge, an additional 6 to 10 transport trucks per day (round trips) to move freight to the Meliadine West Advanced Exploration site are expected.

Based on AEM's experience with the Meadowbank road, and from discussions with the KIA and Municipality, AEM expects to see the following non-project related road usage pattern during the advanced exploration program:

Winter months

- Week days – between 1 and 2 pick-up trucks and 5 to 10 snowmobiles daily when the weather is good, dropping to zero when the weather is bad.
- Weekend days – between 2 and 5 pick-up trucks and 10 to 20 snowmobiles daily when the weather is good, dropping to zero when the weather is bad.

Summer months

- Week days – between 2 and 5 pickup trucks and 5 to 10 ATVs daily when the weather is good, dropping to zero when the weather is bad.
- Weekend days – between 5 and 10 pickup trucks and 10 to 20 ATVs daily when the weather is good, dropping to zero when the weather is bad.

AEM estimates that between 25 to 50% of these trips will be incremental to current access, which is by ATVs and snowmobiles on the existing trails.

3.3.7 Wildlife Management

Wildlife is expected to be occasionally observed on or immediately along the side of the AWAR. Caribou and other wildlife will have the right-of-way at all times. Air, ground, and general noise disturbance will disrupt caribou behaviour with potential impacts to fitness and survival.

In the case of aggregations of caribou or other wildlife related problems, the environmental personnel on-site will be in charge of managing the situation, and, with the collaboration of the security department, will advise road users by patrolling the road. The project personnel will be notified by dispatch radio if any wildlife is observed on the road.

The following protocol will be implemented on the road for the protection of wildlife:

- Vehicular traffic speeds on the access road will be limited to 50 km/h.

- No activity will be allowed that could block or cause diversion to migrating caribou. In the circumstance where road activity may interfere with caribou migration, AEM shall cease such activity until the migrating caribou have passed.
- The period of 1 May to 15 July is critical caribou calving time. During this window no road activity will be allowed that could disturb caribou present with calves within 250 m of the road alignment.
- Where small to moderate aggregations of caribou (i.e., 1 to 50 animals) are observed within 100 m of the road, travel speeds will be reduced to 30 km/h.
- Where large aggregations of caribou (i.e., 50 or more) are observed within 100 m of the road, at the discretion of the road supervisor, vehicle movements may be suspended until animals have moved away from the road.
- Caribou and all wildlife will be given right-of-way on the road and must be allowed to pass uninhibited. Vehicles must stop until the animal is off the road.
- Locations of large aggregations of animals must be reported to the road supervisor, who will inform all potentially affected employees and the environmental representative.
- All incidents between vehicles and wildlife must be reported to the AEM road supervisor and the environmental representative whether they are
  - near-miss;
  - collision with injury to the wildlife; or
  - accidental death of wildlife.
- Each incident will be investigated by the road supervisor and the AEM environment department, and measures taken to avoid re-occurrence put in place. Disciplinary measures will be taken against any employee if the investigation concludes that the accident is the result of negligence.
- In the case of accidental death of an animal, the AEM Meliadine Project Environmental Coordinator will contact the GN Conservation Officer in Rankin Inlet. The carcass should be removed from the road and incinerated to avoid attracting scavengers such as Arctic fox, wolves, grizzly bear, and/or wolverine.
- AEM must contact the GN Conservation Officer in Rankin Inlet under any of the following circumstances:
  - if a situation occurs where wildlife becomes a nuisance (returning frequently, or unable to deter);
  - if wildlife has been killed (either to resolve a conflict or unintentionally);
  - if wildlife has been injured and the injured animal has not been located or destroyed;
  - if a human has been attacked or bitten by wildlife; or
  - assistance/advice is needed to deter nuisance wildlife to minimize potentially harmful wildlife-human contact.

3.4 Emergency Response

As a private road, the responsibility for response to any emergency or accident lies solely with AEM. It will be AEM personnel that respond and deal with any emergencies that occur on the road. AEM will have people on-site trained in emergency response (firefighting, first aid, mine rescue, spill response, etc.). In urgent circumstances, where appropriate, AEM will request assistance from other parties in Rankin Inlet. However, based on AEM's experience with the Meadowbank road, AEM does not believe that the Phase 1 AWAR will result in any increased demand on local public service providers (i.e., fire, police, ambulance, medical, and maintenance) in Rankin Inlet. In most circumstances, the emergency response will be met by AEM personnel.

Emergency response is reactive whereas prevention lowers the frequency of emergency response. AEM's emphasis will be on the latter, while at the same time keeping resources close at hand to respond to emergencies on the road in a timely manner.

Three possible causes of road emergencies are the road, vehicle, and people. It is the interplay of these 3 elements that lead to either safe use of the road or emergency response. AEM is fully responsible for the design, construction, and maintenance of the Phase 1 AWAR for private, and non-project related use. AEM will ensure its vehicles are in good working order before they venture out on the road. As well, AEM will train its employees on road safety and emergency response (first aid, firefighting, emergency response), and by educating and protecting its workers, they will lead by example in road safety. However, AEM can only influence the non-project users in their choice of vehicle and behaviour on the road through education.

AEM will work to develop partnerships with the residents of Rankin Inlet, community organizations, and government departments in educating the non-project related users on road safety, shaping good driving practices, and influencing people's behaviour on the road. Emphasis will be directed to the use of helmets, seat belts, observing the posted speed limits, improving one's visibility by wearing reflective clothing when on a snowmobile or ATV, not drinking and driving, dealing with driver inexperience, etc. AEM, however, will have little influence on the condition of the non-AEM owned vehicles that will use the road. Vehicles could suffer from poor maintenance, and individuals could also make poor choices such as using an ATV in winter when a snowmobile would be more appropriate.

3.4.1 Accidents and Malfunctions

There is reasonable probability that accidents and malfunctions will occur on this road. Such unfortunate events can occur no matter how much effort is devoted to preventing them. However, mitigation measures and response plans are in place that can be applied to reduce the frequency and severity of such events. In the event of such an accident, AEM staff will follow the procedures in place in the Project's Emergency Response Plan. The types of events that may occur are as follows:

- vehicle collisions that may result in personal injury and spillage of potential harmful materials such as fuel, lubricating fluids, antifreeze, etc;
- contact between vehicles and wildlife that may result in harm to wildlife, personal injury, and spillage of potentially harmful materials, etc.;
- single vehicle accidents that may result in personal injury and spillage of potentially harmful materials;

- risk of people getting stuck on the road in bad weather, such as in heavy snow or white out conditions, or due to mechanical breakdown;
- risk of accident due to an intoxicated or impaired driver on the road; and
- spills of harmful materials onto the land or into water through a vehicle rollover or tipping during bad weather.

Emergency response equipment is to be carried in all AEM vehicles using the road to improve response in the event of an incident or accident. This equipment includes survival gear, emergency first aid equipment, and initial spill response equipment.

It is AEM's responsibility to respond to all emergencies along the road, including but not limited to the following:

- Vehicular Accidents – AEM emergency response personnel are tasked with responding to any vehicle accident resulting in personal injury or spillage of harmful material. AEM will initiate extraction and transport to medical assistance at Rankin Inlet's medical center. AEM will initiate spill containment and clean up measures;
- Spills – AEM emergency response personnel are tasked with responding to any spills and will initiate spill containment and clean up; and
- Reporting – AEM will report all reportable spill incidents to the appropriate Government authority (e.g., Mines Inspector, RCMP, Nunavut Water Board, NU Spill Line, Environment Canada, GN Department of Environment, Fisheries and Oceans Canada, KIA, and Rankin Inlet Municipality).

Emergency response personnel and equipment will be available at all times on the exploration site to allow for quick action should an accident occur. AEM will have a program to train and maintain personnel on-site at all times that can respond and address all emergencies that may occur, ranging from personal injuries, fire, spills of harmful materials, etc. AEM will also have appropriate equipment and material available to equip its emergency response personnel.

The Meliadine West Advanced Exploration site has an emergency and spill response plan in place. This Plan will be periodically reviewed and updated to learn from past experience. Emergency response personnel will be trained on the procedures and protocols contained in the Emergency and Spill Response Plan.

Based on AEM's experience with the road between Baker Lake and the Meadowbank Gold Mine, AEM understands that accidents can occur but the prevention and proposed mitigation measures along the road, emergency response planning, training, and preparation, will substantially reduce the risk, frequency, and severity of such incidents.

3.4.2 Spill Response

An AEM trained site-based emergency response and spill clean-up team will be available on-site with appropriate equipment to respond to any spills or road accidents. Spill response will be implemented by environmental staff who will advise, document, and report on initial response and clean-up actions. The existing exploration project Fuel Management and Spill Contingency Plan for Water Licences 2BE-MEP0813 and 2BB-MEL0914 (November 2010) will be updated to include the all-weather road.

The following actions are to be taken in the event of an accident on the AWAR involving other vehicles (including ATVs) or in the event of an accident involving contact with wildlife such as caribou, muskox, bear, wolf, etc.:

- check the condition of people involved in the accident and provide immediate first aid if appropriate;
- call the Meliadine road dispatch by radio and report the location and nature of the accident and indicate the type of assistance required (medical help, environmental cleanup, fire, and/or mechanical help);
- secure the accident site so that the vehicles do not continue to present a hazard to others. This may involve moving the vehicles to the nearest pull off in the event of a minor accident, or blocking off the road back from the site in both directions in the event of a more serious accident; and
- if safe to do so, secure the site to prevent continued spill or leakage of contaminants into the surrounding environment.

Upon receiving the accident call, the road dispatch will initiate the emergency response procedure, passing along the information to the emergency response coordinator. The emergency response coordinator will then call out the required emergency response personnel to assist at the accident site.

Once the accident site is secured and all people requiring assistance have been removed to medical care, the emergency coordinator will turn the scene over to the site's safety personnel so that an appropriate accident investigation can be initiated.

In the event of an incident involving contact with wildlife, the dispatcher will notify the site security personnel and the environmental representative. Security and the site environmental team will then initiate an appropriate accident investigation. The environmental department will ensure that appropriate reporting of such incidents is made on a timely basis to the KIA, the Rankin Inlet HTO, and the GN Department of Environment.

In the event of a serious accident, the RCMP will be contacted and advised of the incident. The RCMP will then decide on whether they will become involved or take the lead on any subsequent accident investigation.

3.5 References

Golder (Golder Associates Ltd.). 2011a. All weather access road, Meliadine Gold Project, Feasibility Level Design. Prepared for Agnico Eagle Mines Ltd. January 2011. Report number 09-1426-0015/4700 – 085 Rev.1.

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TAC (Transport Association of Canada). 2007. Geometric design guide for Canadian roads.

4.0 ASSESSMENT APPROACH

4.1 Introduction

4.1.1 Context

This section describes the approach that will be used for analyzing effects, and classifying and determining the environmental significance of impacts from the Phase 1-Meliadine All-weather Access Road (the AWAR Project) on the biophysical and socio-economic components in this Environmental Assessment (EA). The approach described below will be applied to the analysis and assessment of the effects from the AWAR Project using information from the Project Description (Section 3.0) and existing (baseline) conditions. Information from traditional and non-traditional land use will also be used to help assess effects.

4.1.2 Purpose and Scope

The purpose of this section is to describe the methods and approach to analyzing and assessing impacts. Key elements of the EA include the following:

- valued components;
- pathway analysis (also known as linkage analysis);
- spatial and temporal boundaries;
- Project-specific effects;
- residual effects and significance;
- cumulative effects;
- uncertainty; and
- monitoring and follow-up.

The assessment approach presented here is based on ecological, cultural, and socio-economic principles, and EA best practice. Several elements of the approach can be consistently applied to all biophysical and socio-economic components. Alternately, certain elements of the assessment approach may have to be modified for some components.

For example, the definition of a valued component can be applied to all environmental disciplines (e.g., air, soil, fish, wildlife, socio-economics). There is general consistency in the approach for identifying pathways that link the AWAR Project to potential effects on valued components of the biophysical and socio-economic environment. Likewise, the approach to determining the spatial and temporal boundaries for the effects analysis and assessment is similar across biophysical and socio-economic components.

In contrast, the methods for analyzing effects, classifying residual impacts (e.g., direction, magnitude, and duration), and predicting environmental significance can differ between biophysical and socio-economic components. For example, socio-economic effects of a specific project are difficult to isolate from the ongoing processes of interdependent social, cultural, and economic change. Evolving social trends, government policy and programming decisions, and individual choice all have effects that will be concurrent with potential AWAR Project effects. Biophysical components also are influenced simultaneously by natural and human-related factors. However, for many disciplines, Project-specific effects can be quantified (e.g., incremental changes to air quality, soil, vegetation and wildlife).

Because the socio-economic status of different communities, subpopulations, and individuals may vary, a socio-economic effect may have both positive and negative aspects. An effect to a biophysical component is typically negative or positive. Therefore, differences in the overall approach and methods between biophysical and socio-economic components are identified in this section, and details are provided in the Socio-Economic section of the EA.

4.1.3 Content

The following sections present approaches and methods for assessing effects from the AWAR Project on the biophysical and socio-economic environment.

Section 4.2: Valued Components – provides definitions of valued components and valued component endpoints for biophysical and socio-economic attributes of the environment, which determines the effects that will be classified.

Section 4.3: Pathway Analysis – provides the definition of pathways, and approach and methods for verifying no linkage, secondary, and primary pathways.

Section 4.4: Spatial and Temporal Boundaries – links component-specific characteristics with the appropriate spatial and temporal scales for effects analyses, and gives broad definitions for spatial and temporal boundaries.

Section 4.5: Effects Analysis – gives the general approach to analyzing Project-specific and cumulative effects for biophysical and socio-economic components.

Section 4.6: Impact Assessment Method – introduces and provides generic definitions for residual impact criteria and presents an overview of the approach and method used to classify impacts and predict environmental significance.

Section 4.7: Uncertainty – introduces the key sources of uncertainty and discusses how uncertainty is addressed to increase the level of confidence that effects will not be worse than predicted.

Section 4.8: Monitoring and Follow-Up – presents the concepts of adaptive management and different types of monitoring. Explains how monitoring and follow-up programs are used to test impact predictions to reduce uncertainty and unexpected effects, and determine the effectiveness of mitigation.

4.2 Valued Components

4.2.1 Identification of Valued Components

Valued components (VCs) represent physical, biological, cultural, social, and economic properties of the environment that are considered to be important by society. The inter-relationships between components of the biophysical and socio-economic (human) environments provide the structure of a social-ecological system (Walker et al. 2004; Folke 2006). Examples of physical properties that can be considered VCs include surface water, soil, and air. Aquatic and terrestrial plant and animal populations represent biological properties that can be considered VCs. Traditional and non-traditional uses of water, plants, and animals and other biophysical properties (e.g., ecological services or resources) can be VCs of the cultural, social, and economic environment.

The EA integrates AWAR Project-related effects on biophysical, cultural, and socio-economic VCs for the people who likely will be directly and indirectly influenced by the AWAR Project.

In nature, VCs can be found at the beginning, middle, or end of pathways, or analogously, at the bottom, middle, or top trophic level of food chains (Section 4.3). For example, benthic invertebrates and plankton are at the lower trophic level (towards the beginning of the pathway) in an aquatic ecosystem, while lake trout or Arctic char are the top predator in some aquatic systems not fished by people (at the end of the pathway). In Arctic terrestrial ecosystems, changes to soil and vegetation represent initial pathways to ptarmigan, caribou, and muskox, which influence top trophic level predators such as wolves and polar bears. Cultural and socio-economic VCs typically enter at the middle and top levels of pathways. For example, people hunt caribou that occur in the middle of the food chain, and fish for lake trout or Arctic char, which occur at the top of food chains. Exceptions include the drinking of water, and harvesting berries and medicinal plants that occur at the lower trophic level of food chains.

Based on input at public meetings held by Agnico-Eagle Mines Limited (AEM) in the region and experience AEM has gained through construction and operation of the Meadowbank All-Weather Access Road, the following biophysical and socio-economic VCs were selected for the environmental assessment of the Meliadine Phase 1 AWAR:

- Atmospheric environment
  - air quality
  - climate
  - noise
- Aquatic Resources
  - water quantity (hydrology)
  - surface water quality
  - fish and fish habitat
- Terrestrial Resources
  - soil;
  - vegetation
  - wildlife (including caribou and raptors)
- Terrain and permafrost
- Archaeological resources (archaeology sites);
- Traditional land use;
- Socio-economic Resources
  - Employment and training opportunities;

- Business opportunities; and
- Economic development.

4.2.2 Assessment Endpoints and Measurement Endpoints

Assessment endpoints represent the key properties of the VC that should be protected for their use by future human generations. Assessment endpoints are general statements about what is being protected. For example, protection of water supply and water quality, persistence of wildlife populations, and continued opportunities for traditional and non-traditional use of these ecological resources may be assessment endpoints for surface water, wildlife, and traditional and non-traditional land use.

Measurement endpoints are defined as quantifiable (i.e., measurable) expressions of changes to assessment endpoints (e.g., changes to chemical concentrations, rates, habitat quantity and quality, and number and distribution of organisms). For example, measurement endpoints for assessing persistence of surface water quantity may include changes to drainage patterns at stream crossings associated with the AWAR Project. Measurement endpoints for predicting effects to air quality may include changes in concentrations of particulate matter (dust) and nitrogen oxides. Impacts to long-term social, cultural, and economic values are predicted through analysis of measurement endpoints such as employment and income, education and training, and capacity for agricultural and recreational land use. Measurement endpoints also provide the primary factors for discussions concerning the uncertainty of impacts to VCs, and subsequently, are the key variables for study in monitoring and follow-up programs.

The overall determination of significance of impacts from the AWAR Project on VCs is then predicted by linking residual effects on measurement endpoints to the associated assessment endpoint (Section 4.6). For example, changes to habitat quantity and quality are used to assess the significance of impacts from the AWAR Project on the persistence of the abundance and distribution of wildlife populations (assessment endpoint). Impacts to wildlife are then used to determine the significance of the AWAR Project on the continued opportunity for traditional and non-traditional use of wildlife (also an assessment endpoint, which incorporates sustainability). Valued components, assessment endpoints, and measurement endpoints used in this EA are presented in Table 4.2-1.

Table 4.2-1: Assessment and Measurement Endpoints Associated with Valued Components

Valued Component	Assessment Endpoints	Measurement Endpoints
Atmospheric environment	■ Maintaining compliance with air quality standards.	■ Total suspended particulates. ■ Carbon, sulphur, and nitrogen oxides. ■ Particulate matter (e.g., dust).
Surface water quality	■ Protection of surface water quality for aquatic and terrestrial ecosystems, and human use.	■ Physical analytes (e.g., pH, conductivity, turbidity). ■ Major ions and nutrients. ■ Total and dissolved metals.
Hydrology	■ Persistence of the spatial and temporal distribution of water quantity for aquatic and terrestrial ecosystems.	■ Flow rate and the spatial and temporal distribution of water. ■ Surface topography, drainage boundaries, waterbodies, and water pathways.

Table 4.2-1: Assessment and Measurement Endpoints Associated with Valued Components (continued)

Valued Component	Assessment Endpoints	Measurement Endpoints
Fish and fish habitat	■ Persistence of abundance and distribution of fish habitat and populations.	■ Habitat quality. ■ Relative abundance and distribution of fish species.
Soil	■ Persistence of soil capability to support other plant communities.	■ Soil quality. ■ Soil quantity and distribution.
Vegetation: ■ plant populations and communities	■ Persistence of plant populations and communities. ■ Persistence of plant species at risk.	■ Plant community health and diversity. ■ Relative abundance and distribution of plant species.
Wildlife: ■ caribou; ■ northern grey wolf; ■ polar bear; ■ upland birds; and ■ raptors.	■ Persistence of wildlife populations. ■ Continued opportunity for traditional and non-traditional use of wildlife.	■ Habitat quantity and fragmentation. ■ Habitat quality. ■ Relative abundance and distribution of species. ■ Survival and reproduction.
Archaeology	■ Protection of archaeological resources.	■ Archaeological and sacred sites.
Socio-economics	■ Persistence of Long-term Social, Cultural, and Economic Properties	■ Employment and training opportunities ■ Business activity and opportunities ■ Community wellness

4.3 Pathway Analysis

Pathway analysis identifies and assesses the linkages between AWAR Project components or activities, and the correspondent potential residual effects to VCs (e.g., water quality, soil, wildlife, and socio-economics). Potential pathways through which the AWAR Project could affect VCs were identified from a number of sources including:

- a review of the AWAR Project description and scoping of potential effects by the environmental, socio-economics and engineering teams for the AWAR Project;
- scientific knowledge, and experience with other northern mines;
- results of AEM's public consultation; and
- consideration of potential effects identified for this AWAR Project.

The first part of the analysis is to produce a list of all potential effects pathways for the AWAR Project. Each pathway is initially considered to have a valid linkage to potential effects on VCs. This step is followed by the development of environmental design features that can be incorporated into the Project Description to remove a pathway or limit (mitigate) the effects to VCs. Environmental design features include AWAR Project design elements, environmental best practices, management policies and procedures, and social programs.

Environmental design features are developed through an iterative process between the AWAR Project's engineering and environmental teams to avoid or mitigate effects.

Knowledge of the environmental design features is then applied to each of the pathways to determine the expected amount of Project-related changes to the environment and the associated residual effects (i.e., effects after mitigation) on VCs. Changes to the environment can alter physical measurement endpoints (e.g., water and soil chemistry, and amount of habitat) and biological measurement endpoints such as animal behaviour, movement, and survival (Table 4.2-1). For an effect to occur, there has to be a source (Project component or activity) that results in a measurable environmental change (pathway) and a correspondent effect on a VC.

Project activity → change in environment → effect on VC

Pathway analysis is a screening step that is used to verify the existence of valid linkages from the initial list of potential effects pathways for the AWAR Project. This screening step is largely a qualitative assessment, and is intended to focus the effects analysis on pathways that require a more comprehensive assessment of effects on VCs. Pathways are determined to be primary, secondary, or as having no linkage using scientific and traditional knowledge, logic, and experience with similar developments and environmental design features. Each potential pathway is assessed and described as follows:

- no linkage – pathway is removed by environmental design features so that the AWAR Project results in no detectable (measurable) environmental change and residual effects to a VC relative to baseline or guideline values;
- secondary - pathway could result in a minor environmental change, but would have a negligible residual effect on a VC relative to baseline or guideline values; or
- primary - pathway is likely to result in a measurable environmental change that could contribute to residual effects on a VC relative to baseline or guideline values.

Primary pathways require further effects analysis and impact classification to determine the environmental significance from the AWAR Project on VCs. Pathways with no linkage to a VC or that are considered secondary are not analyzed further or classified in the EA because environmental design features will remove the pathway (no linkage) or residual effects to the VC can be determined to be negligible through a simple qualitative evaluation of the pathway (minor). Pathways determined to have no linkage to a VC or those that are considered secondary are not predicted to result in environmentally significant effects on VCs.

All primary pathways are assessed in the EA. However, primary pathways for one VC may end up being secondary or having no linkage to other VCs. For example, local changes to surface water levels may be a primary pathway for effects on aquatic vegetation, but may be considered a secondary pathway for effects on the population size and distribution of a wildlife species with a larger home range.

4.4 Spatial and Temporal Boundaries

4.4.1 Spatial Scales and Boundaries

Individuals, populations, and communities function within the environment at different spatial (and temporal) scales. In addition, the response of physical, chemical, and biological processes to changes in the environment can occur across a number of spatial scales at the same time (Holling 1992; Levin 1992). As a result, the scale of the investigation will determine the range of patterns and processes that can be observed and predicted with certainty (Wiens 1989; Harris et al. 1996).

Effects from the AWAR Project on the biophysical environment are typically stronger at the local scale, and larger scale effects are more likely to result from other ecological factors and human activities. For example, effects from the AWAR Project on environmental components with limited movement (e.g., soil and vegetation) will likely be limited to local changes from the footprint of the road. Some indirect changes to vegetation from dust deposition and air emissions may occur, but the effect should be limited to the local scale of the AWAR Project. Similarly, for species with small home ranges, any effects from the AWAR Project on a local population will likely not be transferred to other populations in the region. Depending on the species, an increase in distance among local populations can decrease effective dispersal and result in subpopulations that fluctuate independently (Schlosser 1995; Steen et al. 1996; Sutcliffe et al. 1996; Ranta et al. 1997; Bjørnstad et al. 1999). In other words, changes in the number of individuals within subpopulations over time are more related to local factors that influence reproduction and survival rates than the movement of individuals between populations.

For VCs with more extensive distributions, such as wildlife species with large home ranges, effects from the AWAR Project have a higher likelihood of combining with effects from other human developments and activities. Watersheds may be influenced by multiple users, who generate cumulative effects to these resources. Similarly, larger animals (e.g., caribou) that are influenced by the AWAR Project will likely encounter other human activities and developments in their daily and seasonal ranges. Consequently, effects from the AWAR Project could combine with influences from other developments in the individual’s home range. In addition, the home ranges of several individuals may be affected, which results in cumulative effects to the population.

The purpose of the examples above is to emphasize the different levels of organization in natural systems, and the correspondent need to analyze and predict AWAR Project effects to VCs at the appropriate spatial scales. For the EA, the spatial scope must be able to capture the scale-dependent processes and activities that influence the geographic distribution and movement patterns specific to each VC. Because the responses of physical, biological, cultural, and economic properties to natural and human-induced disturbance will be unique and occur across different scales, studies should use a range of spatial (and temporal) scales (Wiens 1989; Levin 1992). Accordingly, the EA has adopted this multi-scale approach for describing baseline conditions (existing environment) and predicting effects from the AWAR Project on VCs.

For this assessment, the spatial boundaries of the local study areas were designed to measure baseline environmental conditions and then predict direct effects from the AWAR Project footprint and activities on the VCs and associated measurement endpoints (e.g., changes to surface water quality, physical disturbance to vegetation, and soils). Local study areas were also defined to assess small-scale indirect effects from AWAR Project activities on VCs, such as changes to soil and vegetation from dust and air emissions related to the exhaust from motorized vehicles driving along the AWAR (i.e., fuel related emissions).

The boundaries for regional study areas were designed to describe baseline conditions at a scale that are large enough to assess the maximum predicted geographic extent (i.e., maximum zone of influence) of direct and indirect effects from the AWAR Project on VCs and measurement endpoints. Project-related effects at the regional scale include potential changes to downstream surface water quantity and quality, vegetation communities, wildlife habitat quality, wildlife, and people that use these ecosystem services. Cumulative effects are typically assessed at a regional spatial scale and, where relevant, may consider influences that extend beyond the regional study area.

4.4.2 Temporal Boundaries

Spatial and temporal boundaries are tightly correlated because processes that operate on large spatial scales typically occur at slower rates and have longer time lags than processes that operate on smaller spatial scales (Wiens 1989; Chapin et al. 2004; Folke et al. 2004).

For the purposes of this environmental assessment, the temporal boundary for construction, operation, and closure for the Phase 1 AWAR is about 4 years (i.e., 6 month construction, 2 years operation, and 1 year for closure following closure of the advanced exploration project infrastructure). If the Meliadine Gold Project advances through feasibility and the project is successful in obtaining a NIRB Project Certificate and other regulatory approvals, then road would be upgraded to a 2-lane road, and the timeline would be extended out through construction of the gold mine infrastructure and 10 year expected mine life.

For some VCs (e.g., vegetation) where effects are expected to extend out a considerable length of time, the temporal boundary is adjusted to encompass the expected duration of the effect.

4.5 Effects Analysis

4.5.1 Project-Specific Effects

In the EA, the effects analysis considers all valid pathways that likely result in measurable environmental changes and residual effects to VCs (i.e., after implementing environmental design features). Thus, the analysis is based on residual Project-specific (incremental) effects that are verified to be valid in the pathway analysis (Section 4.3). Residual changes to VCs will be analyzed using measurement endpoints and expressed as effects statements in the EA (e.g., Effects to Hydrology, Effects to Wildlife Population Size and Distribution, and Effects to Cultural Resources). Effects statements may have more than one valid pathway that link an AWAR Project activity with a change in a VC. For example, the pathways for effects to hydrology include alteration of local flows and drainage areas from the AWAR Project footprint. Incremental effects from the AWAR Project to wildlife population size and distribution may include changes in habitat quantity and quality, and behaviour, and movement.

Effects to social, economic, and cultural properties include positive and negative changes to employment, training, and education, family income, traditional land use, family and community cohesion, and long-term social, cultural, and economic sustainability. Some of these measurement endpoints can be analyzed quantitatively (e.g., number of jobs created, estimated income levels). Other endpoints, such as community cohesion and traditional land use, are more difficult to quantify, and involve information from public engagement, literature, examples from similar projects under similar conditions, and experienced opinion. The effects analysis considers the interactions among the unique and common attributes, challenges, and opportunities related to social, cultural, and economic measurement endpoints. A key aspect of the effects analysis is to predict the influence from the AWAR Project on the development and sustainability of socio-economic conditions in the region.

Residual effects to traditional and non-traditional land use practices (e.g., hunting, fishing, plant and berry gathering) will be assessed through the analysis of VCs that are directly associated with these assessment endpoints. For example, analysis of Project-specific effects to vegetation quantity and quality will be used to determine the associated influence on caribou habitat. Therefore, effects to assessment endpoints for traditional and non-traditional land use will be analyzed and assessed within discipline sections that contain the applicable biophysical or socio-economic VC.

A description of the methods used to analyze residual effects from the AWAR Project on VCs will be provided in each discipline section (e.g., hydrology, atmospheric environment, terrain and soils, wildlife). Where possible and appropriate, the analyses will be quantitative, and may include data from field studies, modelling results, scientific literature, government publications, effects monitoring reports, and personal communications. Available traditional knowledge and community information will be incorporated into the analysis and results, where information is available. Due to the amount and type of data available, some analyses will be qualitative and include professional judgement or experienced opinion.

Following the effects analysis, a summary of residual effects will be provided for each discipline where primary pathways have been identified. Results from the effects analyses are used to describe the direction, magnitude (intensity), duration, and geographic (spatial) extent of the predicted residual changes to VCs. Where possible and appropriate, expected changes will be expressed quantitatively or numerically. For example, the magnitude of the effect may be expressed in absolute or percentage values above baseline (existing) conditions or a guideline value. Duration (which is linked to reversibility) of the change will be estimated relative to AWAR Project phases (i.e., construction, operation, decommissioning, and the geographic extent of effects will be expressed in area (ha) or distance (m, km) from the AWAR Project. In addition, the likelihood, and frequency of effects may also be described, where applicable.

Expressions such as “short-term” duration or “moderate” magnitude will not be used in the summary of residual effects. These expressions will be reserved for the classification of impacts, where definitions of these expressions are provided.

4.5.2 Approach to Cumulative Effects

4.5.2.1 Definition and Application

Cumulative effects represent the sum of all natural and human-induced influences on the physical, biological, cultural, and economic components of the environment through time and across space. Some changes may be human-related, such as increasing agricultural and industrial development, and some changes may be associated with natural phenomenon such as extreme rainfall events, and periodic harsh and mild winters. It is the goal of the cumulative effects assessment to estimate the contribution of these types of effects, in addition to AWAR Project effects, to the amount of change in the VCs.

Not every VC requires an analysis of cumulative effects. The key is to determine if the effects from the AWAR Project and one or more additional developments/activities overlap (or interact) with the temporal or spatial distribution of the VC (Section 4.4). For some VCs, Project-specific effects are important and there is little or no potential for cumulative effects, because there is little or no overlap with other developments (e.g., soils). For other VCs that are distributed, or travel over large areas and can be influenced by a number of developments (e.g., caribou), the analysis of cumulative effects can be necessary and important. Socio-economic components also must consider the potential cumulative effects of the AWAR Project and other developments and human activities.

Similar to Project-specific effects, the analysis of cumulative effects involves pathway and effects analyses, and the classification and determination of significance of residual impacts.

4.5.3 Assessment Cases

For VCs that require cumulative effects analysis, the concept of assessment cases is applied to the associated spatial boundary (effects study area) to estimate the incremental and cumulative effects from the AWAR Project (Table 4.5-1). The approach incorporates the temporal boundary for analyzing the effects from previous, existing, and reasonably foreseeable developments before, during, and after the anticipated life of the AWAR Project.

Table 4.5-1: Contents of Each Assessment Case

Baseline Case	Application Case	Future Case
Range of conditions from existing and approved developments prior to the AWAR Project.	Baseline Case plus the AWAR Project.	Application Case plus reasonably foreseeable developments.

The baseline case represents a range of conditions over time within the effects study area prior to application of the AWAR Project, and not a single point in time. Observations collected during baseline studies represent part of the range of variation in the ecological and socio-economic systems produced by historical and current environmental selection pressures (both human and natural).

The temporal boundary of the application case begins with the anticipated start of construction of the AWAR Project, and continues until the predicted effects are reversed (Section 4.4.2). For some VCs, the effects may be determined to be irreversible within the temporal boundary of assessment. The future case includes the predicted duration of residual effects from the AWAR Project, and other previous, existing, and reasonably foreseeable developments. Thus, the minimum temporal boundary for the application and future case is the expected operational lifespan of the AWAR Project, which in the case of the Phase 1 AWAR is 2 years if the proposed Meliadine Gold Project is not approved, or up to 15 years if the mine project and Phase 2 of the AWAR receives approval. For several VCs, the temporal extent of some effects likely will be greater than the operation phase of the AWAR Project because the effects will not be reversible until beyond closure.

Analyses of the effects for the baseline and application cases are largely quantitative. Alternately, effects analyses for the future case may be more qualitative due to the large degree and number of uncertainties. There are uncertainties associated with the timing, rate, type, and location of developments in the study areas for each VC. There are also uncertainties in the direction, magnitude, and spatial extent of future fluctuations in ecological, cultural, and socio-economic variables, independent of AWAR Project effects.

4.6 Impact Assessment Methods

4.6.1 Application of Residual Impact Classification

In the EA, the term “effect” used in the effects analyses and residual effects summary (Section 4.5) is regarded as an “impact” in the residual impact classification. An effect represents an unclassified change in a VC. The term “impact” is only used during the classification process. Therefore, in the residual impact classification, all residual effects are discussed and classified in terms of impacts to VCs.

Quantitative and qualitative descriptions of the direction, magnitude, geographic extent, and duration of changes to measurement endpoints for primary pathways are provided in the residual effects summary (Section 4.5). Frequency and likelihood of effects also are described where applicable. However, the classification of residual impacts (and associated pathways) and determination of environmental significance is only completed for those VCs that have assessment endpoints. This is because assessment endpoints represent the key properties of the VC that should be protected for use by future human generations (i.e., assessment endpoints consider sustainability). Results from the residual impact classification are then used to determine the environmental significance from the AWAR Project on assessment endpoints.

4.6.2 Residual Impact Criteria and Definitions

The purpose of the residual impact classification is to describe the residual effects from the AWAR Project on VCs using a scale of common words (rather than numbers and units). The use of common words or criteria is accepted practice in environmental assessment. The following criteria will be used to assess the residual impacts from the AWAR Project in the EA:

- direction;
- magnitude;
- geographic extent;
- duration;
- reversibility;
- frequency; and
- likelihood.

Generic definitions for each of the residual impact criteria are provide below.

Direction: Direction indicates whether the impact on the environment is negative (i.e., less favourable), positive (i.e., beneficial), or neutral (i.e., no change). While the main focus of the impact assessment is to predict whether the development is likely to cause significant adverse impacts on the environment or because of public concern, the positive changes associated with the AWAR Project also are reported. Neutral changes are not assessed.

Magnitude: Magnitude is a measure of the intensity of an impact, or the degree of change caused by the AWAR Project relative to baseline conditions or a guideline value. It is classified into 4 scales: negligible, low, moderate, and high. For each VC, the scales of magnitude are defined. Magnitude can relate to a percentage change (e.g., change from baseline), or to absolute changes that are above or below guidelines or thresholds. Where possible, magnitude is reported in absolute and in relative terms.

Geographic Extent: Geographic extent refers to the area affected, and is categorized into 3 scales of local, regional, and beyond regional. Local-scale impacts mostly represent changes that are directly related to the AWAR Project footprint and activities, but may also include small-scale indirect impacts. Changes at the regional scale are largely associated with indirect impacts from the AWAR Project, and represent the maximum predicted spatial extent of impacts from the AWAR Project (zone of influence). Impacts beyond the regional scale are mostly associated with VCs that have large spatial distributions and are influenced by cumulative effects from the AWAR Project and other developments such as wildlife and socio-economics.

Duration: Duration is defined as the amount of time from the beginning of an impact to when the impact on a VC is reversed, and is expressed relative to AWAR Project phases. Thus, duration is a function of the length of time that the VC is exposed to AWAR Project activities or phases (e.g., construction, operation, and decommissioning and reclamation), and reversibility.

Reversibility: After removal of the stressor, reversibility is the likelihood and time required for a VC or system to return to a state that is similar to the state of systems of the same type, region, and time period that are not affected by the AWAR Project. This term usually has only one alternative: reversible or irreversible. The time frame is provided for reversibility (i.e., duration) if an impact is reversible. Permanent impacts are considered irreversible. In terms of the socio-economic environment, the manageability of impacts is considered rather than their reversibility. Where appropriate, the evaluation identifies the resources that may be diverted to facilitate recovery.

Frequency: Frequency refers to how often an impact will occur and is expressed as isolated (confined to a discrete period), periodic (occurs intermittently, but repeatedly over the assessment period), or continuous (occurs continuously over the assessment period). Frequency is explained more fully by identifying when it occurs (e.g., once at the beginning of the AWAR Project). If the frequency is periodic, then the length of time between occurrences, and the seasonality of occurrences (if present) is discussed.

Likelihood: Likelihood is the probability of an impact occurring and is described in parallel with uncertainty. Four categories are used: unlikely (impact is likely to occur less than once in 100 years); possible (impact will occur at least once in 100 years); likely (impact will likely occur at least once in 10 years); and highly likely (impact has 100% chance of occurring within a year).

For criteria such as frequency and likelihood, the scales can be applied consistently across all biophysical VCs (e.g., isolated, periodic, or continuous frequency). Socio-economic criteria do not include frequency and likelihood as it is assumed that the impacts have a high likelihood to occur continuously during the assessment period. The scale of classifications for direction, magnitude, geographic extent, and duration are dependent on each biophysical and socio-economic VC. To provide transparency in the EA, the definitions for these scales are ecologically, socially, or logically based on the VC. Although professional judgement is inevitable in some cases, a strong effort is made to classify impacts using scientific principles and supporting evidence. The scales for these criteria are specifically defined for each VC in the EA.

4.6.3 Residual Impact Classification and Significance

As explained in Section 4.5.1, effects statements are used to focus the analysis of changes to VCs that are associated with one or more valid pathways. The residual effects summary presents a numerical and/or qualitative description of magnitude, geographic extent, duration, and frequency of residual effects from each pathway. From the summary of residual effects, each pathway that is linked to an assessment endpoint is classified using categorical scales for each impact criterion (e.g., low magnitude, regional geographic extent, long-term duration, high likelihood).

The classification of residual impacts on primary pathways provides the foundation for determining environmental significance from the AWAR Project on assessment endpoints. Magnitude, geographic extent, and duration are the principal criteria used to predict significance (FEARO 1994). Other criteria, such as frequency and likelihood, are used as modifiers (where applicable) in the determination of significance. Duration of impacts, which includes reversibility, is a function of ecological resilience, and these ecological principles are applied to the evaluation of significance.

Although difficult to measure, resilience is the capacity of the system to absorb disturbance, and reorganize and retain the same structure, function, and feedback responses (i.e., properties of the social-ecological system) (Holling 1973; Walker et al. 2004; Folke 2006). Resilience includes resistance, capability to adapt to change, and how close the system is to a threshold before shifting states (i.e., precariousness). Highly resistant systems require stronger disturbances over a longer duration and larger geographic area to change the system's current path or trajectory, even if it is close to a threshold. In contrast, a similar system with lower resistance would be less resilient to a weaker disturbance, and may generate a change in state or a regime shift with a subsequent impact on the ecosystem and society (Folke et al. 2004; Walker et al. 2004).

The adaptive capability of a system is related to the evolutionary history and adaptations accumulated by communities, species, and populations while experiencing a range of disturbances and fluctuations through space and time (Holling 1973; Gunderson 2000). If the frequency, duration, geographic extent, and/or intensity (magnitude) of a disturbance are beyond that historically encountered by the system, and outside the adaptive capability of species, then the likelihood of a regime shift increases. Regime shifts and changes in state of the population or ecosystem can be reversible or irreversible.

Reversibility is the likelihood and time required for a system to recover after removal of the stressor, and is a function of resilience. Due to the complex relationships among biophysical components and unpredictable events, the recovery of the system following disturbance can result in the same or altered state (Gunderson 2000; Folke 2006). In other words, the impact from disturbance may be reversible, but the exact nature of ecosystem properties and services, and human uses are different. In some cases, the shift in ecological properties and services may not be reversible and will have a consequence to socio-economics and land use (Gunderson 2000; Scheffer and Carpenter 2003; Folke et al. 2004; Carpenter and Brock 2006).

Human development and natural disturbances erode the resilience of existing ecosystems by stressing and disrupting the relationships among species and their environment. Through the implementation of management and policy, humans also can increase or maintain resilience by making the system more resistant, moving the system away from threshold boundaries, and/or moving the boundary further away from the system (Folke et al. 2004; Walker et al. 2004). People have the ability to exert change across several spatial and temporal scales and levels of organization in the system, although some more strongly and quickly than others. Through the actions of adaptive management, mitigation, and changes to land use practices, humans have the ability to modify resilience in a positive way, and potentially decrease environmental significance.

In the EA, the determination of significance from AWAR Project impacts on the assessment endpoint for the socio-economic environment is completed on a subset of VCs (e.g., quality of life, employment, and community services), and typically, each VC is directly associated with an individual pathway. Because people have an ability to modify the system across several spatial and temporal scales, each pathway can result in different levels of effects on individuals, communities, and the region. Consequently, it is more practical to independently classify and predict the significance of the impact from each pathway on a socio-economic VC than to classify the entire set of pathways and generate a single evaluation of significance on the socio-economic environment. However, after evaluating the significance the pathways associated with the subset of VCs, the overall significance of the AWAR Project on the assessment endpoint for the socio-economic environment is provided.

In contrast, the evaluation of significance for biophysical VCs considers the entire set of pathways that influence a particular assessment endpoint. The relative contribution of each pathway is then used to determine the significance of the AWAR Project on assessment endpoints. For example, a pathway with a high magnitude, large geographic extent, and long-term duration would be given more weight in determining significance relative to pathways with smaller scale effects. The relative impact from each pathway is discussed; however, pathways that are predicted to have the greatest influence on changes to assessment endpoints would also be assumed to contribute the most to the determination of environmental significance.

Environmental significance is used to identify predicted impacts that have sufficient magnitude, duration, and geographic extent to cause fundamental changes to a VC. It is difficult to provide definitions for environmental significance that are universally applicable to each VC assessment endpoint. Consequently, specific definitions are provided for each assessment endpoint in the EA. The evaluation of significance uses ecological principles, to the extent possible, but also involves professional judgement and experienced opinion.

In summary, results from the effects analysis and residual impact classification of valid pathways are used in the evaluation of the significance of impacts from the AWAR Project on VCs. Some of the key factors considered in the determination of environmental significance include the following:

- results from the residual impact classification of valid pathways;
- magnitude, geographic extent, and duration (which includes reversibility) of the impact are the principal criteria, with frequency and likelihood as modifiers; and
- professional judgment and ecological principles, such as resilience, are used to predict the duration and associated reversibility of impacts.

4.7 Uncertainty

Most assessments of impacts embody some degree of uncertainty. The purpose of the uncertainty section of the EA is to identify the key sources of uncertainty and discuss how uncertainty is addressed to increase the level of confidence that effects will not be worse than predicted. Confidence in effects analyses can be related to many elements, including the following:

- adequacy of baseline data for understanding existing conditions and future changes unrelated to the AWAR Project (e.g., extent of future developments, climate change, catastrophic events);
- model inputs (e.g., estimates of the spatial distribution of dust deposition);
- understanding of Project-related impacts on complex ecosystems that contain interactions across different scales of time and space (e.g., how and why the AWAR Project will influence wildlife); and
- knowledge of the effectiveness of the environmental design features for reducing or removing impacts (e.g., environmental performance of the AWAR).

Uncertainty in these elements can result in uncertainty in the prediction of environmental significance. Where possible, a strong attempt is made to reduce uncertainty in the EA to increase the level of confidence in impact predictions, as shown in the following examples:

- using the results from several models (where feasible) and analyses to help reduce bias and increase precision in predictions;
- using data from effects monitoring programs at existing mines and the literature as inputs for models rather than strictly hypothetical or theoretical values; and

- implementing a conservative approach when information is limited so that impacts are typically overestimated.

Where appropriate, uncertainty may also be addressed by additional mitigation, which would be implemented as required. Each discipline section includes a discussion of how uncertainty has been addressed and provides a qualitative evaluation of the resulting level of confidence in the effects analyses and impact classifications.

4.8 Monitoring and Follow-Up

In the EA, monitoring programs are proposed to deal with the uncertainties associated with the impact predictions and environmental design features. In general, monitoring is used to test (verify) impact predictions and determine the effectiveness of environmental design features (mitigation). Monitoring is also used to identify unanticipated effects and implement adaptive management. Typically, monitoring includes one or more of the following categories, which may be applied during the development of the AWAR Project.

- **Compliance inspection:** monitoring the activities, procedures, and programs undertaken to confirm the implementation of approved design standards, mitigation, and conditions of approval and company commitments.
- **Environmental monitoring:** monitoring to track conditions or issues during the development lifespan, and subsequent implementation of adaptive management.
- **Follow-up:** programs designed to test the accuracy of impact predictions, reduce uncertainty, determine the effectiveness of environmental design features, and provide appropriate feedback to operations for modifying or adopting new mitigation designs, policies, and practices. Results from these programs can be used to increase the certainty of impact predictions in future environmental assessments.

These programs form part of the environmental management system for the AWAR Project. If monitoring or follow-up detects effects that are different from predicted effects, or the need for improved or modified design features, then adaptive management will be implemented. This may include increased monitoring, changes in monitoring plans, or additional mitigation.

4.9 References

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