



# **AGNICO EAGLE**

**MELIADINE GOLD PROJECT**

**SD 2-10**

**Borrow Pits and Quarries  
Management Plan**

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**APRIL 2014  
VERSION 3**

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**DOCUMENT CONTROL**

Version	Date	Section	Page	Revision	Author
1	December 2012			First draft of the Borrow Pits and Quarries Management Plan	John Witteman, Env. Consultant, AEM
2	March 2013	1.2.2	3-4	More detail on Discovery access road	John Witteman, Env. Consultant, AEM
3	April 2014			FEIS submission	

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## EXECUTIVE SUMMARY

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The Borrow Pits and Quarries Management Plan describes Project's components which will require the use of borrow pit and quarry materials for construction and maintenance. Main use of this type of materials will be for the construction of the All-weather Access Road (AWAR) between Rankin Inlet and Meliadine site.

Borrow pits and rock quarries on Inuit Owned Lands (IOL) require a commercial lease and quarry permit issued by the KIA. Quarry permits on municipal land are administered by the Government of Nunavut (GN) Department of Community and Government Services (CGS) on behalf of the hamlet of Rankin Inlet. Other relevant regulations are mentioned in the Plan.

Best management practices start at borrow pits and quarries selection process and continue through all phases of exploitation. These can be identified as follows:

- Minimize the surface area of quarries and borrow pits where possible;
- Minimize rock and borrow pit cuts where possible;
- Maintain the floor of the quarries and borrow pits slightly above the elevation of the surrounding area to promote drainage, to avoid creating quarry lakes, and to prevent permafrost degradation in borrow pits;
- Prevent erosion and sedimentation through appropriate control measures;
- Carry out ARD/ML testing and water quality monitoring in support of mitigation measures;
- Protect archeological resources;
- Maintain air quality through dust control/suppression; and
- Use progressive reclamation in closing quarries and borrow pits no longer needed.

The quarries and borrow pits selected for building the AWAR showed no potential to generate acid drainage; some potential quarries/borrow pits were rejected due to potential metal leaching. Visual examinations of materials and additional testing will be conducted during construction in order to confirm that the best available building materials are being used.

Quarry operations will use a "drill, blast, load, haul, dump" sequence, the final step being putting the rock into place using a dozer. Some rock could be crushed to produce aggregate of various sizes. Wherever possible, borrow pit material will be ripped using a dozer. Standard drill and blast procedures could be used in instances where ripping is not possible.

Mitigations measures pertaining to archaeological resources and adjacent historical sites, and attractions and facilities within boundaries of Iqalugaajuup Nunanga Territorial Park and wildlife were developed and are described in details in the Plan. Dust, noise and water quality monitoring related to the use of the quarries and borrow pits will be done during construction phase.

As a surety measure, rock berms are to be placed 10 m from the edge of the quarry and above any exposed high walls that are more than 2 m in height where there is a risk of an ATV or snowmobile accidentally going over the edge. Progressive reclamation will be done as much as practicable. With prudent initial design, the quarries/borrow pits should require little reclamation. The reclaimed quarries and borrow pits will have gently sloping walls and positive drainage wherever possible. Loose wall rock will be pulled to the floor of the quarry, and the entrance blocked with large boulders.

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**ACRONYMS**

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AANDC	Aboriginal Affairs and Northern Development Canada
AEM	Agnico Eagle Mines Limited
ARD/ML	Acid Rock Drainage/Metal Leaching
ATV	All-Terrain Vehicle
AWAR	All-weather Access Road
CGS	Department of Community and Government Services, GN
CLEY	Department of Culture, Language, Elders and Youth, GN
EIS	Environmental Impact Statement
GN	Government of Nunavut
ID	Identification
IOL	Inuit Owned Lands
KIA	Kivalliq Inuit Association
NIRB	Nunavut Impact Review Board
NLCA	Nunavut Land Claims Agreement
SD	Support Document

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## SECTION 1 • INTRODUCTION

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### 1.1 Overview

The Borrow Pits and Quarries Management Plan was prepared in accordance with the Guidelines issued by the Nunavut Impact Review Board (NIRB). It is one in a series of environmental management plans that have been prepared for the Meliadine Project.

### 1.2 Project Components

#### 1.2.1 All-weather Access Road

The Phase 1 All-weather Access Road (AWAR) connecting Rankin Inlet to the Meliadine site was allowed as an exception to the Nunavut Impact Review Board's review of the Meliadine Project, pursuant to Section 12.10.2(b) of the Nunavut Land Claims Agreement (NLCA). For the exception application, Agnico Eagle Mines Limited (AEM) prepared the Phase 1 – Meliadine All-weather Access Road Project Description and Environmental Assessment (Golder Associates 2011) and an associated Borrow Pit and Quarry Management Plan (AEM 2011).

The 23.8 kilometre AWAR route is shown on Figure 1-1 as are the borrow pits and quarries selected for road building material with the quantity of material extracted from each listed in Table 1-1. The initial number of quarries was reduced from five to three, and the number of borrow pits from eight to seven. Those selected are immediately next to the road route thereby minimizing the haul distances for road construction. Only R19 is located on municipal land, the remainder of the quarries and borrow pits are located on Inuit Owned Lands (IOL) administered by the Kivalliq Inuit Association (KIA). Other considerations in their selection included: the volume of road building material available, proximity to receiving waters, acid rock drainage/metal leaching (ARD/ML) potential, archaeological resources in the immediate vicinity, surface area to be disturbed, wildlife and territorial park concerns (Golder Associates 2011). The goal in selecting the quarries/borrow pits was to avoid or minimize wherever possible potential negative effects to the environment.

The Phase 2 AWAR will be constructed following receipt of the Project Certificate from the NIRB. Its construction will allow AEM to safely and efficiently support construction of the Project and its operations. Approximately 100,000 m<sup>3</sup> of additional material will be extracted from existing borrow pits and rock quarries to upgrade the AWAR to a width of 8 m and two lanes<sup>1</sup>. It is estimated that this will increase the surface area of the existing quarries and borrow pits by about five hectares (5 ha) to a total of 20 ha overall.

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<sup>1</sup> Phase 1 AWAR is 6.5 m wide and one lane only. While Phase 1 AWAR has restricted access, Phase 2 will be open to non-Project related access.



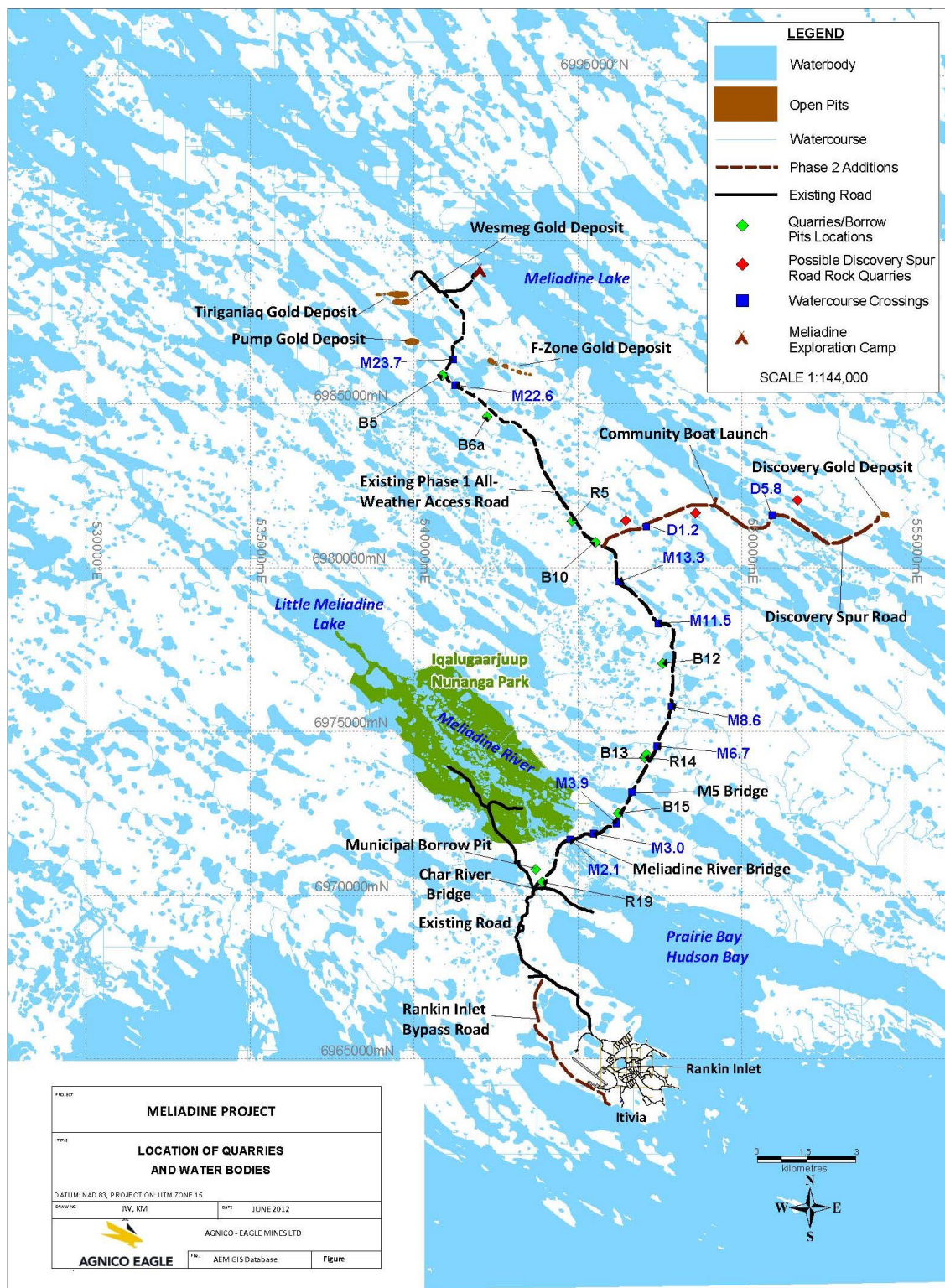


Figure 1-1 Borrow Pits and Quarries – Meliadine Project

Table 1-1 Phase 1 AWAR Rock Quarries and Borrow Pits

ID Number	Surface (ha)	Volume (m <sup>3</sup> )	Location	Additional number of samples to be collected for ARD/ML testing
<b>Rock Quarries</b>				
R19	1.80	40,000	Hamlet	10
R14	1.35	30,000	IOL	7
R5	1.75	30,000	IOL	7
<b>Sub -Total (A) :</b>	<b>4.90</b>	<b>100,000</b>		<b>24</b>
<b>Borrow Pits – Glacial/Fluvial Material</b>				
B15	1.60	24,000	IOL	5
B13	1.40	45,000	IOL	7
B12	1.40	26,000	IOL	5
B11A	3.40	50,000	IOL	8
B10	2.05	55,000	IOL	9
B6A	2.00	45,000	IOL	7
B5	1.45	55,000	IOL	9
<b>Sub-Total (B):</b>	<b>13.30</b>	<b>300,000</b>		<b>50</b>
<b>G-Total (A+B)</b>	<b>15.10</b>	<b>400,000</b>		<b>74</b>

R = Rock quarry; B = Borrow pit.

### 1.2.2 Access Road to Discovery Deposit

A component of the Phase 2 AWAR is to construct the initial 3.7 km of the 9.8 km long access road to the Discovery gold deposit as shown on figure 1-1<sup>2</sup>. The construction and design of the access road will be identical to the Phase 2 AWAR – 8 m wide and 2 lanes. AEM committed to build the access road as far as Meliadine Lake and to build a boat launch for use by the residents of Rankin Inlet following necessary approvals. The remainder of the access road to Discovery will be built in advance of mining the gold deposit.

The quantity of road building material required to construct the Discovery access road as far as Meliadine Lake is approximately 75,000 m<sup>3</sup> with 25 to 40 % to come from existing borrow pit B10 and rock quarry R5, both of which were/are being used to build the Phase 1 and 2 AWAR. A single

<sup>2</sup> A haul road parallel to and separate from the Discovery access road will be built prior to mining the Discovery gold deposit. For information on the operation and management of roads, refer to SD 2-9 Roads Management Plan.

borrow pit and single quarry are anticipated to be required to build this section of the road, subject to the volume of material in each. Three possible rock quarries, figure 1-1, have tentatively been identified near the access road. The road will cross a large esker where a borrow pit could be located. The selection of any new quarry or borrow pit will follow the protocol established for the quarries and borrow pits for Phase 1<sup>3</sup>.

Material for building the haul road to the Discovery gold deposit could be sourced from waste rock, overburden, a rock quarry and/or a borrow pit. This section of road will be built about a year in advance of mining the Discovery gold deposit.

### 1.2.3 Hamlet Bypass Road and Itivia Laydown

A bypass road will be built around the airstrip to Itivia harbour as shown on Figure 1-1. This will allow traffic from Itivia harbour to bypass the hamlet in delivering dry goods and fuel from Itivia to the Meliadine site. It will also be used for moving air freight and mine personnel between the airport and the mine site.

#### Why a bypass road is preferable to using existing roads in the hamlet?

One hundred and twenty two million litres of fuel are required annually for mine operations and it is to be stored in the Itivia tank farm. All this fuel needs to be transported to the Meliadine site where a tank farm with single 5.4 million litre tank will be constructed. If each fuel tanker carries 45,000 litres, it will result in a total of 2,711 trips annually or, on average, 7.4 trips per day. Added to this would be moving 20,000 to 40,000 tonnes of dry cargo from Itivia to the site annually, and 350 workers to and from the airport for each two week work rotation.

By building the bypass road, use of municipal roads by AEM will be kept to a minimum. The bypass road will be approximately 5.1 km long and will require about 100,000 m<sup>3</sup> of road building materials. Rock quarry R19 shown on Figure 1-1 is exhausted with no further material available to be extracted. For road building materials, either a new quarry will be established or rock purchased from the hamlet's quarry. AEM will purchase the required granular material from the hamlet. The hamlet maintains a borrow pit northwest of the Char River bridge as shown on Figure 1-1. No new borrow pit will be established in building the bypass road.

The laydown yard at Itivia harbour will cover 14 ha. Leveling the pad will require about 21,000 m<sup>3</sup> of quarry and/or borrow pit material. Sources of materials will be the same as for the bypass road.

<sup>3</sup> Considerations include distance from the road, hauling distances, volume of road building material available, proximity to receiving waters, ARD/ML potential, archaeological resources in the immediate vicinity, wildlife and territorial park concerns - all with the goal of minimizing potential effects to the environment.

### **1.2.4 Traditional ATV and Ski-doo Trails**

The building of roads and the mine infrastructure at Itivia will impact existing ATV and ski-doo trails. Where these trails cross a road, a ramp will be constructed to ease road crossing, and signage will be installed to alert road users of the crossing. Similarly, there will be a sign alerting ATVs and ski-doods that they are approaching a road. Maintenance of the roads would see no snow placed on the trails.

In accommodating existing trails rather than building new ones, the area impacted will be minimized. The ramps leading up to the road will be small and require little road building material.

The present ski-doo trail crossing near Itivia harbour will be moved to the east of the laydown yard.

### **1.3 Quarry and Borrow Pit Extraction Methods**

Quarry operations will use explosives. The design, size and shape of the blasts are planned with safety being the foremost consideration. A predetermined pattern of drill holes are drilled to a depth not exceeding the overall depth of the quarry and filled with explosives. Prior to a blast, all personnel and equipment are moved to a safe distance from the blast area. The blast fragments the rock, is then loaded into haul or dump trucks using either a loader or an hydraulic shovel. The truck drives to the end of the road (or other construction area) where the rock is dumped. The final step is putting the rock into place which is done using a dozer. This sequence is called a “drill, blast, load, haul, dump” sequence.

Some rock can be moved to a crusher to produce aggregate of various sizes. The crusher is normally located as far from water as possible and where it is best shielded from the prevailing wind, preferably behind a high wall in the quarry so as to reduce the quantity of wind-blown dust and have as much dust as possible fall within the bounds of the quarry.

Wherever possible, borrow pit material will be ripped using a dozer. This loosens the material and allows it to be picked up using a loader or an hydraulic shovel. Standard drill and blast procedures can be used in instances where ripping is not possible. The sequence of steps under this circumstance follows that for rock quarries.

### **1.4 Related Documents**

Environmental Impact Statement (EIS) documents that provided input to the Borrow Pits and Quarries Management Plan include the following:

- Air Quality Monitoring Plan (SD 5-1);
- Explosives Management Plan (SD 2-14);
- Occupational Health and Safety Plan (SD 9-6);
- Mine Closure and Reclamation Plan (SD 2-17);
- Roads Management Plan (SD 2-9); and
- Surface Water Management Plan (SD 2-6).



The Borrow Pits and Quarries Management Plan is part of the Environmental Management and Protection Plan (SD 2-5) for the Meliadine Project.

### 1.5 Regulatory Setting

The Meliadine Project is located on Inuit Owned Lands, with some components located within the municipality of Rankin Inlet. This includes all borrow pits and quarries that will be exclusively used to obtain material to build and maintain the AWAR during construction, operations and closure. Storage, laydown and service pads, service and haul roads, and dikes will be constructed as much as possible using waste rock and overburden obtained in stripping the open pits.

Although federal requirements do not apply, the *Northern Land Use Guidelines, Pits and Quarries* prepared by Aboriginal Affairs and Northern Development Canada (AANDC 2008) provides useful guidance in establishing and operating borrow pits and quarries in an Arctic setting.

Borrow pits and rock quarries on IOL require a commercial lease and quarry permit issued by the KIA. Quarry permits from the KIA include terms and conditions specifying how operations are to be conducted. Quarry permits on municipal land are administered by the Government of Nunavut (GN) Department of Community and Government Services (CGS) on behalf of the hamlet of Rankin Inlet. When the hamlet council pass a resolution approving the quarry and/or borrow pit, the permit is issued by CGS.

The Department of Culture, Language, Elders and Youth (CLEY) administers the archaeology permitting process for Nunavut. Archaeological surveys are undertaken in advance of borrow pit and quarry selection to ensure all archaeological sites are identified and avoided if possible. If the sites cannot be avoided, they are mitigated with the approval of CLEY.

The Nunavut *Wildlife Act and Regulations* will apply as raptors nesting close to the AWAR and quarries/borrow pits may be disturbed or raptors may nest in the quarries and/or borrow pits upon the completion of road construction. Land animals may also be disturbed by the quarrying activities.

The quarries and possibly the borrow pits in some instances will require the use of explosives. The activities will have to comply with the *Explosive Use Act and Regulations*, and the *Mine Health and Safety Act and Regulations*. The latter is administered by the Worker's Safety and Compensation Commission.

A Class B Water Licence will be required under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and associated water regulations. The federal *Fisheries Act* will apply if runoff water containing deleterious substances flow from the quarries/borrow pits into fish bearing waters.

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## SECTION 2 • QUARRIES AND BORROW PITS MITIGATION MEASURES

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The ranking of mitigation options is as follows:

- **Avoidance** – using an alternate site or technology to avoid the adverse effect all together. This is the most desirable;
- **Minimization** – taking actions to minimize and/or contain effects to the maximum extent possible during engineering design, construction, operation and closure;
- **Rectification** – taking actions to rehabilitate or restore the affected environment after the fact; and
- **Compensation** – this is used as a last resort to offset adverse environmental effects. This is the least desirable.

*Source: Meliadine Project Environmental Management and Protection Plan (SD 2-5)*

Best management practices will employ the following general mitigation measures for the quarries and borrow pits:

- Minimize the surface area of quarries and borrow pits where possible;
- Minimize rock and borrow pit cuts where possible;
- Maintain the floor of the quarries and borrow pits slightly above the elevation of the surrounding area to promote drainage, to avoid creating quarry lakes, and to prevent permafrost degradation in borrow pits;
- Prevent erosion and sedimentation through appropriate control measures;
- Carry out ARD/ML testing and water quality monitoring in support of mitigation measures;
- Protect archeological resources;
- Maintain air, water and sediment quality through dust control/suppression; and
- Use progressive reclamation in closing quarries and borrow pits no longer needed.

### 2.1 Acid Rock Drainage and Metal Leaching

Initial testing of potential quarry and borrow pit materials was completed in 2010 (Golder Associates 2010). Static methods were used to assess the chemical composition of the potential building material, its potential to generate acid rock drainage (ARD), and its potential to leach metals into the receiving environment upon exposure to ambient conditions.

Sampling and testing prior to use of any quarry or borrow pit significantly reduced the risk of ARD/ML. The quarries and borrow pits selected for road building materials showed no potential to generate acid drainage due to the high buffering capacity and low sulphide content in the bedrock and glacial-fluvial deposits. In early testing, some potential quarries/borrow pits were rejected due

to potential metal leaching (Golder Associates 2010). Avoiding the use of undesirable or questionable road building materials ranks this mitigation measure as highly desirable.

Additional measures are being used while the quarries and borrow pits are operational. Visual examinations of the quarry material for sulphur species and additional testing for ARD/ML will be conducted during construction of the roads. As recommended by Price (2009), for every 10,000 m<sup>3</sup> of material removed from a borrow pit or rock quarry, a sample will be collected for static testing (ARD/ML), this will include samples of wall rock (AEM 2012). If ARD/ML materials were to be found, the area will be covered with a minimum two metre thick layer of non-acid generating borrow material to encapsulate it below the active layer.

The additional testing will confirm that the best available road building materials are being used in constructing the road.

The same procedures will be used should any new quarry and/or borrow pit be developed.

## 2.2 Management of Water Originating from Quarries and Borrow Pits

While ARD/ML testing is a measure to avoid using questionable road building materials, water quality monitoring of seeps from quarries and borrow pits provides information on possible impacts on the environment (e.g, water and sediment quality) should the water reach any nearby water bodies. A buffer of at least 100 m of undisturbed land is maintained between quarries/borrow pits and water bodies, and best management practices will prevent direct drainage. However, any significant seeps originating from the borrow pits or rock quarries likely to reach receiving waters will be sampled and analysed for a full suite of water quality parameters<sup>4</sup>. Any problematic water will be directed away from water bodies, or held if possible. If necessary, silt curtains will be used to control suspended sediments in water seeping from the quarries/borrow pits.

Although erosion is not expected to originate from water flow from quarries/borrow pits, any evidence of erosion will be repaired by placing rip-rap over the affected area, and measures will be taken to reduce the velocity of the water with, for example, silt curtains and/or small dikes.

## 2.3 Archaeological Resources

Quarries and borrow pits were selected to avoid archaeological resources. Archaeological surveys were completed along the AWAR alignment, its buffer zone, over the footprint of selected quarries and borrow pits, and the immediate area. The archaeological site identified at borrow pit B11A will be protected. This borrow area is large in extent allowing AEM to develop the borrow pit without

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<sup>4</sup> Physical Parameters: pH (field and laboratory), temperature (field), alkalinity, bicarbonate, carbonate, electrical conductivity, hardness, hydroxide, ion balance, total dissolved solids, total suspended sediments

Nutrients: NH<sub>4</sub>, NO<sub>3</sub>, NO<sub>2</sub>, PO<sub>4</sub>

Major Ions: Ca, Cl, Mg, K, Na, SO<sub>4</sub>

Trace Metals: Al, Sb, As, Ba, Be, B, Cd, Cr, Cu, Fe, Pb, Li, Mn, Hg, Mo, Ni, Se, Ag, Sr, Sn, Ti, U, V, Zn

disturbing this site. There were sites identified at borrow pit B12 and quarry R14 that could not realistically be avoided and these were mitigated under a permit issued by CLEY to AEM.

If any potential archaeological site is identified during the operation of any quarry/borrow pit, work will stop, a professional archaeologist will be consulted, and CLEY will be informed of the discovery.

All road construction equipment will remain within the boundaries of the quarries/borrow pits to ensure any nearby archaeological site is not inadvertently damaged.

Before any new quarry/borrow pit is selected, it will be surveyed for archaeological resources by a professional archaeologist registered in Nunavut. Sites with archaeological resources present will not be selected if there is a similar site devoid of archaeological resources nearby.

## **2.4 Iqaluqaarjuup Nunanga Territorial Park**

Quarries and borrow pits will not be developed in or near the Territorial Park. Rock quarry R19 and borrow pit B15 (Figure 1-1) are the closest to the Territorial Park, and both are more than one kilometre from the Park boundary. All personnel working in the quarries/borrow pits and on the AWAR will not enter the Park during work hours. Noise from construction vehicles will be minimized as part of best management practices by ensuring noise control equipments installed on the vehicles are maintained and operating according to specifications.

Noise related to quarry/borrow pit operations will be of short duration and should be restricted primarily to the construction phase. While noise can be expected to be heard in a 5-km radius, the majority of the noise should be within one kilometre of the activities. The noise should not extend far into Iqaluqaarjuup Nunanga Territorial Park. A noise monitoring program is to be carried out to confirm noise predictions.

The prevailing wind direction at Rankin Inlet is from the north-northwest. This prevailing wind direction is consistent for all months of the year and would tend to blow dust from the road and quarry/borrow pit away from the Park. All wind directions that could carry dust towards the Park occur on average 25 to 35 % of the time. A dust monitoring program between the road and the Park is carried out.

## **2.5 Dust Control**

Dust will be generated as part of quarry/borrow pit operations and will be restricted primarily to the Phase 2 AWAR construction phase when dust levels should peak. To limit the creation of dust, any crusher will be located where it is best shielded from the prevailing wind, preferably behind a high wall in the quarry. That way, the quantity of wind-blown dust should be reduced, and most of the dust should fall within the bounds of the quarry.

Transport of material from the quarries/borrow pits will be subject to speed limit restrictions to help reduce dust.



Dust monitoring will occur after completion of the AWAR and at a time when the quarries/borrow pits will be inactive. The monitoring will occur between the AWAR and the Territorial Park.

## **2.6 Ground Ice and Permafrost Protection**

The borrow pits<sup>5</sup> sites selected are from glaciofluvial deposits and weathered bedrock deposits located in well-drained areas. All have positive topography rising above the local setting. These types of granular deposits were selected because they are largely free of ground ice, thereby minimizing possible thaw settlement and melting ground ice, which can result in erosion, slumping of side slopes, and an altered landscape that extends beyond the borrow pit. 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 reclamation effort would allow the permafrost to move up into the material covering the area and stop any remaining ground ice from melting. Inspections of quarries/borrow pits will continue after their closure at the end of construction.

Any significant seeps originating from the borrow pits as a result of ground ice, permafrost melting, or from precipitation events will be monitored if the water is likely to reach receiving waters<sup>6</sup>.

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<sup>5</sup> Quarry sites are expected to be free of ground ice and should not release any water should the permafrost melt.

<sup>6</sup> Shallow, standing water will not be collected as it poses little risk to the receiving environment.

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**SECTION 3 • PROGRESSIVE RECLAMATION STRATEGY**

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

A practical, cost-effective approach will be central to the closure and reclamation of the borrow pits and quarries. The intent is to pursue progressive reclamation to return areas to natural conditions and avoid long-term care and maintenance requirements. Most quarries and borrow pits will no longer be needed following the completion of road construction<sup>7</sup>. Using best management practices, borrow pits and quarries will be reclaimed by stabilizing disturbed land surfaces which will promote natural re-vegetation.

The reclaimed quarries and borrow pits will have gently sloping walls and positive drainage wherever possible. With prudent initial design, the quarries/borrow pits should require little reclamation. Loose wall rock will be pulled to the floor of the quarry, and the entrance blocked with large boulders. For the interim until the quarries and borrow pits are reclaimed, rock berms are to be placed 10 m from the edge of the quarry and above any exposed high walls that are more than 2 m in height where there is a risk of an ATV or snowmobile accidentally going over the edge.

Should acid-generating bedrock be exposed in borrow pit/quarry, these areas will be covered with a minimum of a 2-m thick layer of non-acid generating soil or rock. Water will be directed away from the area.

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<sup>7</sup> A small number will remain active to store and/or supply crushed rock and/or granular material for ongoing road maintenance.

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