Kiggavik Project
Final Environmental Impact Statement

Tier 1 Appendix 1DII
Project Environment Interactions

September 2014

History of Revisions

Revision Number	Date	Details of Revisions
01	December 2011	Initial release Draft Environmental Impact Statement (DEIS)
02	April 2012	Revised DEIS – to address comments received from the Nunavut Impact Review Board as part of their conformity determination released on January 18, 2012
03	September 2014	FINAL Environmental Impact Statement

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1 Introduction

This document provides a summary of the Project components and activities that have the potential to interact with the environment and the socio-economic environment and result in a potential effect. These components and activities are identified during scoping. Scoping is a widely accepted best management practice in environmental assessment, and is used to determine the appropriate content and extent of issues to be addressed in detail in an Environmental Impact Statement. The approach is also consistent with the Nunavut Impact Review Board (NIRB) guideline Section 1.3: Preparation and Review of the Environmental Impact Statement, in which the NIRB states the "… expectation that the Proponent will focus its discussions on key issues, and will provide a level of detail appropriately weighted to the importance of the issue being analyzed" (NIRB 2011). Scoping lays the foundation for the assessment stage (i.e., effects prediction and evaluation) by providing a structured approach for identifying and prioritizing issues of importance.

Key elements of a comprehensive scoping process include:

- identification of the range of regulator, community and scientific concerns about the Project and its actions;
- evaluation of these concerns to identify potentially significant issues (and elimination of those issues that are not); and
- organization and prioritization of those issues to focus the information that is critical for decision making, and that will be studied in detail in the environmental assessment.

One of the key objectives of scoping is to ensure that the environmental assessment is focused on important issues and potentially significant effects that need to be assessed in detail. A commonly used tool to assist in the scoping process is an interaction matrix that links Project activities and key environmental components. Specifically, the interaction matrix is used to guide the following steps:

- identifying where interactions are likely to occur between the Project and the Valued Component (VC) during each Project phase (construction, operation and maintenance, final closure and decommissioning, post-closure) based on potential overlap in space and time;
- prioritizing each interaction according to the potential for an activity to cause an environmental effect; and
- justifying the rankings for those interactions that will not be assessed in detail in the assessment.

For the Kiggavik Project EIS, the rankings of Project-environment interactions were based on the following considerations to support a precautionary approach during the issues scoping process. The following criteria

were considered important in determining which project effects warranted a detailed evaluation in the assessment.

- Legal and Policy Criteria – Are there relevant policies stated in legislation, regulations and policy statements that need to be considered?
- Functional Criteria – How much an environment component or system is likely to change as a result of Project actions?
- Normative Criteria – What are the societal values placed on certain environmental features and qualities?
- Controversy – Is there any meaningful controversy surrounding the issue?
- Uncertainty – Is there a meaningful degree of uncertainty with respect to the environmental effect or the effectiveness of planned mitigation?

To address each of these criteria, and identify where potential interactions could occur based on likely spatial and temporal overlap during each Project phase, the assessor relied on the Project Description and Assessment Basis, as well as available information regarding the Valued Component (VC) (published and unpublished information sources, as well as field baseline studies), the effects literature, experience with similar northern mining projects and best professional judgment related to each VC . This was undertaken based on a thorough consideration of all issues identified through regulatory and stakeholder engagement. Consideration was also given to the expected effectiveness of planned mitigation, including both BMPs and mitigation by Project design. Where there was a meaningful degree of uncertainty related to the potential interactions, potential effects, or the effectiveness of planned mitigation, a precautionary approach was taken in assigning rankings to the Project-environment interaction to best support a detailed analysis of the potential environmental effect.

Through the scoping process, a number of potential interactions, potential effects and VCs were removed from further consideration, either because there is likely to be no interaction under normal operating conditions or no potential for substantive interaction between a Project activity and the VC that would cause a potential environmental effect. For consideration of events outside of normal operations such as spills or accidents, refer to Tier 2, Volume 10 (Accidents, Malfunctions and Effects of the Environment on the Project). In some cases, there is likely to be a potential interaction between a Project activity and a VC, but that interaction is not likely to be substantive in light of planned mitigation. In the latter case, such interactions are considered to be well understood, and mitigable with a high degree of certainty given proven technology and practices.

1.1 Project-Biophysical Environment Interactions

Potential biophysical environment-Project interactions are examined for all phases of the Project, including construction, operation, and decommissioning. Once all potential interactions between a VC and the Project are identified, the interactions are ranked.

Each Project interaction is ranked according to the potential for a given activity to cause an environmental effect. The interactions are ranked according to the following:

- If the interaction is removed by environmental design features and mitigation so that the Project results in no detectable (i.e., measureable) change and no residual effect on a VC relative to baseline or guideline values, the interaction is given a 0 (zero) classification. Because these interactions are removed through design and mitigation, an assessment of the environmental effect is not required, and the interaction is not considered further in the assessment. The environmental effects of these activities are thus, by definition, rated not significant.
- If there is likely to be an interaction between a Project activity and a VC that will result in a minor environmental change, but a negligible residual effect on a VC relative to baseline or guideline values in light of planned mitigation, the interaction is categorized as a 1 (one). Category 1 interactions are not expected to contribute to effects of other existing or reasonably foreseeable projects. These interactions are subject to a less detailed environmental effects assessment and are rated as not significant. Justification is provided and the mitigation is described for such categorizations. Such interactions can be mitigated with a high degree of certainty with proven technology and practices.
- If a potential interaction between a Project activity and a VC could result in a measurable environmental change that could contribute to significant residual effects on a VC relative to baseline or guideline values, despite the planned mitigation, the interaction is categorized as a 2 (two). Interactions may be given a 2 classification if there is less certainty regarding the effectiveness of mitigation, or if there is high concern from regulatory agencies, Inuit or stakeholders. These potential interactions are subject to more detailed analysis and consideration in the environmental assessment in order to predict, mitigate and evaluate the potential environmental effects.

The ranking takes a precautionary approach, whereby interactions with a meaningful degree of uncertainty are assigned a rank of 2 so that a detailed analysis of the potential environmental effect is undertaken.

Justification for ranking the Project -Biophysical environmental interactions considered for each VC is provided in the scoping section for each discipline. The interaction matrices, for biophysical environment-Project interactions, for each phase of the Project, are provided in Tables 1.1-1 to 1.1-3 below.

Table 1.1-1: Construction Interaction Matrix

		Atmospheric Environment				Terrestrial Environment							Aquatic Environment						Marine Environment								Human Health			
	Activities	Air Quality (including dust)	Noise	Vibration	Climate Change	Terrain	Soils	Vegetation	Terrestrial Wildlife and Habitat	Raptors and Habitat	Migratory Birds and Habitat	Species at Risk	Groundwater	Surface Hydrology	Water Quality	Sediment Quality	Aquatic Organisms and Fish Habitat	Fish Populations	Marine Mammals	Marine Fish	Marine Birds	Marine Benthic Invertebrates	Marine Vegetation	Marine Sediment Quality	Marine Water Quality	Marine Species at Risk	Worker Exposure to Hazardous Substances	Worker Exposure to Radioactivity	Exposure to Criteria Air Contaminants - Members of the Public	Exposure to Radioactivity and Other COPC - Members of the Public
Economic Activities	Construction Workforce Management (hiring and training) Contracts and Taxes Advance Training of Operations Workforce	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
In-Water Construction	Construct freshwater diversions and site drainage containment systems (dykes, berms, collection ponds)	1	1	1	1	2	2	2	0	0	2	0	0	1	1	1	2	1	0	0	0	0	0	0	0	0	1	0	0	0
	Construct in-water / shoreline structures (water intake and effluent diffuser structures and lines, spud barge dock, culverts)	1	2	1	1	1	2	2	0	0	2	0	0	1	1	1	2	1	0	0	0	0	0	0	0	0	1	0	0	1
	Water transfers and discharge	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	2	1	0	0	0	0	0	0	0	0	1	0	0	0
	Freshwater withdrawal	1	1	1	1	0	0	0	0	0	1	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
On-Land Construction	Site clearing and pad construction (blasting, earth-moving, loading, hauling, dumping, crushing)	2	2	2	1	2	2	2	2	2	2	2	0	2	1	1	2	1	0	0	0	0	0	0	0	0	1	0	1	0
	Construct foundations	2	2	2	1	2	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Construct buildings	2	2	2	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Install equipment	1	1	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Install and commission fuel tanks	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Mill dry commissioning (water only)	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Supporting Activities	Transport fuel and construction materials	2	2	2	1	0	2	2	2	2	2	2	0	0	0	0	1	0	2	2	1	1	1	1	1	1	1	0	1	0
	Air transport of personnel and supplies	1	2	1	1	0	0	1	2	1	2	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
	Hazardous materials storage and use	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Explosives storage and use	1	2	2	1	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Waste incineration and disposal	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Industrial machinery operation	2	2	2	1	0	2	2	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
	Power generation	2	2	2	1	0	2	2	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0

Table 1.1-2: Operations Interaction Matrix

		Atmospheric Environment				Terrestrial Environment							Aquatic Environment						Marine Environment								Human Health			
	Activities	Air Quality (including dust)	Noise	Vibration	Climate Change	Terrain	Soils	Vegetation	Terrestrial Wildlife and Habitat	Raptors and Habitat	Migratory Birds and Habitat	Species at Risk	Groundwater	Surface Hydrology	Water Quality	Sediment Quality	Aquatic Organisms and Fish Habitat	Fish Populations	Marine Mammals	Marine Fish	Marine Birds	Marine Benthic Invertebrates	Marine Vegetation	Marine Sediment Quality	Marine Water Quality	Marine Species at Risk	Worker Exposure to Hazardous Substances	Worker Exposure to Radioactivity	Exposure to Criteria Air Contaminants - Members of the Public	Exposure to Radioactivity and Other COPC - Members of the Public
Economic Activities	Workforce Management (hiring and training) Employment Contracts and Taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining	Mining ore (blasting, loading, hauling)	2	2	2	2	2	2	2	2	2	2	2	0	0	2	1	0	2	0	0	0	0	0	0	0	0	1	1	1	1
	Ore stockpiling	2	2	2	2	1	2	2	1	0	1	1	1	0	2	1	0	2	0	0	0	0	0	0	0	0	1	1	1	1
	Mining special waste (blasting, loading, hauling)	2	2	2	2	2	2	2	2	0	1	1	0	0	2	1	0	2	0	0	0	0	0	0	0	0	1	1	1	1
	Special waste stockpiling	2	2	2	2	1	2	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
	Mining clean waste (blasting, loading, hauling)	2	2	2	2	2	2	2	2	0	1	1	0	0	2	1	0	2	0	0	0	0	0	0	0	0	1	1	1	1
	Clean rock stockpiling	2	2	2	2	1	2	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
	Mine dewatering	0	2	1	0	0	0	1	0	0	0	0	2	2	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	Underground ventilation	2	2	1	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
	Backfill production and underground placement	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
Milling	Transfer ore to mill	2	2	2	2	0	2	2	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
	Crushing and grinding	2	2	2	0	0	2	2	2	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
	Leaching and U Recovery	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
	U purification	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
	Yellowcake drying and packaging	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
	Tailings neutralization	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
	Reagents Preparation and use	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0
Tailings Management	Pumping and placement of tailings slurry	0	2	1	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	Consolidation of tailings	0	2	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	Pumping of TMF supernatant	0	2	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	Create and maintain water levels	0	2	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Water Management	Freshwater withdrawl	0	2	1	0	0	0	0	0	0	0	0	1	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Potable water treatment	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Collection of site and stockpile drainage	0	1	1	0	0	0	0	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
	Water and sewage treatment	0	2	1	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1
	Discharge of treated effluents	0	1	1	0	0	0	0	0	0	0	0	1	2	2	2	2	2	0	0	0	0	0	0	0	0	0	1	0	1
Waste Management	Disposal of industrial waste	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Management of hazardous waste	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Management of raiologically contaminated waste	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	Disposal of domestic waste	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Incineration and handling of burnables	2	2	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
	Disposal of sewage sludge	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
General Services	Generation of power	2	2	1	2	0	2	2	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
	Operate accommodation complex	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Recreational activities	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Maintain vehicles and equipment	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Maintain infrastructure	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Operate airstrip	1	2	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hazardous materials storage and handling (reagents, fuel and hydrocarbons)	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
	Explosives storage and handling	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Transportation	Marine transportation	2	2	1	2	0	0	0	0	0	0	0	0	0	1	0	1	0	2	2	1	1	1	1	1	1	n/a	0	1	0
	Truck transportation	2	2	2	2	0	2	2	2	1	1	1	0	0	2	1	2	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	0	1	0
	General traffic (project-related)	2	2	1	2	0	1	1	1	1	1	1	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	Controlled public traffic	2	1	1	1	0	1	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Air transportation of personnel, goods and supplies	1	2	1	1	0	1	1	2	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Air transportation of yellowcake	1	2	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	General air transportation support	1	2	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-going Exploration	Aerial surveys	1	2	1	1	0	1	1	2	2	1	1	0	0	0	0	0	0									1	0	0	0
	Ground surveys	1	1	1	1	0	0	0	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Drilling	1	2	2	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0

Table 1.1-3: Decommissioning and Post Closure Interaction Matrix

		Atmospheric Environment				Terrestrial Environment							Aquatic Environment						Marine Environment								Human Health			
	Activities	Air Quality (including dust)	Noise	Vibration	Climate Change	Terrain	Soils	Vegetation	Terrestrial Wildlife and Habitat	Raptors and Habitat	Migratory Birds and Habitat	Species at Risk	Groundwater	Surface Hydrology	Water Quality	Sediment Quality	Aquatic Organisms and Fish Habitat	Fish Populations	Marine Mammals	Marine Fish	Marine Birds	Marine Benthic Invertebrates	Marine Vegetation	Marine Sediment Quality	Marine Water Quality	Marine Species at Risk	Worker Exposure to Hazardous Substances	Worker Exposure to Radioactivity	Exposure to Criteria Air Contaminants - Members of the Public	Exposure to Radioactivity and Other COPC - Members of the Public
General	Decommissioning Workforce Management (hiring and training) Contracts and Taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hazardous materials storage	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	Industrial machinery operation	2	1	1	2	0	2	2	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0
	Ongoing withdrawal, treatment and release of water, including domestic wastewater	0	0	0	0	0	0	0	0	0	1	0	0	2	2	2	2	2	0	0	0	0	0	0	0	0	1	1	0	0
In-Water Decommissioning	Remove freshwater diversions; re-establish natural drainage	1	1	1	1	1	1	1	0	0	0	0	1	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	Remove surface drainage containment	1	1	1	1	1	1	1	0	0	0	0	1	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	Remove in-water/shoreline structures	1	1	1	1	0	1	1	0	0	2	0	1	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	1
	Water transfers and discharge	1	1	1	1	2	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Construct fish habitat as per Fisheries Offset	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
On-Land Decommissioning	Remove site pads (blasting, earth-moving, loading, hauling, dumping)	1	1	1	1	2	2	2	1	0	1	1	1	0	1	1	2	0	0	0	0	0	0	0	0	0	1	1	1	1
	Backfilling	2	1	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
	Contouring	2	1	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
	Covering	2	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0
	Revegetation	1	1	1	1	1	0	0	2	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	Remove foundations	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	Remove buildings	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	Remove equipment	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	Remove fuel tanks	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
	Marine Transportation: loading barges, barging, off-loading (fuel, reagents and supplies), Baker Lake and Churchill/Chesterfield, back-haul	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2	2	1	1	1	1	1	1	n/a	n/a	0	0
	n/a- Not Applicable																													

The overall objective of the environmental assessment is to identify the potential residual environmental effects resulting from the Project and to determine the significance of such effects.

1.2 Project-Socio-Econmonic Interactions

The presentation of socio-economic interactions with the Project and consequent socio-economic effects is different from the presentation used for biophysical effects, for the following reasons.

- Although there are exceptions, socio-economic effects are largely in response to the totality of a project, to its location, scale and operational procedures, and not to its component parts. It is not helpful to attempt to look at the individual effects of water management systems, waste disposal or energy supply (as examples) on employment or levels of traditional activity. Socio-economic assessment more usefully considers responses to a project as a whole. Exceptions can be spatially distinct project components with unique effects such as, in the case of the Project, the access road options and the marine transportation route.
- The linkages between various potential socio-economic effects are interrelated in complex ways, and can be mutually reinforcing. They may also cascade. For example, in migration is itself an effect, but in turn may engender additional effects such as pressures on housing. In migration can also combine with increased incomes to result in public security challenges. Socio-economic effects are thus often in response to 'drivers of change', particular elements and combinations of elements of a project that may have more to do with, as an example, its operational policies and procedures than its built environment.
- Interactions between the biophysical environment and the socio-economic environment are considered in a number of ways. Results of biophysical assessments were incorporated into the socio-economic assessment. For example results of terrestrial wildlife and marine assessments were discussed in the assessment of effects on traditional culture (harvesting). Inherent in the assessment of effects on land use are activities related to the biophysical environment, such as camping, travel, harvesting, fishing, collecting eggs, berry picking etc. Refer to Tier 1, Appendix 1F for a discussion of how AREVA's understanding of local land use and relative importance can be used as a lens through which to evaluate significance determinations. Similar to the discussion in the previous bullet, the interplay between socio-economic and biophysical effects are complex. For instance, traditional culture and hunting is related to marine mammals and terrestrial wildlife and can also influence other socio-economic components such as health, income, values and knowledge. A framework for managing and monitoring risk perception (including for example, the need to assure community members that country food continues to be safe for consumption), is detailed in Tier 3, Technical Appendix 3C as part of AREVA's on-going community engagement.

- For many biophysical disciplines, there are substantive differences between construction and operations phase effects. However, most socio-economic effects occur on a continuum from the initiation of construction activity through operations. Many effects on individuals, families and communities are a result of the same processes (interactions) in both phases. For example, employment and its socio-economic effects will begin with the start of construction and continue through operations. Where construction and operations phase effects are clearly different in detail, these differences are noted in the assessments of effects in Volume 9, Sections 8 to 13, however in not all cases are effects of construction and operations discussed separately. Premature closure, final closure and post closure effects are quite distinct from those of construction and operations and are discussed separately, although they are in fact the result of many of the same interactions, operating in reverse.

Accordingly, Table 1.2-1, below, presents what are considered to be primary Project/socio-economic environment interactions and effects in terms of 'drivers of change', phenomena that can be expected to occur as a result of the Project and that have the potential to result in a significant change to a Valued Socio-Economic Component (VSEC). It is acknowledged that there are more interactions than the table includes – the interrelatedness of socio-economic conditions suggests that almost any driver of change can be conceived to have at least some consequent effect on almost any VSEC for at least some individuals. Table 1.2-1 thus indicates where the emphases are placed, on primary interactions and effects, in the socio-economic assessments in Tier 2, Volume 9, Part 1, Sections 8 to 13. This however is not to the exclusion of considering additional interactions and effects related to issues that have been raised during engagement and socio-economic and IQ data collection events.

Table 1.2-1: Primary Project/Socio-Economic Interactions and Effects

Major Socio-EconomicComponent	Community Economies						Traditional Culture					Individual, Family and Community Wellbeing						Public Infrastructure and Services					Non Traditional Land Use and Land Use Planning				Economy of Nunavut	
Primary Drivers of Potential Effects on Valued Socio-Economic Components	**Valued Socio-Economic Components**																										
	Employment	Education and Training	Contracting	Economic growth and diversification	Incomes	Population change	Harvesting	Food security	Language	Values and knowledge	Cultural sites	Health	Family function	Savings	Public security	Public health and safety	Social cohesion and participation	Social infrastructure and services	Policing	Housing	Other infrastructure and services	Institutional capacity and governance	Mining	Commercial harvesting	Tourism	Land use in Baker Lake	Economic effects	Fiscal effects
Project Policies and Procedures*																											
Employment	■	■		■	■	■	■	■	■	■		■	■	■	■		■	■	■	■	■	■				■	■	■
Education and training	■	■	■	■	■				■	■				■			■	■				■						
Contracting	■	■	■	■	■	■								■													■	■
Increased incomes				■	■		■	■				■	■	■	■		■	■	■	■	■					■	■	■
Migration	■			■		■									■		■	■	■	■	■					■		
Working conditions	■	■				■	■	■	■	■		■	■		■	■		■										
Rotational work	■					■	■	■	■	■		■	■		■		■	■	■									
Stakeholder engagement										■						■	■					■						
Community contributions										■							■	■			■							
IIBA	■	■	■		■		■	■	■	■	■	■	■			■	■	■			■	■					■	■
Environmental Effects*																											

Table 1.2-1: Primary Project/Socio-Economic Interactions and Effects

Major Socio-EconomicComponent	Community Economies						Traditional Culture					Individual, Family and Community Wellbeing						Public Infrastructure and Services					Non Traditional Land Use and Land Use Planning				Economy of Nunavut	
Project footprint							■	■			■					■					■		■		■	■			
Biophysical effects							■	■			■					■							■	■				
Traffic, ecological health and human health risks							■	■								■							■	■				
Project Components*																												
Winter road							■	■			■					■					■		■					
All-weather road							■	■			■					■					■		■	■	■		■	
Marine transportation							■	■			■					■					■		■	■	■		■	
Project Economics**																												
Project capital investment																											■	■
Project operations expenditures																											■	■
Project taxes and royalties	■		■	■	■													■			■	■					■	■
Closure***																												
Premature, final and post closure	■		■	■	■							■	■	■	■		■	■	■								■	■

Notes: Shaded boxes indicate primary interactions and effects; * interactions apply during both construction and operations; ** capital investment is primarily a construction phase effect while operations expenditures and taxes and royalties are primarily operations phase effects; *** closure effects include almost all of those in other rows, many operating in reverse

1.3 Project-Archaeological Resources Interactions

Heritage resources in the region generally occur on the ground surface or immediately below the surface with little to no vegetation cover. Archaeological sites in this environment can be easily disturbed by Project activities such as clearing and leveling of ground for the construction of roads, airstrips and buildings, and the removal of overburden and bedrock for pit and quarry excavation. Additional effects can be created by moving equipment, laydown areas and vehicular traffic on unmodified landscapes. Artifacts are typically small and made from stone, bone or wood. As a result, they can be very delicate. Further, artifact and feature context is vital to interpreting past activities and lifeways. Project activities can compress or remove soils and disturb surface features that can compromise the integrity of archaeological sites. Artifacts may be displaced, resulting in the loss of valuable contextual data, or artifacts and features may be destroyed, resulting in the complete loss of heritage information.

The Project has the potential to interact with archaeological resources during all phases; however, most of the interaction is expected to occur during the construction phase. Reduced interaction with archaeological resources would occur during the operation and decommissioning phases since the majority of these activities would occur in areas previously disturbed during the construction phase.

Based on the issues and concerns identified in the assessment, a number of Project activities have been identified with potential to interact with archaeological resources. A summary of relevant project activities and a description of the associated environmental interaction are included in Table 1.3-1. Project activities are ranked as 0, 1, or 2 according to the following descriptions:

- 0 No interaction
- 1 Interaction occurs; however, based on past experience and professional judgment, the resulting effect can be managed to acceptable levels through standard operating practices and/or through the application of best management or codified practices. No further assessment is warranted.
- 2 Interaction occurs, and resulting effect may exceed acceptable levels without implementation of specified mitigation. Further assessment is warranted.

Table 1.3-1: Project Environmental Interactions and Effects on Archaeological Resources

Phase	Activities	Study Area	Component	Potential Environmental Effects
Construction	Site clearing and pad construction, (blasting, earth moving, loading, hauling, dumping, crushing); construction of surface facilities (buildings, foundations, installation of fuel tanks and equipment)	Mine Site	Kiggavik and Sissons Pit	2
			Mill, powerhouse, mine shops, water treatment plants, accommodation complex, temporary camps	2
			Freshwater diversions, dykes, berms, run off ponds	2
			Intake pipeline, effluent pipelines	2
			Quarry development	2
			Haul Road	2
			Airstrip	2
		Site Access	Winter Road	2
			All-Season Road	2
			Quarry development	2
			Baker Lake Port, storage facilities, fuel tank farm, wharf construction	2
			Thelon bridge, ferry crossings, water crossings (culverts, clear span bridges)	2
			Freshwater Diversions	2
Operation	Ongoing exploration- ground surveys, drilling Recreational activities– fishing, hiking	Mine Site	Exploratory drilling locations in claim area; recreation areas adjacent to accommodation complex, temporary camps	1
	Controlled public traffic	Site Access	Winter and All-Season Road	1
Decommissioning	Potential for additional rock and earth movement relating to: removing site pads, (blasting, earth moving, loading, hauling, dumping, crushing); backfilling, contouring, revegetation, removal of buildings, and foundations.	Mine Site	Same as Construction	2

Note: Project-environment interactions ranked as zero were not included in the table