Kiggavik Project
Environmental Impact Statement

Tier 3 Technical Appendix 2M:
Road Management Plan

September 2014

History of Revisions

Revision Number	Date	Details of Revisions
01	December 2011	Initial release Draft Environmental Impact Statement (DEIS)
02	September 2014	FINAL Environmental Impact Statement

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Attachments

Abbreviations

ARD ..... Acid rock drainage

AREVA.....AREVA Resources Canada Inc.

DFO .....Fisheries and Oceans Canada

EIS ..... Environmental Impact Statement

GN ..... Government of Nunavut

ML..... Metals leaching

SHEQ..... Safety, Health, Environment and Quality

the Plan..... Road Management Plan

the Project..... Kiggavik Project

VEC ..... Valued Environmental Component

VSEC .....Valued Socio-Economic Components

ATV..... All Terrain Vehicle

1 Introduction

1.1 Purpose

This document is a Technical Appendix to Volume 2, Project Description, of the Kiggavik Environmental Impact Statement (EIS) and includes the preliminary Road Management Plan (Plan) for the Project. Variations of this Plan will be in effect during the construction, operation, and decommissioning phases of the Kiggavik Project. The Plan is intended to apply to the Kiggavik Project located approximately 80 km west of Baker Lake, Nunavut.

The Kiggavik Project requires that the majority of fuel, reagents and supplies required for yearly operations be transported from Baker Lake to the Kiggavik site for the operating life of the mine. In addition to this annual re-supply, the building materials and construction/mining equipment required to operate the site will also need to be transported in the same manner.

The proposed Kiggavik Project road network consists of the following:

- Service roads around the Baker Lake port and dock facilities;
- A winter road between the Baker Lake facilities and the Kiggavik site. Uncertainty surrounding the annual variability in climate conditions combined with the potential effects of climate change over the life of the mine suggests that it is prudent to also include an all-season road option for a full assessment in case the winter road cannot adequately support the Project through to decommissioning and closure.
- Site service roads around the Kiggavik and Sissons mine facilities, including the Kiggavik-Sissons haul road.
- Roads in the open pit mines

1.2 Regulatory Framework

The remote location of the Project necessitates construction of new access roads from Baker Lake to the site in order to transport materials and supplies. Minimizing the effects of road construction on waterbodies and tributaries, wildlife interactions, sensitive ecosystems, and traditional lands is foremost. Minimization of these effects and mitigation of unavoidable effects is necessary for sustainable development at the Kiggavik Project.

The mine road design criteria have been determined using the Mine Health and Safety Act, Northwest Territories and Nunavut (GN 1994). The act indicates that the minimum haul road width be

three times the maximum width of the largest haul truck and safety berms of at least three-quarters the height of the haul truck tire are required if the embankment is greater than 3 m high.

1.3 AREVA Road Policy

For safety reasons, use of service roads around the dock at Baker Lake and mine sites, including the Kiggavik to Sissons haul road will be restricted to AREVA employees and contractors, and will not be available for public use. The winter road and the potential all-season road will also be restricted; however, due to the limited availability of roads in the Baker Lake region, residents of the local community may request to use the road. Prior to road construction, policies on access to the Baker Lake to Kiggavik road will be developed in consultation with the community of Baker Lake and the Baker Lake Hunters and Trappers Organization and will be communicated to the community of Baker Lake.

1.4 Relationship to Other Management Plans

Other Tier 3 Technical Appendices related to this plan include:

- Kiggavik Sissons Access Road – Technical Appendix 2G
- Winter Road Report – Technical Appendix 2K
- All-Season Road Report – Technical Appendix 2L
- Borrow Pit and Quarry Management Plan – Technical Appendix 2N
- Environmental Management Plan – Technical Appendix 2T
- Air Quality Monitoring and Mitigation Plan – Technical Appendix 4C
- Noise Abatement Plan – Technical Appendix 4F Aquatic Effects Monitoring Plan – Technical Appendix 5M
- Wildlife Mitigation and Monitoring – Technical Appendix 6D
- Spill Contingency and Landfarm Management Plan – Technical Appendix 10B

1.5 Mitigation and Monitoring

Mitigation can be design- or management- based. AREVA's iterative approach to design and environmental assessment allows opportunities for design-based mitigation. Management-based mitigation can further reduce or eliminate project-environment interactions.

Monitoring of the Project and environment will occur to ensure design and management mitigation measures are functioning as intended. Monitoring results will be compared to predicted performance. A continual improvement and adaptive management approach will be implemented to ensure that predicted performance is achieved.

A summary of mitigation and monitoring commitments regarding the roads are discussed in the following sub sections. Mitigation and monitoring of roads will adhere to AREVA's Environmental Protection Framework as detailed in the Environmental Management Plan, Technical Appendix 2T. This iterative process will ensure continual improvement of the Road Management Plan from the current conceptual stage to, and throughout the Project life. Further details of mitigation measures can be found in the following sections of this plan.

1.5.1 Mitigation by Design

Specific design features of facilities are intended to mitigate potential environmental, health and safety effects. The main mitigation measures by design regarding roads outlined in this plan include (Tier 3, Technical Appendix 2K; Tier 3 Technical Appendix 2L):

- The roads have been designed to facilitate wildlife crossing.
- The roads have been designed to minimize the potential for ground ice melting, erosion, and ponding of water.
- The roads have been designed to avoid disturbance of archaeological sites (e.g. alignment adjustments or in compliance with the archaeological management plan).
- The preferred option for the road from Baker Lake to the Kiggavik site is a winter road, utilizing over-ice distance to reduce potential dust generation.

1.5.2 Mitigation by Management

Management of the Project will be conducted in a manner to mitigate environmental, health and safety effects. This often includes the use, enforcement, and revision of procedures. Mitigation by management considerations include:

- Road construction will be scheduled to minimize effects on the receiving environment.
- Speed limits for the roads will be set and enforced for environmental protection and worker health and safety.
- Water required for flooding the winter road and/or Thelon ice bridge will follow Fisheries and Oceans Canada (DFO) procedures for water withdrawal from ice-covered lakes, specifically no more than 10% of the under-ice volume will be withdrawn during ice-covered season.
- Roads will be maintained on an as-needed basis for environmental protection, and worker health and safety.
- Dust suppression of mine site roads will be used as required to ensure environmental effects remain acceptable.

1.5.3 Monitoring

Monitoring of facilities, infrastructure and operations will be used to assess the accuracy of predictions and effectiveness of mitigation so that this knowledge can lead to adaptive management as required. Monitoring commitments include:

- Road conditions will be monitored as required to ensure worker health and safety, and environmental protection.
- Wildlife monitors will be employed with duties that will include consideration for wildlife presence on the road.
- The winter road will be monitored during use for structural integrity during the winter road operating season.
- Dust along the roads will be monitored as outlined in the Air Quality Monitoring Plan (Tier 3 Technical Appendix 4C).

1.6 Update of This Management Plan

The Road Management Plan is a living document and will be updated as required based on management reviews, incident investigations, regulatory changes, or other Project-related changes. The start of the construction phase will be a major milestone for the Project. The Road Management Plan will be updated with input from the road construction contractors to reflect the complexities of the construction phase. Detailed road use procedures such as winter road protocol will be created and employee training provided by the Safety, Health, Environment, and Quality (SHEQ) department.

2 Valued Environmental Components

The target valued environmental components (VECS) and valued socio-economic components (VSECS) considered in the writing of this plan are:

- water quality
- fish habitat
- terrestrial wildlife
- health and safety of employees
- cultural resources and heritage

3 Proposed Roads

Site roads constructed within the Kiggavik Project lease boundary will provide access between the mine operations and site facilities. For detailed information on the Kiggavik to Sissons road, refer to Tier 3 Technical Appendix 2G Kiggavik to Sissons Road Report. In addition to on-site haul roads, a site access road must be constructed between the Baker Lake dock facility and the Kiggavik Project site.

3.1 Access Road

There is currently a winter overland haul route between Baker Lake and the Kiggavik area that supplies the exploration site; however, construction and maintenance of a more substantial access road will be required. A number of road alternatives have been developed and assessed, including multiple all season road and winter road options (refer to Tier 3 Technical Appendix 2A for more detail).

AREVA is proposing the following two options:

- The preferred road option is a winter road from the north shore of Baker Lake
- An all-season road from the north shore of Baker Lake; including a cable ferry across the Thelon River is fully assessed as a secondary option. The all-season road would be constructed if the winter road is deemed insufficient to meet the logistical needs of the Project.

Details regarding the proposed access roads are included in the following reports: Tier 3 Technical Appendix 2G Kiggavik to Sissons Road Report, Technical Appendix 2L All Season Road Report and Technical Appendix 2K Winter Road Report.

3.1.1 Winter Road

The preferred option is a winter road originating from the north shore of Baker Lake. (Figure 3.1-1). The winter road follows a chain of lakes south of the Thelon River and crosses Baker Lake ice outside of the Thelon estuary far enough south-east of the community to maintain a 1 to 2 km buffer. The winter road will be used during the construction phase and the operational phase.

The winter access road will pass over ice for approximately 50% of the route. In order to protect the tundra from heavy traffic, a thin permanent pad of granular material may be placed on the overland parts of the route. Parts of the over-ice traverse are assumed to cross fish-bearing water bodies.

Rig matting may be used along the winter road in areas where soft spots occur on the road alignment and granular material is not practical to prevent damaging the underlying vegetation. The road would be re-constructed every year by clearing the overland portions and flooding the over-ice portions.

Winter road truck operations will be conducted on a 24 hours, 7 days/week basis. Trucks will travel essentially in pairs giving a heated back-up in case of engine failure. Groups of three trucks or more could also be considered with the lead driver responsible for the party. Proposed speed limits for the road are outlined in Section 5.2.

The rate of ice growth on a lake surface in winter and how long it is sustained into spring can be estimated using the "Winter Freezing Index" (WFI). A reasonable correlation was found between the winter air freezing index and available operating window for the Tibitt to Contwoyto Winter Road (TCWR) that is constructed each year from near Yellowknife northeast to Lac de Gras. The total WFI is significantly greater at Baker Lake than at Yellowknife, suggesting that a winter road at Baker Lake could open earlier and close later than the TCWR. The estimated operating period based on the WFI values would be about 110 days at Baker Lake compared to 75 days for the TCWR. However for winter road planning purposes, a more conservative 90-day operating window is considered for the Kiggavik Project to account for factors such as potential climate warming, blizzard conditions, high winds and drifting snow management. The traffic volume is estimated at an average of 37 round trips per day.

3.1.2 All Season Road

The proposed all season road alignment (Figure 3.1-2) has been located generally on higher ground. Proposed speed limits for the road are outlined in Section 5.2. The maximum width of the travelling surface will be 10 m at a maximum grade of 5%. The road would be operated for approximately 8 months per year. The traffic volume is estimated at an average of 14 round trips per day.

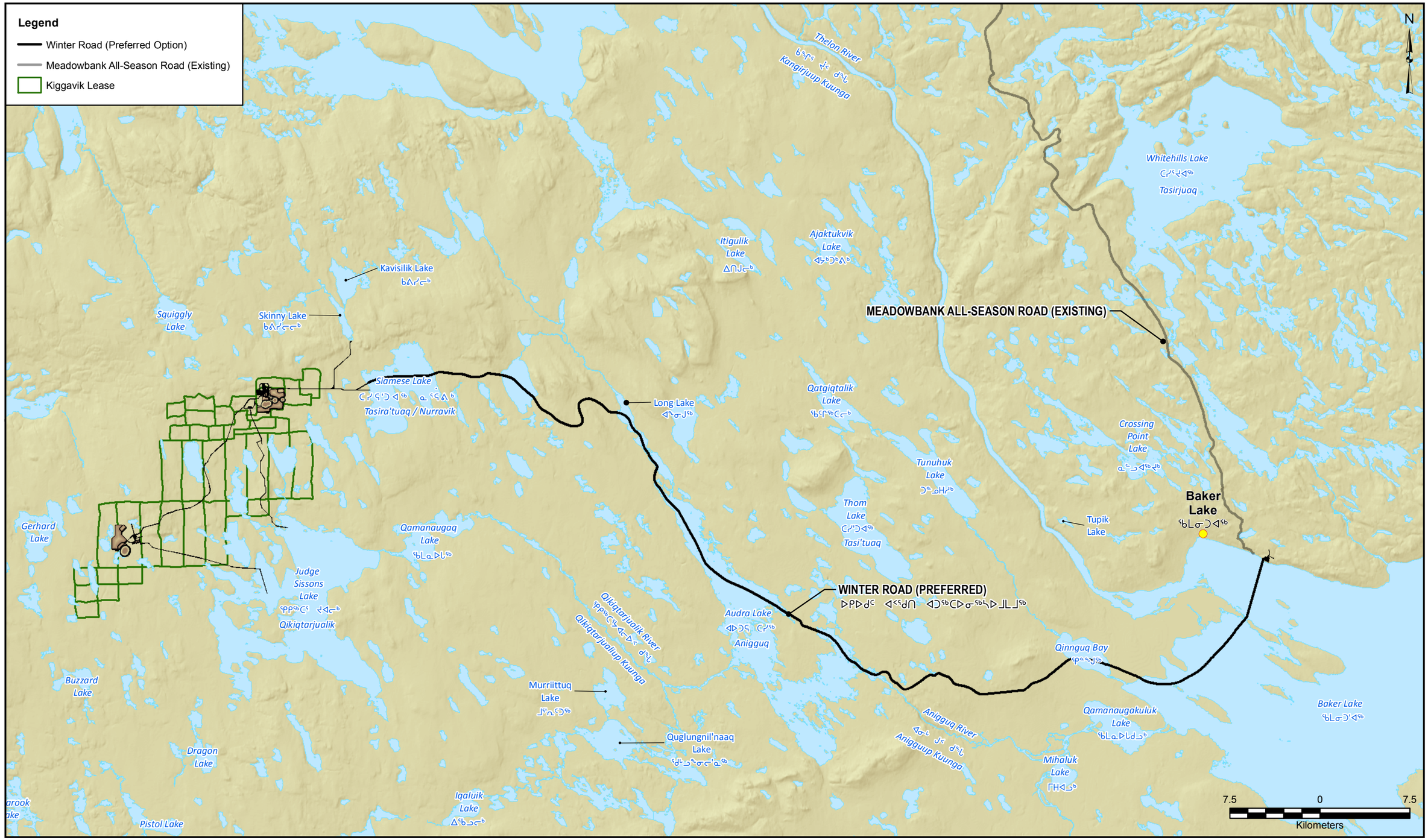
The all-season road will be constructed if the winter road is insufficient for meeting the logistical needs of the Project. Prior to potential construction of an all-season road, the need for the all-season road will be evaluated based on the following:

- A review of past performance of the winter road for meeting the logistical requirements of the operation;
- potential and available modifications to winter road management that may extend the operational window for the winter road;
- other potential operational adjustments that may allow the winter road access to remain adequate during operations;
- engagement with Baker Lake residents including the Baker Lake Hunter and Trapper Organization and surface rights administrators for right-of-way agreements;

- an evaluation of the most recent wildlife data would be conducted to validate and possibly refine FEIS effects predictions of an all-season road; and
- updated design and updated construction, operational, and decommissioning costs of an all-season road.

The proposed all season road is 114 km in length from the Baker Lake dock site to the Kiggavik site. There are three bridges (less than 50 meters in length) proposed along the route and one major river crossing (Thelon River). At the Thelon River crossing, it is proposed to use a cable ferry in the summer to cross the river. The proposed cable ferry will operate in the open water season. The river in this area does not carry any commercial traffic. The cable which operates the ferry lies on the river bottom after the ferry passes therefore small craft will be able to pass the crossing area without interference. The proposed location for the cable ferry crossing is presented in Figure 3.1-2. Please refer to Tier 3 Technical Appendix 9A Attachment D for further discussion on the Thelon River, Tier 2 Volume 2 Section 2.3.5.6 for discussion on navigable waters, and Volume 5 for the full aquatics assessment.

The remainder of the water crossings can be accommodated with culverts or rockfill. The road will be 10 meters wide, built with Run-of-Quarry (ROQ) rock embankment (fill). There will be no earth cuts along the alignment, and the only cut sections will be through rock, which will serve as quarry material. Material for the rock embankment and road surfacing will be derived from rock quarries developed along the road.



Projection: NAD 1983 UTM Zone 14N
Compiled:TL
Date:9/17/2014 Scale: 1:300,000
Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, AREVA Resources Canada Inc.*

FIGURE 3.1-1
PROPOSED WINTER ROAD

ENVIRONMENTAL IMAPACT STATEMENT
APPENDIX 2M

File: Q:\SHEQ\GIS\KIGGAVIK\2014\EIS\Volume 2 - Project Description\Volume 2 - Tier 3\Appendix 2M - Roads Management Plan\MXD\Figure 3.1-1 Proposed Winter Road.mxd

KIGGAVIK PROJECT

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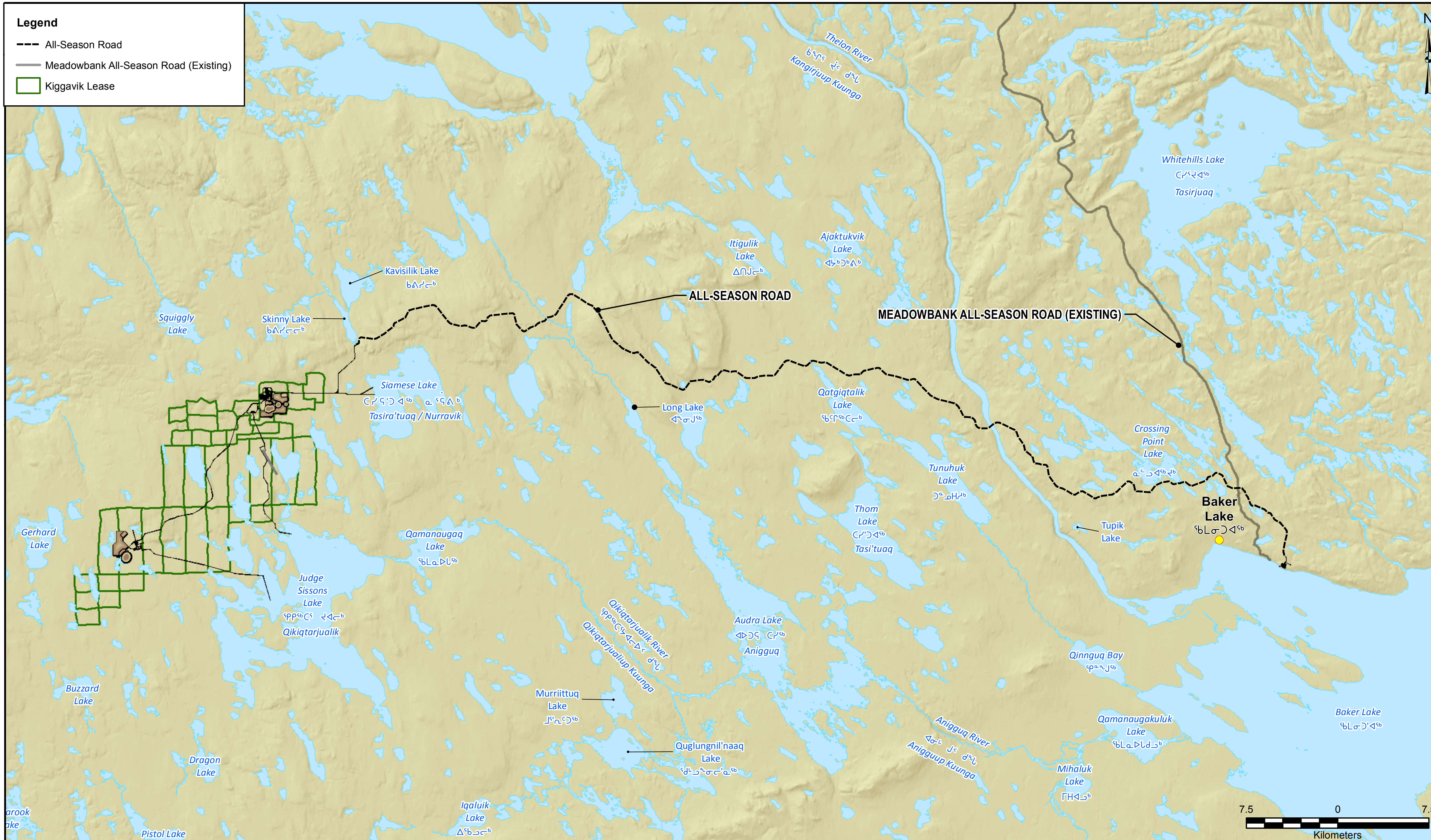

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Data Sources: *Natural Resources Canada, Geobase®, Nation Topographic Database, AREVA Resources Canada Inc.*

FIGURE 3.1-2
PROPOSED ALL-SEASON ROAD

ENVIRONMENTAL IMAPACT STATEMENT
APPENDIX 2M

KIGGAVIK PROJECT

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File: Q:\SHEQ\GIS\KIGGAVIK\2014\EIS\Volume 2 - Project Description\Volume 2 - Tier 3\Appendix 2M - Roads Management Plan\MXD\Figure 3.1-2 Proposed All Season Road.mxd

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3.2 Kiggavik Site Roads

A 19.6 km long site road is required to connect mining operations at the End Grid and Andrew Lake area (Sissons site) to the main mine and mill area (Kiggavik site) (Figure 3.2-1). Two bridges will be required along the route. There will be no earth cuts along the alignment, only rock cut sections. The road will be a 10 m wide road with a maximum grade of 5% built with run-of-quarry embankment material with safety berms where required. Proposed speed limits are outlined in Section 5.2. The site haul road is designed to accommodate the proposed ore haul tractor trailer units. These will consist of a hi-drive tractor with two custom designed B-train trailers. The 12-axle unit would be capable of hauling a payload of 120 tonnes. All vehicles will be equipped with radios. Traffic management on the haul route will be radio controlled with drivers calling in their positions when entering or departing the haul road. Kilometre markers will be installed along the route. These call-in procedures will be posted and communicated to all drivers during mandatory site orientation.

Figure 3.2-1 Kiggavik-Sissons Haul Road

4 Effects and Mitigation Measures

4.1 Road Construction

An all season road or winter road (some sections may require thin pad of granular material over frozen subgrade), and site roads would require cut and fill locations along road alignments and excavation of sand and gravel from borrow areas. These activities can result in a change in the ground thermal regime, as the active layer may be modified. Modification to the thermal regime can induce melting of ground ice present, resulting in thaw settlement and depressions and ultimately road hazards in areas that are more prone to erosion and ponding of water. Roads will be designed to minimize the potential for ground ice melting, erosion, and ponding of water and to enable rapid discharge of water through the road embankment via existing drainages and streams (e.g., by appropriately designed and constructed culverts). Road construction will be scheduled to minimize effects on the receiving environment.

4.1.1 Road Alignment

Unique landforms and archaeological sites have been identified in the proposed road corridor and the road alignments routed around these areas when possible. If new archaeological sites are discovered, these sites will be respected and management will be in accordance with regulation and the Archaeological Mitigation Plan (Tier 3 Technical Appendix 9D Archaeological Resource Management Plan). Where possible, the alignment of new roads will consider unique landforms, archaeological sites, sensitive wildlife areas, and areas of traditional use.

Some additional environmental surveys and engagement work is anticipated prior to construction of the road from Baker Lake to Kiggavik to inform the final alignment within the assessed and approved corridor. This work would be conducted close to construction, to remain relevant and useful in realizing any spatial or temporal avoidance to minimize disturbance.

4.1.2 Road Materials

The all-season road and site roads will be composed of granular rock. Quarries and borrow pits located at regular intervals along the proposed road alignment will be necessary for road construction and maintenance. The locations of 31 potential quarry sites along the proposed Baker Lake – Kiggavik and Sissons access roads were identified (see Tier 3 Technical Appendix 2G Kiggavik to Sissons Road Report and Technical Appendix 2L All Season Road Report). Refer to the Borrow Pits and Quarry Management Plan (Tier 3 Technical Appendix 2N) for detailed information on the construction methods and source of road course materials. Where practical, non-calcareous

materials from quarry sites will be used during road construction to reduce the amount of dust-prone aggregate used.

In general, quarries will be located at bedrock outcrops near to the road in order to minimize environmental disturbance. Roads will be surfaced likely with 19 to 25 mm crushed gravel produced from the quarried rock, placed in a layer approximately 300 mm thick. The risk of acid rock drainage (ARD) or metal leaching (ML) from quarried rock has been assessed for the proposed quarry locations. Analyses indicate the majority of borrow sites are not anticipated to have ARD or ML potential.

4.1.3 Stream Crossings

For the mitigation measures related to protection of surface water quality and fish habitat, refer to Tier 3 Technical Appendix 5M Aquatic Effects Monitoring Plan. Bridges and culverts will be required along the road to deal with surface runoff. The snow will be cleaned from the culverts in late winter to avoid blockage when the peak runoff occurs. Provisions will also be made for steaming the culvers to melt the ice. Where small bridges are required, if competent bedrock is not found at a shallow enough depth, the foundations for the bridges will be grouted rock socketed steel pipe piles to provide resistance to the frost heave forces as well as provide substantial load carrying capacity.

4.1.4 Thelon River Crossing

The all season road crosses the Thelon River (a 300-400 m crossing), and a cable ferry/ice bridge is proposed for the crossing.

A cable ferry is a simple flat bottom shallow draft barge type vessel with the bottom sloping upward at each end. A hydraulic operated hinged ramp is fitted at each end to facilitate loading and unloading of wheeled vehicles. They are configured for Roll on Roll off operation. Typically the ferry is operated by a crew of two persons. Emergency equipment includes an anchor, VHF radio, life rafts, rescue boat, and firefighting capability. The maximum load and speed of the cable ferry will be 105 tonnes and 8-10 km/h, respectively. On each trip, the ferry will be capable of transporting two trucks.

The cable ferry crossing location was chosen to minimize erosion. If required during construction, sediment ponds and/or silt fencing may be installed to mitigate the transportation of sediments. No additional transportation of sediments into the river is expected and the river bottom will not be disturbed by construction activities.

The cable ferry, if constructed and operated, would have no residual effect on the non-traditional land use of commercial harvest or significant residual effects in tourism (DEIS Tier 2, Volume 9, Socio-

Economics and Community, Part 1 Socio-Economic Environment, Sections 6.3.9 and 12.1; Please refer to Tier 3 Technical Appendix 9A Attachment D for further discussion on the Thelon River).

During the winter, an ice road will be constructed at the ferry crossing location. Ice thickness will be monitored to safely handle loaded trucks. A comprehensive management plan for the annual building, operation and maintenance of an ice road at Thelon crossing consistent with Best Practices will be developed, if the all-season road is constructed. Ploughing of the ice road will correspond to regular maintenance of the all season road.

Water required for flooding the ice bridge will be drawn from the Thelon River. Although the actual thickness of the ice bridge will be increased, this will not have an impact on the Thelon water flow. Upon melting the water removed from the Thelon will be naturally returned. DFO procedures for water withdrawal from ice-covered waterbodies in the Northwest Territories and Nunavut will be followed. Specifically, no more than 10% of the under-ice volume will be withdrawn during one ice covered season. The volume of water anticipated for use is negligible compared to the flow of water naturally occurring in the Thelon.

With regard to the Canadian Heritage River 1 km management area buffer as it applies to the all-season road, AREVA is committed to the application of the Archaeological Mitigation Plan (Technical Appendix 9D) during road construction.

4.1.5 Winter Road Construction

Prior to the start of construction activities for the winter road, actual ground temperatures will be monitored from installed ground temperature cables to ensure the ground is adequately frozen and will support construction activities associated with the winter road. Snow will be cleared from the route as early as possible to promote natural ice growth.

Water withdrawal may be required to increase ice thickness of the winter road. DFO procedures for water withdrawal from ice-covered waterbodies in the Northwest Territories and Nunavut will be followed. Specifically, no more than 10% of the under-ice volume will be withdrawn from a lake during one ice covered season.

4.2 Freshet Management and Spring Thaw

Extreme flows occurring during freshets can result in erosion and damage to road embankments, stream-crossing structures, and fish habitat. Fisheries and Oceans Canada (DFO) regulations and authorization where required, will be maintained. Several operating procedures have been developed to mitigate potential effects caused by freshets events and AREVA will work with Fisheries and Oceans Canada to approve a Fisheries Offsetting Plan during licensing (see Tier 3,

Technical Appendix 5L for the Conceptual Fisheries Offsetting Plan). Procedures relevant to the development and maintenance of an all-season road include:

- establishing/marking locations of all susceptible crossings
- clearing of snow from roads where culverts/crossings are located
- excavating downstream and upstream of creek crossing before the melt
- monitoring culverts for clearance of snow, ice, and debris
- where snow and ice blocks occur, ensure that the blocks are removed to ensure free flow of water
- monitoring crossing conditions regularly to ensure acceptable conditions for fish migration
- effecting repairs/modifications to crossing structures as required

4.3 Wildlife Interaction

Tier 3, Technical Appendix 6D Wildlife Mitigation and Monitoring Plan outlines detailed mitigation strategies regarding Project - wildlife interactions. The potential effects to wildlife along the proposed road alignments is expected to be low. Mitigation measures to reduce the likelihood of a barrier effect and reduced habitat effectiveness for caribou may include limiting truck traffic by travelling in convoys, and using snow management practices that will grade snow banks along the roadway so that caribou can more easily cross the transportation corridor.

The following recommendations from the Wildlife Mitigation and Monitoring Plan (Tier 3, Technical Appendix 6D) will apply to road management:

- All drivers will undergo informational and training sessions during orientation regarding the potential for wildlife/vehicle collisions.
- All roads will have posted speed limits to ensure that interactions between ungulates and vehicles can be avoided. Speed limits will be strictly enforced by the environmental supervisor and security personnel.
- Trucks will be equipped with radios so that drivers can alert each other of caribou and other wildlife approaching or crossing roads.
- Communicating presence and location of wildlife observed using radios to all personnel working in or transiting the area. Project personnel will be warned with signage and radio communication when wildlife are moving through the area.
- Road activity will be managed during migration movements of caribou and muskox, and temporary road shutdowns may occur. A “do not disturb the leader” guideline will be established regarding caribou movement.
- When animals are present on or moving/migrating across roads, they will be given the right-of-way.

- For all vehicle-wildlife collisions associated with the Project, a report will be completed. This information will be analyzed on an annual basis to determine whether changes to mitigation measures are warranted.
- Vehicle traffic will be restricted to approved site roads only (no off-roading by project vehicles).
- Effort will be made to enforce a no-hunting/shooting zone 1 km on either side of the Barker Lake to Kiggavik access road to reduce mine-related effects on wildlife in the area and to protect the safety of mine employees who use the road. Consultations will be held with Baker Lake residents to emphasize the importance of these measures, and with territorial and federal stakeholders as they relate to land use issues in the region. Signs will be posted alongside roads.
- Mine employees will not be permitted to carry firearms or hunt while at the mine site or in transit. Only authorized personnel will carry firearms for specific purposes.
- Road activity and blasting for road construction will be managed during wolf and bear denning season to minimize sensory disturbances during early denning period.
- Protocols will be established for relaying any important information about caribou and other wildlife to a central wildlife registry that contains information reported about wildlife. This will be administered by the environmental supervisor on site. The SHEQ supervisor will also be familiar with procedures in the event of a potentially dangerous or uncontrolled situation involving wildlife.

Wildlife mortality along roadways is expected to be minimal and likely limited to individual animals. A comprehensive list of management actions is contained in the Wildlife Mitigation and Monitoring Plan (Tier 3, Technical Appendix 6D).

4.4 Worker Health and Safety

Outside of mitigation measures required to prevent vehicle-wildlife interactions, additional mitigation measures are required to ensure the health and safety of personnel using the roads. Mitigation measures include the following:

- Driver training and enforcement of a driver code of conduct, to control speeds and encourage considerate driving.
- A preventative maintenance program and pre-operational checks will be implemented to reduce the likelihood of vehicle malfunction.
- The maximum loads of the trucks will be limited based on road design, road condition, and payload capacity.
- A minimum spacing of between vehicles hauling over ice crossings of 500m is required. No passing is allowed.
- Provisions will be made to handle poor winter weather driving issues such as whiteouts, snow drifting/clearing, and surface traction.

- To address the potential of winter whiteout conditions, there will be emergency shelters located along the Baker Lake - Kiggavik road with enough supplies for 10 days.
- Vehicle use will be restricted to approved areas (i.e. no off-roading).

4.5 Road Decommissioning

AREVA will work with the local community and the government to determine if there may be alternative uses for roads after operations cease; however, the current plan is to decommission all roads. Should there be any future use for the roads AREVA will co-operate with the party who is to become responsible such that they may acquire all appropriate approvals for the future use of the roads prior to completion of the decommissioning program by AREVA.

All roads for the Kiggavik Project will be decommissioned in the following manner:

- Culverts will be removed to re-establish natural flow paths and replaced with drive - through cross ditches, safe for snowmobile or ATV use in winter;
- Wildlife access will be provided at suitable intervals along the roads by regrading the embankment shoulders to flatter slopes;
- Radiological surveys of road surfaces will be conducted;
- All road berms that impede natural drainage flows will be breached at regular intervals;
- All ramps will be cross-ditched at no more than 30 metre intervals or removed where practical;
- All driving surfaces of travelways will be scarified to promote natural revegetation.

Additional information on road decommissioning is found in Tier 3, Technical Appendix 2R Preliminary Decommissioning Plan.

5 Roles and Responsibilities

5.1 Road Maintenance and Monitoring

Whenever unsafe conditions are identified (washout, severe rutting, weather), the roads will be closed until the issue is addressed. All trucks will be equipped with radios and drivers will be required to radio in to the mine controller if unsafe conditions are encountered.

The Kiggavik-Sissons haul road and all-season road will be regularly graded to prevent rutting (furrow creation) and to minimize the associated noise and vibration effects caused by a rutted or washboard road surface. The Kiggavik-Sissons haul road and all-season access road (if constructed) will be monitored for structural integrity and the requirement for or effectiveness of dust mitigation measures, as well as the effectiveness of culverts for allowing surface drainage while preventing soil scouring. Active borrow sites will be maintained to secure access to sand and gravel as required (see Tier 3, Technical Appendix 2N Borrow Pit and Quarry Management Plan).

During winter months, drifting snow is likely to accumulate in areas of the roads. Roads will be designed to minimize drifting snow on the road embankment. Snow fences may be a consideration in those areas of unavoidable accumulation to minimize these effects. Roads will be ploughed and maintained as necessary. Shelters will be situated at regular intervals along the roads in the event of a breakdown.

The road alignments have been sighted to follow elevated terrain where possible and drifting snow is expected to blow clear of the road, minimizing the requirement for snow storage areas. If required during operations, the selected location of snow storage areas will be no closer than 100m from designated archeological sites. During the winter months, roads in the open pit mines can become slippery. Roads will be sanded, as needed, to provide traction for heavy equipment working in the open pit mines.

The winter road will be monitored during use for structural integrity and repairs will be made as necessary. Repairs to the over ice portions will be conducted to maintain the road in a safe condition. Soft spots along the winter road will be identified and avoided by vehicular traffic. Rig matting may be used to mitigate any soft spots that may develop.

Dust will be generated from unpaved surfaces mainly during the summer season. High traffic roads such as the Kiggavik-Sissons haul road will be monitored for dustfall as outlined in Tier 3, Technical Appendix 4C, Atmospheric Monitoring and Mitigation Plan. Mitigation measures to reduce dust can include reducing vehicle speeds, regular road maintenance, and the application of water or an

approved chemical dust suppressant on mine site roads and where necessary. Additional details on dust suppression are provided in Attachment A of this Plan.

Proposed dust suppression will consist of spraying water from a tanker truck affixed with either a spray nozzle or spray bar. Approved dust suppressants will be used where dust suppression with water is not viable. Dust suppressants, if required, will be selected to minimize effects to the surrounding environment. Additional details regarding road dust mitigation measures are presented in Attachment A.

5.2 Speed Control and Signage

Speed limits for Project roads will be established and communicated to all Project personnel operating vehicles. Speed limits will be set for each road, and a single road may have different speed limits at different road segments. Speed limits will be developed for each road based on the following factors:

- Road design speeds
- Minimizing interactions between wildlife and vehicles
- Avoidance of excessive dust generation
- Reduced speed limits when hauling vehicles meet other hauling vehicles in opposite direction
- Ice thickness and truck payload for ice bridge and over-ice portions of winter road
- Road and weather conditions

Road signs will indicate hazards and blind road curves or intersections, radio frequencies, and radio call-in requirements. Markers positioned approximately each kilometer along the road will be used to identify position in case of emergencies, and reporting wildlife/non-Project visitor observations.

5.2.1 Speed Limits on Winter Road

The speed limits on the winter road will be established to prevent ice breakage and to protect wildlife. Speed limits may vary depending on weight of vehicle and cargo and ice thickness. Anticipated speed limits are as follows:

- Maximum vehicle speed is 30km/h to minimize wildlife/vehicle interactions
- Maximum vehicle speed for vehicles hauling at 100% of the load limit for the ice crossings: 25 km/h
- Maximum vehicle speed for hauling vehicles that meet another hauling vehicle going in opposite direction: 10 km/h;

Reduced speed limits may apply during periods of wildlife migration and/or adverse climatic conditions.

5.2.2 Speed Limits on All-Season Road

The speed limits on the potential future all-season access road will be set based on the final design of the road. The anticipated speed limit is the current design maximum speed of 70 km/h. Reduced speed limits will apply in areas where topography requires a reduced limit. Near the Kiggavik site and Baker Lake, reduced speed limits will apply as there is greater potential for conflict with other traffic. Reduced speed limits may apply during periods of wildlife migration and/or adverse climatic conditions.

5.2.3 Speed Limits on Kiggavik-Sissons Haul Road

The speed limits on the Kiggavik-Sissons haul road will be set based on the final design of the road. The anticipated speed limit is the current design maximum speed of 60km/h. Reduced speed limits may apply during periods of wildlife migration, and/or adverse climatic conditions.

5.3 Right of Way

Whenever possible, traffic will yield to wildlife encountered on roads. Pullouts will be constructed along the site roads. All traffic on-site will be radio controlled with drivers calling in their position using kilometer marker posts. Ore haul right of way procedures will be provided to all drivers upon site orientation.

5.4 Use of Road by the Public

Use of the Baker Lake to Kiggavik road by the public has been a topic of interest to Kivalliq residents (EN-CI NIRB May 2010[1]). Residents have expressed an interest in having access to the road for hunting and see no benefit to a road that cannot be used (EN-BL KIA Feb 2010[2], EN-BL NTI May

[1] EN-CI NIRB May 2010: *Concerns over the roads that would be built and accessibility. Would the roads be accessible to community members*

[2] EN-BL KIA Feb 2010: *Do not want a road like the one to Meadowbank because it would be useless, since the residents cannot use it.*

2007[3]). The use of the road by the public has to be balanced with maintaining a safe road for the haulage of fuel and cargo to the Project site.

AREVA anticipates the Baker Lake to Kiggavik road will be a controlled access road, and will be accessible to non-Project individuals (snowmobile, ATV) from Baker Lake. Residents have suggested that road access *should be discussed with the Baker Lake HTO and people* (EN-RI KWB Oct 2009). Road access was specifically discussed with the Baker Lake HTO in a workshop on November 2, 2011. Discussions included road management experiences by Baker Lake residents and the potential for the Baker Lake HTO to collaboratively manage public road access with AREVA should there be concerns with hunting along the access road. AREVA intends to manage potential public access to address safety concerns. Prior to road construction, policies on access to the Baker Lake to Kiggavik road will be developed in consultation with the community of Baker Lake and the Baker Lake HTO and will be communicated to the community of Baker Lake. Residents are interested in how far off the road they can hunt, and they want to maintain access to hunting trails. (EN-BL CLARC Apr 2013[4], EN-RI HS Nov 2013[5]). A no hunting/shooting buffer zone will be established within a specific distance from the road for safety.

Members of the public who use the Baker Lake to Kiggavik road will be required to follow the rules of the road (i.e. speed limits) and give right of way to Project vehicles. Extra care will be taken whenever non-Project individuals are sighted along these roads as they might not be aware of the hazards associated with Project activities and traffic. Sighting of non-Project personnel shall be reported by drivers and recorded by AREVA SHEQ personnel.

Site roads, including the Kiggavik to Sissons Haul Road, will not be accessible to the public.

[3] EN-BL NTI May 2007: *My husband and I were traveling on the land and we were told not to go on the Meadowbank road. Would AREVA do the same thing?*

[4] EN-BL CLARC Apr 2013: *How far no hunting on roads?*

[5] EN-RI HS Nov 2013: *Are local people going to be allowed to use the roads? Would you have to block hunting trails?*

6 Communication

All vehicles will be equipped with radios. Unsafe road conditions must be reported by drivers. To ensure safety and prevent accidents, drivers must radio their positions when departing or arriving at camps and when approaching blind curves or hills. These call-in locations will be posted and procedures will be communicated to vehicle operators during mandatory site orientation.

For the construction phase, a contractor will be responsible for road construction and maintenance. For the operation phase, AREVA's Maintenance Superintendent will be responsible for maintenance of roads and stream crossings.

Drivers will report unsafe road conditions to the road contractor, to their immediate supervisors, to others using the road that might be at risk, and to AREVA's Maintenance Department.

Sighting of wildlife and non-Project individuals will be reported to the SHEQ Superintendent, who will ensure the sightings are communicated to others and posted on appropriate logs. The logs will be managed by the SHEQ Superintendent or their designate.

Upon orientation at the Kiggavik site, SHEQ personnel will be responsible for ensuring operators are qualified to operate equipment. Vehicle operators will have the appropriate licenses. Only authorized Project personnel will be allowed to operate company vehicles (trucks, ATV's, snowmobiles).

7 Monitoring and Reporting Requirements

7.1 Road Maintenance

Roads and stream crossings will be inspected regularly for signs of degradation and maintenance requirements. The maintenance department will keep a registry of all road maintenance work.

7.2 Incidents and Accidents

Incidents and accidents will be reported to the Operations Manager who will communicate the incident to the SHEQ Superintendent. An investigation and report on the causes and corrective actions to prevent reoccurrence of the incident/accident will be conducted.

7.3 Use of Roads by Non-Project Individuals

The SHEQ Superintendent will maintain a registry of sightings locations and frequencies of non-Project-related individuals. This information is used to formulate policies and initiatives for Project road use by the public, and other related matters. The information is reported annually or more frequently (as requested) to government and stakeholders.

7.4 Wildlife Sighting

The SHEQ Superintendent will maintain a registry of wildlife sighting locations and frequencies. This information will be used to inform terrestrial wildlife studies and to formulate mitigation measures for wildlife protection, and will be included in annual (or more frequent) reports to government and stakeholders.

8 Adaptive Strategies

AREVA is committed to continuous improvement in its work activities with the aim of reducing risks to the environment and improving operational effectiveness. The strategy employed at AREVA is regular monitoring supported by operational change and adoption of other mitigation measures when warranted.

AREVA will conduct and document regular management reviews of this Plan. Such reviews will ensure monitoring results for the road management plan are integrated with other aspects of the Project and that necessary adjustments are implemented as required. These reviews also provide a formal mechanism to assess effectiveness of management in achieving company objectives and maintaining ongoing compliance with Project permits and authorizations.

9 References

Fisheries and Oceans Canada (DFO), (2002). Canada 's *Fisheries Act.* The Habitat Protection and Pollution Prevention Provisions of the *Fisheries Act.*

Government of Nunavut (GN), (1994). *Mine Health and Safety Act. Mine Health and Safety Regulations*. Iqaluit, NU.

Engagement References

BL CLARC (Baker Lake Community Lands and Resources Committee). April 2013. Notes from a project update meeting. April 26, 2013; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

BL KIA (Baker Lake – Kivalliq Inuit Association). February 2010. From “Results of the 2010 KIA Community Engagement Tour for the Proposed Kiggavik Project, Kivalliq Inuit Association April 2010”; in Technical Appendix 3A: Public Engagement Documentation, Part 12.

BL NTI (Baker Lake – Nunavut Tunnvavik Inc.). May 2007. From “Baker Lake Minutes, May 28, 2007, Nunavut Tunngavik Inc., Lands Policy Advisory Committee, Uranium Policy Meeting”; in Technical Appendix 3A: Public Engagement Documentation, Part 13.

CI NIRB (Chesterfield Inlet - Nunavut Impact Review Board). May 2010. From “Public Scoping Meetings Summary Report, April 25-May 10, 2010, for the NIRB’s Review of AREVA Resources Canada Inc.’s Kiggavik Project (NIRB File No. 09MN003)”; in Technical Appendix 3A: Public Engagement Documentation, Part 11.

RI HS (Rankin Inlet High School). November 2013. Notes from discussions at Rankin Inlet High School. November 20, 2013; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

RI KWB (Rankin Inlet- Kivalliq Wildlife Board). October 2009. Notes from questions asked about the AREVA Presentation, October 29, 2009; in Technical Appendix 3A: Public Engagement Documentation, Part 2.

Attachment A Attachment A – Alternative Road Dust Mitigation Measures

A.1 Summary

Dust has the potential to create environmental, health and safety, and operational concerns. Climatic factors such as extended periods of hot, dry and windy conditions can persist in the Project area during the summer months. These conditions can contribute to a breakdown of the bonding properties in a gravel roadbed surface due to a lack of moisture, thus generating airborne dust when heavily travelled. For the Kiggavik Project, the main method proposed to control dust is to increase the moisture content of unpaved road surfaces at the Kiggavik and Sissons mine sites. This method consists of spraying water from a tanker truck affixed with either a spray nozzle or spray bar. This dust suppression technique is a cost effective method widely used at mining operations in Arctic regions as well as at AREVA's McClean Lake Operation in northern Saskatchewan. This method is currently employed at the Diavik mine on the haul roads, site pads, and parking lots daily during the summer months (Wells 2012, pers. comm.).

When hot, dry conditions persist, dust mitigation by water suppression may not be adequate in certain high traffic areas, such as the Kiggavik-Sissons haul road. If water spraying is deemed insufficient in these areas, additional mitigation measures may be employed. These may include restricting vehicle speeds, increasing road maintenance, and/or applying an alternative dust suppressant.

The Government of Nunavut's (GN) Department of Sustainable Development provides a document related to road dust management, entitled Environmental Guideline for Dust Suppression (GN 2002). AREVA will refer to the approved road dust suppressants identified within this document if additional dust suppression methods are warranted. Discussion between AREVA, the GN, and stakeholders will occur to select an approved dust suppressant, as well as to determine mitigation strategies to alleviate any concerns pertaining to health and safety, and the environment, when applying an approved dust suppressant. AREVA's Safety, Health, Environment, and Quality (SHEQ) department will monitor dust suppressant application to ensure worker health and safety and protection of the environment is maintained.

A.2 Dust Control Measures

Controls for dust emissions from gravel roads can include:

- Reducing the numbers of vehicles travelling the road,

- Reducing vehicle speeds;
- Maintaining road surfaces and correcting road structural deficiencies;
- Increasing the moisture content of the road surface materials;
- Binding smaller particles to larger particles in road surface materials; and,
- Sealing gravel road surfaces with pavement or other durable materials.

For the Kiggavik Project, dust control measures will include implementing vehicle speed restrictions, optimizing or limiting the number of vehicles on certain road sections, routine maintenance of gravel road surfaces, and increasing roadbed moisture content by applying water when needed.

A.3 Increasing Moisture Content

Moisture in the surface soils of unpaved roads causes particles to adhere to each other through the surface tension of connecting water droplets and the adhesion of droplets to dust particles. The moisture content of surface soils can be increased through direct application of water to roadway surfaces or through the attraction of water to salts, such as calcium chloride or magnesium chloride, applied to roadway surfaces (Withycombe and Dulla 2006).

Watering provides short-term reductions in dust generation that depend on surface evaporation rates. Regular, light watering is more effective than less frequent, heavy watering (Withycombe and Dulla 2006). Calcium chloride and magnesium chloride absorb moisture from the air and have been proven effective at other mines in northern regions. Calcium chloride is an approved dust suppressant in Nunavut. Chlorides are discussed further in the following section.

A.4 Nunavut Approved Dust Suppressant Products

The long-term performance of any dust suppressant applied to a road surface depends upon many factors, including the type and gradation of the road materials, type and intensity of traffic loading, climate, type of dust suppressant, drainage and thermal stability, and maintenance schedule. These factors must be considered together in the proper maintenance of a road that will safely and cost-effectively resist dust generation (Withycombe and Dulla 2006).

Three products have been approved as dust suppressants in Nunavut according to the Environmental Guideline for Dust Suppression (2002). The approved products are Calcium Chloride, DL 10, and Bunker C. A comparison of these dust suppressant characteristics is provided in Table A1.1-1 which has been adopted from NRC 2005. Further details regarding these products are provided in the Environmental Guideline for Dust Suppression (GN 2002).

Table A.1-1 Comparison of Approved Dust Suppressant Characteristics in Nunavut (adopted from NRC 2005)

Type	Source	Functional Mechanism	Application	Performance Advantages	Performance Limitations	Environmental Considerations
Calcium Chloride	Three forms: flake, ▪ Type I, at 77% to 80% purity pellet ▪ Type II, at 94% to 97% purity. ▪ Clear liquid at 35% to 38% solids.	▪ Attracts and retains moisture at a relative humidity of 29% at 25°C and 20% humidity at 38°C. ▪ Assists compaction. ▪ Treated road can be regraded and recompacted with less concern for losing moisture and density.	▪ Usually one to two treatments per year. ▪ Initial application, flake: at 0.5 to 1.1 g/m^2. ▪ Typical application 0.9 kg/m^2 liquid: 35% to 38% solution at 0.9 to 1.6 l/m^2. ▪ Typical application is 38% concentrate applied at 1.6 l/m^2. ▪ Follow-up: apply 1/2 to 1/3 initial dosage.	▪ Retains moisture and attracts moisture from the air. ▪ Lowers freezing point of water minimizing frost heave and reducing freeze-thaw cycles. ▪ Increases compacted density of road material. ▪ Effectiveness retained after reblading.	▪ Slightly corrosive to metal, highly to aluminum and its alloys. ▪ Rainwater tends to leach out highly soluble chlorides. ▪ If high fines content in treated material, the surface may become slippery when wet.	▪ Repeated applications and long-term use may harm nearby vegetation and aquatic life if a buffer zone is not maintained. ▪ Water quality impact: generally negligible if the proper application and buffer used

Table A.1-1 Comparison of Approved Dust Suppressant Characteristics in Nunavut (adopted from NRC 2005)

Type	Source	Functional Mechanism	Application	Performance Advantages	Performance Limitations	Environmental Considerations
Bitumens, tars, and resins ▪ Emulsified asphalt (DL10) ▪ Residual fuel oil ▪ Technical white oils ▪ Fuel Oils (#4, #5 – Bunker B), (#6 - Bunker C)	Petroleum, coal, and plastics industry by-products.	▪ Asphalt and resinous products are adhesive. ▪ Petroleum oil products coat road surface particles, increasing their mass.	▪ Refer to manufacturers guidelines.	▪ Water insoluble when dry; provide a degree of surface waterproofing. ▪ Good residual effectiveness.	▪ Surface crusting, fracturing, and potholes may develop. ▪ Long-term application may cause road to become too hard for reblading. ▪ Will not prevent frost heave.	▪ Application of used oils is prohibited. ▪ Some petroleum-based products may contain polycyclic aromatic hydrocarbons (PAHs.)

Calcium chloride is a commonly used dust suppressant at other mine sites located in the Arctic (e.g., Giant mine near Yellowknife, NWT; the Red Dog mine in Alaska). Calcium chloride was found to be the most cost-effective product with the best performance for dust suppression at the Giant and Red Dog mines (Borden 2012, pers. comm., Clarke 2012, pers. comm.).

DL 10 is a dust suppressant currently used at the Ekati Diamond Mine, with the suppressant being applied on the Misery Haul Road and airstrip, as well as around the camp (Butler 2012, pers. comm.). The Ekati Diamond Mine has been using DL 10 as a dust suppressant for approximately five years and has observed significant reductions in fugitive road dust (Butler 2012, pers. comm.).

Bunker C was not mentioned as being used as a dust suppressant at any of the Arctic mine sites contacted.

A.5 Alternative Dust Suppression Techniques

Other dust suppressants not listed in the Environmental Guideline for Dust Suppression document (GN 2002) may also be considered. AREVA has experimented with a canola oil-based product at the McClean Lake Operation in northern Saskatchewan for dust suppression. The Meadowbank mine, operated by Agnico-Eagle near the community of Baker Lake, has considered using an alternative product called DUST-STOP which has recently been approved for use by the Government of Nunavut Department of Environment (AEM 2008). This product is an environmentally friendly solution for effective control and suppression of dust from unpaved roads.

Unpaved road stabilization methods are seeing more widespread application. One example is DusTreat, a product that utilizes an organic resin-based binder to seal and stabilize loose road surface materials. At a Suncor test site in Alberta's oilsands, DusTreat was applied to gravel surfaced haul roads and results showed a significant reduction in dust generation as well as reduced road maintenance requirements (Morgan 2014, personal comm.).

The relatively higher cost of these tailored products compared to traditional dust suppressant methods is potentially partially offset by lower direct operating costs (reduced grading, road watering, and related fuel consumption), reduced application frequency, lower freshwater usage, and improved safety and visibility (less potholes, washboard, and visible dust). DusTreat, DUST-STOP, and other similar products are typically non-toxic, biodegradeabe compounds that present minimal risk to environmental receptors.

If other dust suppressants not listed in the GN guideline are considered, AREVA will consult with the appropriate regulatory agencies for approval.

A.6 Dust Suppressant Application Environmental Considerations

During application of an approved dust suppressant, there is a potential for the suppressant to enter a waterbody or watercourse which may be detrimental to the aquatic environment in sufficient quantity. However, proper application techniques and implementation of mitigation measures during dust suppressant application can prevent this. For example, the Misery Haul Road at the Ekati diamond mine crosses numerous watercourses. Prior to dust suppressant application, buffer zones were identified to prevent DL 10 from either being sprayed or migrating into a watercourse or waterbody (Butler 2012, pers. comm.). Site-specific considerations such as road slope length and angle, weather conditions during application, and the type of dust suppressant product being applied (i.e., brine, dry granular substance, oil-based product) would be considered prior to application to prevent any waterbody/watercourse contamination crossed by the road surface being treated. During dust suppressant application, efforts can be made to apply the product in the middle of the

road surface while avoiding the shoulders of the road. The shoulders would act as a further buffer against migration of the product off of the road surface.

In the event of a dust suppressant (other than sprayed water) entering a waterbody/watercourse, AREVA will adhere to the spill response strategies identified in Tier 3, Technical Appendix 10B, Section 2, as well as the emergency response strategies identified in Tier 3, Technical Appendix 10C.

A.7 Air Quality Monitoring

A proposed road dust monitoring plan is described in Tier 3, Technical Appendix 4C Air Quality Monitoring and Mitigation Plan. Monitoring of road dust will consist of two dust monitoring areas along the Kiggavik-Sissons haul road with dustfall sampling conducted at distances from the road centreline corresponding to predicted dustfall gradients. Additional monitoring locations will be adopted for the all-season road option, if constructed. Dustfall monitoring results will be compared to atmospheric predictions and will be evaluated within the environmental protection framework outlined in Tier 3, Appendix 2T Environmental Management Plan.

A.8 References

AEM (Agnico-Eagle Mines Ltd. – Meadowbank Division). 2008. Dust suppression protocol.

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Butler, H. 2012. Senior Environment Advisor - Reclamation and Closure, EKATI Diamond Mine, Northwest Territories. Telephone conversation. October 12, 2012.

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Morgan, G. 2014. Senior Maintenance Co-ordinator, MacKay River Mine, Alberta. Telephone conversation. May 6, 2014.

NRC (National Research Council). 2005. Dust control for unpaved roads. National Guide to Sustainable Municipal Infrastructure, Federation of Canadian Municipalities, Canada. 42 pgs.

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