Kiggavik Project
Environmental Impact Statement

Tier 1 Appendix 1DIV

Significance Determinations

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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Abbreviations

COPC ..... Constituent of Potential Concern

e.g. ..... example

GDP ..... Gross Domestic Product

GN ..... Government of Nunavut

KI ..... Key Indicator

LSA ..... Local Study Area

NO_2 ..... Nitrogen Dioxide

NTI ..... Nunavut Tunngavik Incorporated

PM_{10} ..... Particulate matter less than 10 microns (µm) in diameter

$PM_{2.5}$ ..... Particulate matter less than 2.5 microns (µm) in diameter

RAA ..... Regional Assessment Area

TSP ..... Total Suspended Particulate Matter

VC ..... Valued Component

WTP ..... Water Treatment Plant

1 Introduction

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. This Technical Appendix provides a description of how significance was determined as well as the summary tables of Project residual environmental effects for each of the assessment volumes where significance was determined.

1.1 Environmental Effects Criteria

Where possible, the following characteristics are described quantitatively for each Valued Component (VC) to assist in the assessment of residual environmental effects. Where these residual environmental effects cannot be defined quantitatively, they are described using qualitative terms. If qualitative descriptions are used, definitions are provided for each VC or Key Indicator (KI), as appropriate, in the scoping section of the environmental assessment (Tier 2 Document) for that VC or KI.

- ***Direction:*** the ultimate long-term trend of the environmental effect (e.g., positive, neutral or adverse)
- ***Magnitude:*** the amount of change in a measurable parameter or variable relative to the baseline case (i.e., low, moderate, high)
- ***Geographical Extent:*** the geographic area within which an environmental effect of a defined magnitude occurs (site-specific, local, regional, territorial, national, international)
- ***Frequency:*** the number of times during the Project or a specific Project phase that an environmental effect may occur (i.e., once, sporadically, regular, continuous)
- ***Duration:*** this is typically defined in terms of the period of time that is required until the VEC returns to its baseline condition or the environmental effect can no longer be measured or otherwise perceived (i.e., short term, medium term, long term, permanent)
- ***Reversibility:*** the likelihood that a measurable parameter for the VEC will recover from an environmental effect (i.e., reversible, irreversible)
- ***Ecological or socio-economic context:*** the general characteristics of the area in which the Kiggavik Project is located (i.e., undisturbed, disturbed, urban setting)

1.2 Significance of Residual Project Environmental Effects

Significance of a residual Project environmental effect is determined based on standards or thresholds that are specific to the valued component (VC), key indicator (KI) and/or the measurable parameters used to assess the environmental effect. Standards are recognized federal and territorial regulatory requirements or industry objectives that are applicable to the VC, and that reflect the limits

of an acceptable state for that component. Where standards, guidelines or regulatory requirements do not specifically exist, thresholds are defined for the measurable parameters for an environmental effect on a VC based on resource management objectives, community standards, scientific literature, or ecological processes (e.g., desired states for fish or wildlife habitats or populations).Determination of whether a residual environmental effect is considered to be significant or not significant is based on a comparison of the predicted change in the VC or measurable parameter to the defined threshold or standard. This includes an indication of the likelihood that a residual environmental effect on a VC will occur based on probability of occurrence (i.e., based on past experience) and level of scientific uncertainty.

Determination of significance also includes a discussion of the confidence of the prediction with respect to:

- the characterization of environmental effects, and
- the success of Project design features, mitigation measures, and environmental protection measures in effectively reducing the environmental effect.

Prediction confidence for the environmental effect and the success of mitigation measures is ranked as low, moderate or high. Environmental effects are rated as either *significant* or *not significant*.

2 Significance Determination

2.1 Project Residual Effects

2.1.1 Atmospheric

2.1.1.1 Atmospheric – Air Quality

Table 2.1-1 Summary of Project Residual Environmental Effects to Air Quality

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics					Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Frequency	Reversibility				
Change in Ambient Air Concentrations of Constituents of Potential Concern - Preferred Option										
Construction – Quarries	General mitigation measures – Tier 2, Volume 4, Part 1, Section 6.1.3	No residual effects					n/a			Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.
Construction – Mine Development Area	General mitigation measures – Section Tier 2, Volume 4, Part 1, Section 6.1.3	No residual effects					n/a			Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.
Operation – Mine Development Area										
24-hr TSP	General and activity-specific measures – Tier 2, Volume 4, Part 1, Section 6.1.3	A	M	L	I	R	NS	n/a	n/a	Implement dust management plan and ambient air monitoring program as required. See Appendix 4C.
			H	F*	I	R	NS	n/a	n/a	
24-hr PM_{10}	General and activity-specific measures – Section 6.1.3	A	H	L	I	R	NS	n/a	n/a	
			H	F*	S	R	NS	n/a	n/a	
24-hr $PM_{2.5}$	General and activity-specific measures – Tier 2, Volume 4, Part 1, Section 6.1.3	A	H	F*	I	R	NS	n/a	n/a	

Table 2.1-1 Summary of Project Residual Environmental Effects to Air Quality

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics					Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Frequency	Reversibility				
24-hr Uranium	Design, general and activity-specific measures – Tier 2, Volume 4, Part 1, Section 6.1.3	A	H	F*	I	R	NS	n/a	n/a	
1-hr NO_2	Design, general and activity-specific measures – Tier 2, Volume 4, Part 1, Section 6.1.3	A	H	F*	S	R	NS	n/a	n/a	Implement ambient air monitoring program as required. See Appendix 4C.
24-hr NO_2	Design, general and activity-specific measures – Tier 2, Volume 4, Part 1, Section 6.1.3	A	H	F*	I	R	NS	n/a	n/a	
Other COPCs	Design, general and activity-specific measures – Tier 2, Volume 4, Part 1, Section 6.1.3	No residual effects					n/a			Implement ambient air monitoring program as required. See Appendix 4C.
Operation - Winter Road	Design, general and activity-specific measures – Tier 2, Volume 4, Part 1, Section 6.1.3	No residual effects					n/a			Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.
Operation - Baker Lake Dock and Storage Facility										

Table 2.1-1 Summary of Project Residual Environmental Effects to Air Quality

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics					Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Frequency	Reversibility				
1-hr NO_2	Design, general and activity-specific measures – Tier 2, Volume 4, Part 1, Section 6.1.3	A	H	F*	I	R	NS	n/a	n/a	Implement ambient air monitoring program as required. See Appendix 4C.
24-hr NO_2	Design, general and activity-specific measures – Tier 2, Volume 4, Part 1, Section 6.1.3	A	M	F*	I	R	NS	n/a	n/a	Implement ambient air monitoring program as required. See Appendix 4C.
Final Closure	Design, general and activity-specific measures – Tier 2, Volume 4, Part 1, Section 6.1.3	No residual effects					n/a			Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.
Post-Closure	Design, general and activity-specific measures – Tier 2, Volume 4, Part 1, Section 6.1.3	No residual effects					n/a			Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.
Change in Ambient Air Concentrations of Constituents of Potential Concern - Other Options										
Operation - All-Season Road	General mitigation measures – Tier 2, Volume 4, Part 1, Section 6.1.3	No residual effects					n/a			Complaints response procedure and monitoring, if complaints history warrants action. See Appendix 4C.

Table 2.1-1 Summary of Project Residual Environmental Effects to Air Quality

Project Phase	Mitigation / Compensation Measures	Residual Environmental Effects Characteristics					Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
		Direction	Magnitude	Geographic Extent	Frequency	Reversibility				

KEY

Magnitude:

L Low: The predicted COPC concentrations are less than 25% greater than the Indicator Threshold criterion.

M Moderate: The predicted COPC concentrations are less than 100% greater than the Indicator Threshold.

H High: The predicted COPC concentrations are more than 100% greater than the Indicator Threshold.

Geographic Extent:

F Footprint: Effect confined to the project footprint

F* Footprint: Effect confined to 2km from the project footprint

L Local: Effect confined to the LAA

R Regional: Effect extends beyond the LAA but within the RAA

Duration:

ST Short term: Less than one year (growing season)

MT Medium term: More than one year, but not beyond the end of project decommissioning

LT Long term: Beyond the life of the project

P Permanent

Frequency:

I Infrequent: occurs less than 1% of the time (no more than 4 days per year or 88 hours per year)

S Sporadic: Occurs less than 3.5% of the time (no more than 12 days per year or 305 hours per year)

R Regular: Occurs less than 15% of the time (no more than 55 days per year or 1300 hours per year)

C Continuous: the effect occurs more than 15% of the time.

Reversibility:

R Reversible

I Irreversible

Significance:

S Significant

N Not Significant

Likelihood:

Based on professional judgment

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

N/A Not Applicable

2.1.1.2 Atmospheric – Noise and Vibration

Table 2.1-2 Summary of Project Residual Environmental Effects for Noise

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Socio-Economic Context				
Change in Noise Levels – Preferred Option												
Construction – Dock and Storage Facility	Community complaint/ response procedures; Equipment maintenance; Exhaust mufflers; Other operational and administrative measures	A	M	L	S	R	R	N	N	L	H	Complaints response procedure and monitoring, if complaint history warrants action
Construction – Winter Road	Community complaint/ response procedures; Equipment maintenance; Exhaust mufflers; Other operational and administrative measures	A	L	L	S	R	R	N	N	L	H	Complaints response procedure and monitoring, if complaint history warrants action

Table 2.1-2 Summary of Project Residual Environmental Effects for Noise

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Socio-Economic Context				
Construction – Mine Development Area	Community complaint/ response procedures; Equipment maintenance; Exhaust mufflers; Other operational and administrative measures	A	N	L	S	R	R	N	N	L	H	Complaints response procedure and monitoring, if complaint history warrants action
Operations - Kiggavik Project	Community complaint/ response procedures; Equipment maintenance; Exhaust mufflers; Other operational and administrative measures	A	L	L	L	C	R	N	N	L	H	Complaints response procedure and monitoring, if complaint history warrants action
Change in Noise Levels – Other Options												
Construction – All-Season Road	Community complaint/ response procedures; Equipment maintenance; Exhaust mufflers; Other operational and administrative measures	A	M	L	S	R	R	N	N	L	H	Complaints response procedure and monitoring, if complaint history warrants action

Table 2.1-2 Summary of Project Residual Environmental Effects for Noise

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Socio-Economic Context				
Operations – All-Season Road	Community complaint/ response procedures; Equipment maintenance; Exhaust mufflers; Other operational and administrative measures	A	L	L	L	R	R	N	N	L	H	Complaints response procedure and monitoring, if complaint history warrants action

Table 2.1-3 Summary of Project Residual Environmental Effects for Vibration

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Socio-Economic Context				
Change in Vibration Levels – Preferred Option												
Construction – Dock and Storage Facility	Community complaint/ response procedures; Equipment maintenance; Other operational and administrative measures	N	N	L	S	R	R	N	N	L	H	Complaints response procedure and monitoring, if complaint history warrants action
Construction – Preferred Winter Road	Community complaint/ response procedures; Equipment maintenance; Other operational and administrative measures	N	N	L	S	R	R	N	N	L	H	Complaints response procedure and monitoring, if complaint history warrants action
Construction – Mine Development Area	Community complaint/ response procedures; Equipment maintenance; Other operational and administrative measures	N	N	L	S	R	R	N	N	L	H	Complaints response procedure and monitoring, if complaint history warrants action

Table 2.1-3 Summary of Project Residual Environmental Effects for Vibration

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Socio-Economic Context				
Operations - Kiggavik Project	Equipment maintenance; Other operational and administrative measures	N	N	L	L	C	R	N	N	L	H	Complaints response procedure and monitoring, if complaint history warrants action
Change in Vibration Levels – Other Options												
Construction – All-Season Road	Community complaint/ response procedures; Equipment maintenance; Operational and administrative measures	N	N	L	S	R	R	N	N	L	H	Complaints response procedure and monitoring, if complaint history warrants action
Operations – All-Season Road	Community complaint/ response procedures; Equipment maintenance; Operational and administrative measures	N	N	L	L	C	R	N	N	L	H	Complaints response procedure and monitoring, if complaint history warrants action

Table 2.1-4 Definitions of Criteria Used in the Description of Residual Effects for Noise and Vibration

Direction	Magnitude (see Tier 2, Volume 4, Part 2, Tables 4.8-6 and 4.8-8)	Geographic Extent	Duration	Reversibility	Frequency	Likelihood	Socio-Economic Context
Positive an improvement in noise and vibration levels Adverse a deterioration in noise and vibration levels Neutral no notable change in noise and vibration levels	Negligible an effect on noise and vibration levels that is below the threshold of perception Low an effect on noise and vibration levels that is around the threshold of perception Moderate an effect on noise and vibration levels that is above the threshold of perception and is therefore detectable, but does not pose a serious problem to human health High an effect on noise and vibration levels that is above the threshold of perception and poses a serious problem (e.g., noise levels exceeding applicable criteria)	Project footprint the effect is confined to the project footprint Local the effect occurs within the local assessment area (LSA) Regional the effect extends beyond the local assessment area (RAA)	Short Term less than 2 years in duration Medium Term between 2 and 20 years Long Term more than 20 years to a maximum of 10 years following decommissioning and abandonment Permanent effects that persist more than 10 years after decommissioning and abandonment are considered to be permanent	Reversible the VEC will recover from an environmental effect Not Reversible the VEC will not recover from an environmental effect	Once Sporadic Regular (i.e., occurs on a regular basis and at regular intervals) Continuous	L: Low probability of occurrence. M: medium probability of occurrence. H: High probability of occurrence.	Negligible: No implications to human health, well-being or quality of life Level I: No implications to human health, well-being or quality of life but some changes in annoyance / disturbance levels; potential effects on individuals within populations Level II: Implications to human health, well-being or quality of life; potential population level effects

2.1.2 Aquatics

2.1.2.1 Water Quality

Table 2.1-5 Summary of Project Residual Environmental Effects and Significance Determinations for Water Quality

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in water quality: Treated effluent discharge from the Kiggavik and Sissons WTP may affect surface water quality in the receiving environment. This potential alteration to surface water chemistry has the potential to affect aquatic biota													
Construction		N	-	-	-	-	-	-	-	N	M	H	Wastewater and effluent quality monitoring; water quality monitoring in receiving environment.
Operation	Design of WTP	Y	N	L	L	MT	R	R	U				
Decommissioning and Abandonment		Y	N	L	L	MT	R	R	U				
Change in water quality: Increased dust generated during mine construction and operation could increase particulate and metals deposition in the Kiggavik Project area. Increased atmospheric deposition can report directly and indirectly to waterbodies and potentially change the water quality of those systems. Changes in water quality have the potential to affect aquatic biota.													
Construction		Y	N	L	L	ST	R	R	U	N	L	H	Dust emission levels and deposition monitoring; water quality monitoring in lakes for metals, radionuclide, and TSS
Operation	Dust control on roads and during the pit mining	Y	N	L	L	MT	R	R	U				

Table 2.1-5 Summary of Project Residual Environmental Effects and Significance Determinations for Water Quality

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Decommissioning		Y	N	L	L	ST	R	R	U				concentrations.
Change in water quality: The release of air emissions that result in increased deposition rates of sulphate (SO_4^{2-}) and nitrate (NO_3^-). Deposition of SO_4^{2-} and NO_3^- can lead to a reduction in pH in acid-sensitive lakes, which in turn might alter other aspects of water chemistry, ultimately resulting in adverse effects on aquatic life.													
Construction		N	-	-	-	-	-	-	-	N	L	H	Lakes and streams monitored to confirm acid deposition and lake acidification are not increasing above acceptable levels.
Operation	Scrubbers on sulphuric acid plant; NOx control systems.	Y	N	L	L	MT	C	R	U				
Decommissioning		N	-	-	-	-	-	-	-				

Table 2.1-5 Summary of Project Residual Environmental Effects and Significance Determinations for Water Quality

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				

KEY

Direction:

P Positive

N Negative

Magnitude:

Use quantitative measure; or

L Low: Water quality generally expected to meet applicable benchmarks or no measureable change from baseline conditions; TSS <55mg/L

M Moderate: Water quality within a factor of 5 of benchmarks; TSS 55-148 mg/L

H High: Water quality expected to exceed benchmarks by a factor greater than 5; TSS >148mg/L

Geographic Extent:

Use quantitative measure; or

S Site-specific: area of lake or stream

L Local assessment area

R Regional assessment area

Duration:

Use quantitative measure; or

ST Short term: water quality returns to baseline conditions during operations

MT Medium term: water quality returns to baseline conditions during final closure period

LT Long term: water quality returns to baseline post-closure

P Permanent change in water quality

Frequency:

Use quantitative measure; or

O Occurs once.

S Occurs sporadically at irregular intervals.

R Occurs on a regular basis and at regular intervals.

C Continuous.

Reversibility:

R Reversible

I Irreversible

Environmental Context:

U Undisturbed: Area relatively or not adversely affected by human activity

D Developed: Area has been substantially previously disturbed by human development or human development is still present

N/A Not Applicable

Significance:

S Significant

N Not Significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood:

Based on professional judgment

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Cumulative Effects

Y Potential for effect to interact with other past, present or foreseeable projects or activities in RAA

N Effect will not or is not likely to interact with other past, present or foreseeable projects or activities in RAA

2.1.2.2 Sediment Quality

Table 2.1-6 Summary of Project Residual Environmental Effects and Significance Determinations for Sediment Quality

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in sediment quality: The release of treated effluent from the Kiggavik and Sissons Water Treatment Plants can affect water quality in the receiving environment. Changes in surface water can subsequently affect the sediment through processes such as deposition of settling solids, adsorption, and diffusion. Contaminant levels in sediment can have an effect on biota that reside in sediment (e.g., benthic invertebrates) as well as wildlife that may incidentally ingest sediment while feeding on aquatic biota.													
Construction		N	-	-	-	-	-	-	-	N	L	H	Monitoring to confirm metals and radionuclide concentrations in sediment rates are not increasing above predicted levels.
Operation	Design of WTP	Y	N	L	L	LT	C	R	U				
Decommissioning and Abandonment		N	-	-	-	-	-	-	-				

Table 2.1-6 Summary of Project Residual Environmental Effects and Significance Determinations for Sediment Quality

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				

KEY

Direction:

P Positive

N Negative

Magnitude:

Use quantitative measure; or

N Negligible: No discernible effect on sediment quality.

L Low: Project will measurably affect sediment quality but these changes will be within the range of natural variability.

M Medium: Project will affect sediment quality to the extent that some parameters exceed sediment quality guidelines (<CCME PEL).

H High: Project will affect sediment quality to the extent that several parameters exceed sediment quality guidelines (>CCME PEL)

CCME = Canadian Council of Ministers of the Environment

PEL = probable effects levels

Geographic Extent:

Use quantitative measure; or

S Site-specific: area of lake or stream

L Local assessment area

R Regional assessment area

Duration:

Use quantitative measure; or

ST Short term: sediment quality returns to baseline conditions during operations

MT Medium term: sediment quality returns to baseline conditions during final closure period

LT Long term: sediment quality returns to baseline post-closure

P Permanent change in sediment quality

Frequency:

Use quantitative measure; or

O Occurs once.

S Occurs sporadically at irregular intervals.

R Occurs on a regular basis and at regular intervals.

C Continuous.

Reversibility:

R Reversible

I Irreversible

Environmental Context:

U Undisturbed: Area relatively or not adversely affected by human activity

D Developed: Area has been substantially previously disturbed by human development or human development is still present

N/A Not Applicable

Significance:

S Significant

N Not Significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood:

Based on professional judgment

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Cumulative Effects

Y Potential for effect to interact with other past, present or foreseeable projects or activities in RAA

N Effect will not or is not likely to interact with other past, present or foreseeable projects or activities in RAA

2.1.2.3 Aquatic Organisms and Fish Habitat

Table 2.1-7 Summary of Project Residual Environmental Effects and Significance Determinations for Aquatic Organisms and Fish Habitat

Project Phase	Mitigation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in aquatic biota: Treated effluent discharge from the Kiggavik and Sissons Water Treatment Plants (WTP) may affect surface water quality. These changes can affect the concentration of COPC in aquatic biota (e.g., aquatic plants, benthic invertebrates, plankton).													
Construction		N	-	-	-	-	-	-	-	N	L to M	H	An Environmental Effects Monitoring (EEM) program will be conducted to determine whether effluent discharge from the WTP is having quantifiable effects.
Operation	Design of the WTPs.	Y	N	L	L	MT	C	R	U				
Decommissioning and Abandonment		Y	N	L	L	MT	C	R	U				

Table 2.1-7 Summary of Project Residual Environmental Effects and Significance Determinations for Aquatic Organisms and Fish Habitat

Project Phase	Mitigation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in fish habitat: Instream construction associated with several Project development activities is expected to result in the permanent alteration or destruction of fish habitat.													
Construction	Installation of culverts; use of turbidity curtain; completion of fish salvage.	N	N	L	L	ST	O	R	U	N	L	H	None.
Operation		N	-	-	-	-	-	-	-				
Decommissioning		N	N	L	L	ST	O	R	D				

Table 2.1-7 Summary of Project Residual Environmental Effects and Significance Determinations for Aquatic Organisms and Fish Habitat

Project Phase	Mitigation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				

KEY

Direction:

P Positive

N Negative

Magnitude:

Use quantitative measure; or

N Negligible: The Project will not affect the health of aquatic biota or fish habitat in waterbodies in the LAA; SI maximum mean value <1

L Low: The Project may affect the health of aquatic biota or fish habitat in waterbodies but these effects will be within the natural range of variability: SI maximum mean value 1-5

M Medium: The Project may affect the health of aquatic biota or fish habitat in waterbodies in the LAA and the effects will be beyond the natural range of variability. SI maximum mean value >5 <15

H High: The Project will affect aquatic biota or fish habitat in waterbodies in the LAA and the RAA and the effects will be beyond the natural range of variability; SI maximum mean value >15

Geographic Extent:

Use quantitative measure; or

S Site-specific: area of lake or stream

L Local assessment area

R Regional assessment area

Duration:

Use quantitative measure; or

ST Short term: fish habitat or SI returns to baseline conditions during operations

MT Medium term: fish habitat or SI returns to baseline conditions during final closure period

LT Long term: fish habitat SI returns to baseline post-closure

P Permanent alteration in fish habitat or permanent toxicological risk

Frequency:

Use quantitative measure; or

O Occurs once.

S Occurs sporadically at irregular intervals.

R Occurs on a regular basis and at regular intervals.

C Continuous.

Reversibility:

R Reversible

I Irreversible

Environmental Context:

U Undisturbed: Area relatively or not adversely affected by human activity

D Developed: Area has been substantially previously disturbed by human development or human development is still present

N/A Not Applicable

Significance:

S Significant

N Not Significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood:

Based on professional judgment

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Cumulative Effects

Y Potential for effect to interact with other past, present or foreseeable projects or activities in RAA

N Effect will not or is not likely to interact with other past, present or foreseeable projects or activities in RAA

2.1.2.4 Fish Populations and Fish Health

Table 2.1-8 Summary of Project Residual Environmental Effects and Significance Determinations for Fish Populations and Fish Health

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Fish Populations: The detonation of explosives (blasting) in or near water results in pressure change and vibration which can physically damage the internal organs of fish, especially the swim-bladder. The shock waves can also kill or injure fish eggs and larvae. Changes in fish behaviour have also been observed as a result of noise produced by detonation of explosives.													
Construction	Use of smaller charge sizes during the open water and/or incubation season; complete program outside of sensitive time periods.	N	N	L	L	ST	S	R	U	N	L	H	Monitoring programs to calibrate and refine the ground vibration and IPC models.
Operation		N	N	L	L	ST	S	R	U				
Decommissioning and Abandonment		N	-	-	-	-	-	-	-				

Table 2.1-8 Summary of Project Residual Environmental Effects and Significance Determinations for Fish Populations and Fish Health

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Fish Populations: The release of COPC from the WTPs can affect water quality in the receiving environment. The quality of the water is critical for evaluating the potential effect on fish. Other ecological receptors (including people) may consume fish and would therefore be exposed through this pathway.													
Construction		N	-	-	-	-	-	-	-	N	M	H	An Environmental Effects Monitoring (EEM) program will be instituted to determine whether effluent discharge from the WTP is having quantifiable effects on fish populations.
Operation	Design of the WTPs	N	N	L	L	MT	C	R	U				
Decommissioning		N	N	L	L	MT	C	R	U				

Table 2.1-8 Summary of Project Residual Environmental Effects and Significance Determinations for Fish Populations and Fish Health

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				

KEY

Direction:

P Positive

N Negative

Magnitude:

Use quantitative measure; or

N Negligible: The Project will not affect fish abundance, distribution and health in waterbodies in the LAA.

L Low: The Project will affect fish abundance, distribution and health in waterbodies in the LAA, but these effects will be within the natural range of variability.

M Moderate: The Project will affect fish abundance, distribution and health in waterbodies in the LAA and the effects will be beyond the natural range of variability. The effects do not extend to the regional assessment area (RAA).

H High: The Project will affect fish abundance, distribution and health in waterbodies in the LAA and the RAA, and the effects will be beyond the natural range of variability.

Geographic Extent:

Use quantitative measure; or

S Site-specific: area of lake or stream

L Local assessment area

R Regional assessment area

Duration:

Use quantitative measure; or

ST Short term: fish abundance, distribution and health return to baseline conditions during operations

MT Medium term: fish abundance, distribution and health return to baseline conditions during final closure period

LT Long term: fish abundance, distribution and health return to baseline post-closure

P Permanent alteration in fish abundance, distribution and health

Frequency:

Use quantitative measure; or

O Occurs once.

S Occurs sporadically at irregular intervals.

R Occurs on a regular basis and at regular intervals.

C Continuous.

Reversibility:

R Reversible

I Irreversible

Environmental Context:

U Undisturbed: Area relatively or not adversely affected by human activity

D Developed: Area has been substantially previously disturbed by human development or human development is still present

N/A Not Applicable

Significance:

S Significant

N Not Significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood:

Based on professional judgment

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Cumulative Effects

Y Potential for effect to interact with other past, present or foreseeable projects or activities in RAA

N Effect will not or is not likely to interact with other past, present or foreseeable projects or activities in RAA

2.1.3 Terrestrial

2.1.3.1 Terrestrial – Terrain, soils and vegetation

2.1.3.1.1 Terrain

Table 2.1-9 Summary of Project Residual Environmental Effects for Change in Terrain

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Permafrost Conditions and Terrain Stability: Stripping and/or burial of vegetation, organic soil zone, and underlying overburden materials; change in slope, change in surface drainage patterns and subsurface flow, and blasting will affect thaw depth and ground-ice content.													
Construction	Minimize the Project footprint disturbance area	Y	A	L	S	LT	C	R	D	N	N/A	H	Establishment of ground temperature and thaw depth monitoring system around the mine and mine affected areas; and along the embankment of roads; routine visual field observation of terrain slopes
	Salvage vegetation, soils and overburden materials												
	Confine activities within the boundaries of Project work area												

Table 2.1-9 Summary of Project Residual Environmental Effects for Change in Terrain

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Operation	Avoid surface disturbance in ground-ice rich areas												Monitoring of soil moisture and ground-ice content
Final closure													Monitoring of surface and subsurface groundwater system
Post closure	Not required												
Change in Landforms: Stripping and/or burial of surficial materials will affect common depositional landforms and their abundance and distribution													
Construction	Minimize the Project footprint disturbance area	Y	A	L	S	LT	O	I	D	N	N/A	H	Quantify Project footprint on an annual basis
	Avoid or reduce the use of glaciofluvial deposits												
	Salvage surficial materials												
Operation	Avoid surface disturbance in soft and problematic areas												
Final closure													

Table 2.1-9 Summary of Project Residual Environmental Effects for Change in Terrain

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				

KEY

Direction:

P Positive: improvement relative to baseline conditions

N Neutral: no change relative to baseline

A Adverse: reduction relative to baseline

Magnitude:

N Negligible: No measurable change from baseline conditions or natural variation on permafrost, terrain stability or landforms.

L Low: Effect on one or more of the measurable parameters is detectable, but within the range of natural variation or baseline values; no change in permafrost condition, terrain stability or landforms.

M Moderate: Effect on one or more of the measurable parameters is detectable and outside the range of natural variation or baseline values, but unlikely to change in permafrost condition, terrain stability or landforms.

H High: Effect on one or more of the measurable parameters is detectable and outside the range of natural variation or baseline values, and hence a change in permafrost condition, terrain stability or landforms is evident.

Geographic Extent:

S Site specific: (i.e., within the Project Footprint)

L Local (i.e., within the LAA)

R Regional (i.e., extends beyond the LAA but within the RAA)

Duration:

ST Short term: change no longer detectable at the end of construction.

MT Medium term: change no longer detectable at the end of final closure.

LT Long term: change extends beyond the life of the Project.

Frequency:

O Once: occurs once throughout the Project

S Sporadically: occurs more than once, but at unpredictable intervals.

R Regularly: occurs repeatedly at regular intervals.

C Continuous: occurs continuously throughout the Project.

Reversibility:

R Reversible: effect reversible over human lifetime

I Irreversible: effect not reversible, but reversible over geologic time scale

Environmental Context:

D Disturbed

N Not Disturbed

Significance:

S Significant

N Not Significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood:

Of a significant effect occurring

N/A Not Applicable

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Cumulative Effects

Y Potential for effect to interact with other past, present or foreseeable projects or activities

N Effect will not or is not likely to interact with other past, present or foreseeable projects or activities

2.1.3.1.2 Soils

Table 2.1-10 Summary of Project Residual Environmental Effects on Soils

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in soil quality: Air emissions from Project components will affect soil quality.													
Construction	• All industrial machinery and equipment (including the diesel-powered generators) will meet federal air emission standards	Y	A	L	L	LT	C	R	ND	N	NA	H	Monitoring of air emissions from static emissions sources associated with the Project (e.g., acid plant).
Operation	• Use of low sulphur diesel fuel.												Monitoring of soil permanent sampling plots located around the mine sites and access roads for changes in soil quality.
Final Closure	• Scrubbers installed on mill stacks to remove particulates and contaminants before discharge into the atmosphere.												
Post Closure													
Change in soil quality: Dust created by Project activities will affect soil quality.													
Construction	• Avoid blasting on days when winds are excessive.	N	A	L	L	LT	C	R	ND	N	N/A	H	Dust deposition monitoring around the mine sites as well as the access
Operation													

Table 2.1-10 Summary of Project Residual Environmental Effects on Soils

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Final Closure Post Closure	• Dust suppression in the mine site area by spraying water or other approved substance on travel area.												roads.
Change in soil quality: Soil compaction due to vehicular movement will affect soil quality.													
Construction Operation Final Closure	• Vehicular travel on the winter road will occur during frozen ground conditions, thereby preventing soil compaction. • Scarification of areas to be reclaimed during final closure will loosen compacted soils.	Y	A	L	S	MT	C	R	ND	N	N/A	H	During reclamation and revegetation, identify areas where soil compaction is evident and implement mitigation measures to de-compact soils, allowing better seed germination conditions.
Change in soil quantity: Site clearing during Project construction will affect soil quantity.													
Construction	• Activities confined within the work area boundaries. • Topsoil stripping and salvage.	Y	A	L	S	MT	O	R	ND	N	N/A	H	Environmental monitor on-site during construction.
Change in soil quantity: Soil burial due to the placement of materials on undisturbed areas during Project construction will affect soil quantity.													

Table 2.1-10 Summary of Project Residual Environmental Effects on Soils

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Construction	• Activities confined within the work area boundaries.	Y	A	L	S	LT	O	R	ND	N	N/A	H	Environmental monitor on-site during construction.
Change in soil quality: Soil compaction due to vehicular movement will affect soil quality.													
Change in soil quantity: Soil movement during Project construction will affect soil quantity.													
Construction	• Construction plan during topsoil stripping and salvage. • Using equipment to transport soils to overburden pile rather than pushing soils.	Y	A	L	S	ST	O	R	ND	N	N/A	H	Environmental monitor on-site during construction.
Change in soil quantity: Soil erosion until site stabilization, or vegetation establishment and proliferation on disturbed areas will affect soil quantity.													
Construction Operation Final Closure Post Closure	• Erosion control structures to prevent migration of materials off-site.	Y	A	L	S	MT	S	R	ND	N	N/A	H	Monitoring of site, overburden piles, and culverts along access roads for erosion potential and occurrence.

Table 2.1-10 Summary of Project Residual Environmental Effects on Soils

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				

KEY

Direction:

P Positive

N Neutral

A Adverse

Magnitude:

N Negligible: no measurable change in soil quality or soil quantity

L Low: effect is detectable but no measurable change in soil quality or soil quantity.

M Moderate: effect is detectable and outside the range of natural variation, but is unlikely to change soil quality or soil quantity.

H High: a change in either soil quantity or soil quality will occur, preventing reclaiming the landscape to meet end land use goals.

Geographic Extent:

S Site specific: (i.e., within Project Footprint)

L Local (i.e., within the LAA)

R Regional (i.e., extends beyond the LAA but within the RAA)

Duration:

ST Short term: change no longer detectable at the end of construction

MT Medium term: change no longer detectable at the end of final closure

LT Long term: change extends beyond the life of the Project

Frequency:

O Once.

S Sporadically: occurs more than once, but at unpredictable intervals

R Regularly: occurs repeatedly at regular intervals

C Continuous: occurs continuously throughout the Project

Reversibility:

R Reversible

I Irreversible

Environmental Context:

D Disturbed: area has been substantially disturbed previously by human development, or human development is still present.

N Not Disturbed: area has not been disturbed by human activity.

N/A Not Applicable

Significance:

S Significant

N Not Significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood:

Of a significant effect occurring

N/A Not Applicable

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Cumulative Effects

Y Potential for effect to interact with other past, present or foreseeable projects or activities

N Effect will not or is not likely to interact with other past, present or foreseeable projects or activities

2.1.3.1.3 Vegetation

Table 2.1-11 Summary of Project Residual Environmental Effects: Vegetation

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in vegetation abundance and community diversity: Site clearing and vegetation burial during construction will affect vegetation abundance and community diversity													
Construction	Activities confined within the work area boundaries.	Y	A	L	S	LT	O	R	ND	N	N/A	H	Environmental monitoring during construction.
Change in vegetation quality: Dust created by Project activities will affect vegetation quality													
Construction	Dust suppression by spraying water or other approved substance on mine site travel areas.	Y	A	L	L	LT	C	R	ND	N	N/A	M	Monitoring of vegetation permanent sampling plots located around the mine sites and access roads for changes in vegetation abundance and community diversity.
Operation	Avoid blasting on days when winds are excessive.	Y	A	M	L	LT	C	R	ND				
Final Closure	Reduced speed limits in dust-prone areas.	Y	A	L	L	LT	C	R	ND				Dust deposition monitoring around the mine sites as well as the access roads.

Table 2.1-11 Summary of Project Residual Environmental Effects: Vegetation

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in vegetation quality: Air emissions from Project components will affect vegetation quality													
Construction Operation Final Closure Post Closure	All industrial machinery and equipment (including the diesel-powered generators) will meet federal air emission standards. Use of low sulphur diesel fuel. Scrubbers installed on mill stacks to remove particulates and contaminants before discharge into the atmosphere.	Y	A	L	R	LT	C	R	ND	N	N/A	M	Monitoring of vegetation at locations around the mine sites and access roads for changes in vegetation quality. Monitoring of air emissions from static emissions sources associated with the Project (e.g., acid plant).

Table 2.1-11 Summary of Project Residual Environmental Effects: Vegetation

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				

KEY

Direction:

P Positive

N Neutral

A Adverse

Magnitude:

N Negligible: no measureable change in vegetation abundance and community diversity, or vegetation quality.

L Low: effect is detectable but within the range of natural variation or baseline values.

M Moderate: effect is detectable and outside the range of natural variation or baseline values, but is unlikely to change vegetation abundance and community diversity, or vegetation quality

H High: effect is detectable and outside the range of natural variation or baseline values leading to a change in vegetation abundance and community diversity, or vegetation quality.

Geographic Extent:

S Site-specific: (i.e., Project Footprint)

L Local (i.e., within the LAA)

R Regional (i.e., extends beyond the LAA but within the RAA)

Duration:

ST Short term: change no longer detectable at the end of construction

MT Medium term: change no longer detectable at the end of final closure

LT Long term: change extends beyond the life of the Project

Frequency:

O Once.

S Sporadically: occurs more than once, but at unpredictable intervals

R Regularly: occurs repeatedly at regular intervals

C Continuous: occurs continuously throughout the Project

Reversibility:

R Reversible

I Irreversible

Environmental Context:

D Disturbed: area has been substantially disturbed previously by human development, or human development is still present.

N Not Disturbed: area has not been disturbed by human activity.

N/A Not Applicable

Significance:

S Significant

N Not Significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood:

Of a significant effect occurring

N/A Not applicable

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Cumulative Effects

Y Potential for effect to interact with other past, present or foreseeable projects or activities

N Effect will not or is not likely to interact with other past, present or foreseeable projects or activities

2.1.3.2 Terrestrial – Wildlife

2.1.3.2.1 Caribou and Muskox

Table 2.1-12 Summary of Residual Environmental Effects for Change in Mortality to Caribou

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Caribou Mortality Risk — All-Season Road Option												
Construction		N	N	L	MT	C	R	U	N	N/A	H	None recommended
Operation	Road closures. Private access. Multi-party management speed limits, use of convoys	N	N	L	MT	C	R	U	N	N/A	M	Road check-point monitoring, HHS
Final Closure	Road closures; private access; multi-party management	N	N	L	MT	C	R	U	N	N/A	M	Road check-point monitoring, HHS
Change in Caribou Mortality Risk—Winter Road Option												
All Project Phases		N	N	L	MT	C	R	U	N	N/A	M	Continued monitoring (collar studies) of herd distribution during winter road operation, HHS

Table 2.1-12 Summary of Residual Environmental Effects for Change in Mortality to Caribou

KEY ***Direction:*** P Positive N Negative ***Magnitude:*** N Negligible: No anticipated effect on wildlife species L Low: Observable effect on wildlife species but not likely to affect the species' sustainability in the Project area M Moderate: Observable effect on wildlife species but not likely to affect the species' sustainability in the region H High: Measurable effect on wildlife species but that will likely affect the species' sustainability in the region ***Geographic Extent:*** S Site-specific L Local: Effect confined to the LAA R Regional - Effect extends beyond the LAA but within the RAA T Territorial: Effect extends beyond the RAA but within Nunavut N National: Effect extends beyond Nunavut but within Canada	***Duration:*** ST Short term: Less than one year MT Medium term: More than one year, but not beyond the end of Project decommissioning LT Long term: Beyond the life of the Project ***Frequency:*** O Once: Effect occurs once S Sporadically: Effect occurs occasionally but not consistently throughout the life of the Project R Regularly: Effect occurs at regular intervals throughout the life of the Project C Continuous: Effect occurs continuously throughout the Project ***Reversibility:*** R Reversible: Will likely recover to baseline conditions after or before the end of Project decommissioning I Irreversible: Unlikely to recover to baseline conditions after the end of Project decommissioning	***Environmental Context:*** U Undisturbed: Area relatively or not adversely affected by human activity D Developed: Area has been substantially previously disturbed by human development or human development is still present **N/A** Not Applicable ***Significance:*** S Significant N Not significant ***Prediction Confidence:*** Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence	***Likelihood of Significant Effects:*** Based on professional judgment L Low probability of occurrence M Medium probability of occurrence H High probability of occurrence

Table 2.1-13 Summary of Residual Environmental Effects for Change in Habitat Availability for Caribou and Muskox

Project Phase	Mitigation/ Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Caribou and Muskox Habitat — Mine with All-Season Road Option												
Construction	Dust management; Minimize Project footprint; Progressive reclamation	N	M	R	MT	C	R	U	N	N/A	M	Contribution to GN-led collaring program
Operation		N	M	R	MT	C	R	U	N	N/A	M	
Final Closure		N	M	R	MT	C	R	U	N	N/A	M	None required
Change in Caribou and Muskox Habitat — Mine with Winter Road Option												
Construction	Dust management; Minimize Project footprint; Progressive reclamation	N	M	R	MT	C	R	U	N	N/A	M	Collaring program
Operation		N	M	R	MT	C	R	U	N	N/A	M	Collaring program
Final Closure		N	M	R	MT	C	R	U	N	N/A	M	None required

Table 2.1-13 Summary of Residual Environmental Effects for Change in Habitat Availability for Caribou and Muskox

KEY

Direction:

P Positive

N Negative

Magnitude:

N Negligible: No anticipated effect on wildlife species

L Low: Observable effect on wildlife species but not likely to affect the species' sustainability in the Project area

M Moderate: Observable effect on wildlife species but not likely to affect the species' sustainability in the region

H High: Measurable effect on wildlife species but that will likely affect the species' sustainability in the region

Geographic Extent:

S Site-specific

L Local: Effect confined to the LAA

R Regional - Effect extends beyond the LAA but within the RAA

T Territorial: Effect extends beyond the RAA but within Nunavut

N National: Effect extends beyond Nunavut but within Canada

Duration:

ST Short term: Less than one year

MT Medium term: More than one year, but not beyond the end of Project decommissioning

LT Long term: Beyond the life of the Project

Frequency:

O Once: Effect occurs once

S Sporadically: Effect occurs occasionally but not consistently throughout the life of the Project

R Regularly: Effect occurs at regular intervals throughout the life of the Project

C Continuous: Effect occurs continuously throughout the Project

Reversibility:

R Reversible: Will likely recover to baseline conditions after or before the end of Project decommissioning

I Irreversible: Unlikely to recover to baseline conditions after the end of Project decommissioning

Environmental Context:

U Undisturbed: Area relatively or not adversely affected by human activity

D Developed: Area has been substantially previously disturbed by human development or human development is still present

N/A Not Applicable

Significance:

S Significant

N Not significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood of Significant Effects:

Based on professional judgment

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Table 2.1-14 Summary of Project Residual Environmental Effects for Change in Movement of Caribou and Muskox

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Caribou and Muskox Movement — All-Season Road Option												
Construction, Operation, Final Closure	Temporary road closures, road design, snow management	N	M	L	MT	C	R	U	N	N/A	M	Continued monitoring (collar studies)
Change in Caribou and Muskox Movement — Winter Road Option												
Construction, Operation, Final Closure	Temporary road closures	N	M	L	ST	R	R	U	N	N/A	M	Continued monitoring (collar studies)

Table 2.1-14 Summary of Project Residual Environmental Effects for Change in Movement of Caribou and Muskox

KEY

Direction:

P Positive

N Negative

Magnitude:

N Negligible: No anticipated effect on wildlife species

L Low: Observable effect on wildlife species but not likely to affect the species' sustainability in the Project area

M Moderate: Observable effect on wildlife species but not likely to affect the species' sustainability in the region

H High: Measurable effect on wildlife species but that will likely affect the species' sustainability in the region

Geographic Extent:

S Site-specific

L Local: Effect confined to the LAA

R Regional - Effect extends beyond the LAA but within the RAA

T Territorial: Effect extends beyond the RAA but within Nunavut

N National: Effect extends beyond Nunavut but within Canada

Duration:

ST Short term: Less than one year

MT Medium term: More than one year, but not beyond the end of Project decommissioning

LT Long term: Beyond the life of the Project

Frequency:

O Once: Effect occurs once

S Sporadically: Effect occurs occasionally but not consistently throughout the life of the Project

R Regularly: Effect occurs at regular intervals throughout the life of the Project

C Continuous: Effect occurs continuously throughout the Project

Reversibility:

R Reversible: Will likely recover to baseline conditions after or before the end of Project decommissioning

I Irreversible: Unlikely to recover to baseline conditions after the end of Project decommissioning

Environmental Context:

U Undisturbed: Area relatively or not adversely affected by human activity

D Developed: Area has been substantially previously disturbed by human development or human development is still present

N/A Not Applicable

Significance:

S Significant

N Not significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood of Significant Effects:

Based on professional judgment

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Other Projects, Activities and Actions:

Human disturbance associated with Meadowbank Mine, various exploration operations, and various regional communities

2.1.3.2.2 Wolves

Table 2.1-15 Summary of Residual Environmental Effects for Change in Habitat Availability for Wolves

Project Phase	Mitigation/ Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Wolf Habitat — Mine with All-Season Road Option												
Construction	Minimize Project footprint; Progressive reclamation	N	M	R	MT	C	R	U	N	N/A	M	None required
Operation		N	M	R	MT	C	R	U	N	N/A	M	None required
Final Closure		N	M	R	MT	C	R	U	N	N/A	M	None required
Change in Wolf Habitat — Mine with Winter Road Option												
Construction	Minimize Project footprint; Progressive reclamation	N	M	R	MT	C	R	U	N	N/A	M	None required
Operation		N	M	R	MT	C	R	U	N	N/A	M	None required
Final Closure		N	M	R	MT	C	R	U	N	N/A	M	None required

Table 2.1-15 Summary of Residual Environmental Effects for Change in Habitat Availability for Wolves

KEY

Direction:

P Positive

N Negative

Magnitude:

N Negligible: No anticipated effect on wolf denning habitat or species

L Low: Observable effect on wolf denning habitat or species but not likely to affect wolf sustainability in the LAA

M Moderate: Observable effect on wolf denning habitat or species but not likely to affect wolf sustainability in the RAA

H High: Measurable effect on wolf denning habitat or species that will likely affect wolf sustainability in the RAA

Geographic Extent:

S Site-specific

L Local: Effect confined to the LAA

R Regional - Effect extends beyond the LAA but within the RAA

T Territorial: Effect extends beyond the RAA but within Nunavut

N National: Effect extends beyond Nunavut but within Canada

Duration:

ST Short term: Less than one year

MT Medium term: More than one year, but not beyond the end of Project decommissioning

LT Long term: Beyond the life of the Project

Frequency:

O Once: Effect occurs once

S Sporadically: Effect occurs occasionally but not consistently throughout the life of the Project

R Regularly: Effect occurs at regular intervals throughout the life of the Project

C Continuous: Effect occurs continuously throughout the Project

Reversibility:

R Reversible: Will likely recover to baseline conditions after or before the end of Project decommissioning

I Irreversible: Unlikely to recover to baseline conditions after the end of Project decommissioning

Environmental Context:

U Undisturbed: Area relatively or not adversely affected by human activity

D Developed: Area has been substantially previously disturbed by human development or human development is still present

N/A Not Applicable

Significance:

S Significant

N Not significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood of Significant Effects:

Based on professional judgment

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

2.1.3.2.3 Raptors

Table 2.1-16 Summary of Project Residual Environmental Effects for Change in Habitat Availability for Raptors

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Raptor Habitat — All-Season Road												
Construction	progressive reclamation; minimize Project footprint; dust suppression	N	L	L	MT	R	R	U	N	N/A	M	None required
Operation												
Change in Raptor Habitat —Winter Road												
Construction	progressive reclamation; minimize Project footprint; dust suppression; winter road; tailings management	N	L	L	MT	R	R	U	N	N/A	M	None required
Operation												

Table 2.1-16 Summary of Project Residual Environmental Effects for Change in Habitat Availability for Raptors

KEY ***Direction:*** P Positive N Negative ***Magnitude:*** N Negligible: No anticipated effect on wildlife species L Low: Observable effect on wildlife species but not likely to affect the species' sustainability in the LAA M Moderate: Observable effect on wildlife species but not likely to affect the species' sustainability in the RAA H High: Population-level detectable change to habitat availability, productivity and health of the Peregrine Falcon *tundrius* population ***Geographic Extent:*** S Site-specific L Local: Effect confined to the LAA R Regional - Effect extends beyond the LAA but within the RAA T Territorial: Effect extends beyond the RAA but within Nunavut N National: Effect extends beyond Nunavut but within Canada	***Duration:*** ST Short term: Less than one year MT Medium term: More than one year, but not beyond the end of Project decommissioning LT Long term: Beyond the life of the Project ***Frequency:*** O Once: Effect occurs once S Sporadically: Effect occurs occasionally but not consistently throughout the life of the Project R Regularly: Effect occurs at regular intervals throughout the life of the Project C Continuous: Effect occurs continuously throughout the Project ***Reversibility:*** R Reversible: Will likely recover to baseline conditions after or before the end of Project decommissioning I Irreversible: Unlikely to recover to baseline conditions after the end of Project decommissioning	***Environmental Context:*** U Undisturbed: Area relatively or not adversely affected by human activity D Developed: Area has been substantially previously disturbed by human development or human development is still present **N/A** Not Applicable ***Significance:*** S Significant N Not significant ***Prediction Confidence:*** Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence	***Likelihood of Significant Effects:*** Based on professional judgment L Low probability of occurrence M Medium probability of occurrence H High probability of occurrence ***Other Projects, Activities and Actions:*** Human disturbance associated with Meadowbank Mine, various exploration operations, and various regional communities

Table 2.1-17 Summary of Residual Environmental Effects for Change in Raptor Nest Productivity

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Peregrine Falcon Productivity — All-Season Road Option												
Construction	Blasting outside of breeding window.	N	M	L	MT	S	R	U	N	N/A	M	Individual nest site monitoring during construction. Annual productivity monitoring.
Operation	No disturbance at nest site policy. No overflights.	N	L	L	MT	C	R	U	N	N/A	H	Annual productivity monitoring
Change in Breeding Bird Habitat — All-Season Road Option												
Construction	progressive reclamation; Project footprint; dust suppression	N	L	L	MT	R	R	U	N	NA	M	None required
Operation												
Final Closure	None required	N	L	L	MT	R	R	U	N	NA	M	

Table 2.1-17 Summary of Residual Environmental Effects for Change in Raptor Nest Productivity

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Breeding Bird Habitat —Winter Road Option												
Construction Operation	progressive reclamation; Project footprint; dust suppression; winter road;	N	L	L	MT	R	R	U	N	NA	M	None required
Final Closure	None required	N	L	L	MT	R	R	U	N	NA	M	

Table 2.1-17 Summary of Residual Environmental Effects for Change in Raptor Nest Productivity

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				

KEY

Direction:

P Positive

N Negative

Magnitude:

N Negligible: No anticipated effect on wildlife species.

L Low: Detectable change to high quality habitat that does not cause a behavioural change in birds, or observable effect on wildlife species but not likely to affect the species' sustainability in the LAA.

M Moderate: Detectable change in the amount of high quality habitat that could result in a behavioural response of birds, or observable effect on wildlife species but not likely to affect the species' sustainability in the RAA.

H High: A detectable change in high quality habitat across the seasonal range that results in a behavioural change of a population of birds, or measurable effect on wildlife species that will likely affect the species' sustainability in the RAA.

Geographic Extent:

L Local: Effect confined to the LAA

R Regional - Effect extends beyond the LAA but within the RAA

T Territorial: Effect extends beyond the RAA but within Nunavut

N National: Effect extends beyond Nunavut but within Canada

Duration:

ST Short term: Less than one year

MT Medium term: More than one year, but not beyond the end of Project decommissioning

LT Long term: Beyond the life of the Project

Frequency:

O Once: Effect occurs once

S Sporadically: Effect occurs occasionally but not consistently throughout the life of the Project

R Regularly: Effect occurs at regular intervals throughout the life of the Project

C Continuous: Effect occurs continuously throughout the Project

Reversibility:

R Reversible: Will likely recover to baseline conditions after or before the end of Project decommissioning

I Irreversible: Unlikely to recover to baseline conditions after the end of Project decommissioning

Environmental Context:

U Undisturbed: Area relatively or not adversely affected by human activity

D Developed: Area has been substantially previously disturbed by human development or human development is still present

N/A Not Applicable

Significance:

S Significant

N Not significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood of Significant Effects:

Based on professional judgment

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Other Projects, Activities and Actions:

Human disturbance associated with Meadowbank Mine, various exploration operations, and various regional communities.

2.1.3.2.4 Migratory Birds

Table 2.1-18 Summary of Project Residual Environmental Effects for Change in Bird Habitat Availability

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Breeding Bird Habitat — All-Season Road Option												
Construction	progressive reclamation; Project footprint; dust suppression	N	L	L	MT	R	R	U	N	NA	M	None required
Operation												
Final Closure	None required	N	L	L	MT	R	R	U	N	NA	M	
Change in Breeding Bird Habitat —Winter Road Option												
Construction	progressive reclamation; Project footprint; dust suppression; winter road;	N	L	L	MT	R	R	U	N	NA	M	None required
Operation												
Final Closure	None required	N	L	L	MT	R	R	U	N	NA	M	

Table 2.1-18 Summary of Project Residual Environmental Effects for Change in Bird Habitat Availability

KEY

Direction:

P Positive

N Negative

Magnitude:

N Negligible: No anticipated effect on wildlife species.

L Low: Detectable change to high quality habitat that does not cause a behavioural change in birds, or observable effect on wildlife species but not likely to affect the species' sustainability in the LAA.

M Moderate: Detectable change in the amount of high quality habitat that could result in a behavioural response of birds, or observable effect on wildlife species but not likely to affect the species' sustainability in the RAA.

H High: A detectable change in high quality habitat across the seasonal range that results in a behavioural change of a population of birds, or measurable effect on wildlife species that will likely affect the species' sustainability in the RAA.

Geographic Extent:

L Local: Effect confined to the LAA

R Regional - Effect extends beyond the LAA but within the RAA

T Territorial: Effect extends beyond the RAA but within Nunavut

N National: Effect extends beyond Nunavut but within Canada

Duration:

ST Short term: Less than one year

MT Medium term: More than one year, but not beyond the end of Project decommissioning

LT Long term: Beyond the life of the Project

Frequency:

O Once: Effect occurs once

S Sporadically: Effect occurs occasionally but not consistently throughout the life of the Project

R Regularly: Effect occurs at regular intervals throughout the life of the Project

C Continuous: Effect occurs continuously throughout the Project

Reversibility:

R Reversible: Will likely recover to baseline conditions after or before the end of Project decommissioning

I Irreversible: Unlikely to recover to baseline conditions after the end of Project decommissioning

Environmental Context:

U Undisturbed: Area relatively or not adversely affected by human activity

D Developed: Area has been substantially previously disturbed by human development or human development is still present

N/A Not Applicable

Significance:

S Significant

N Not significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood of Significant Effects:

Based on professional judgment

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Other Projects, Activities and Actions:

Human disturbance associated with Meadowbank Mine, various exploration operations, and various regional communities.

2.1.3.2.5 Species at Risk

Table 2.1-19 Summary of Project Residual Environmental Effects for Short-eared Owl — Habitat Availability

Project Phase	Mitigation / Compensation Measures	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Short-eared owl Habitat Availability –Mine + All-Season Road												
Construction	Pre-clearing nest searches; no-disturbance buffers; reclamation	N	M	L	LT	S	I	U	N	N/A	M	No disturbance buffers around SAR breeding sites through to completion of breeding.
Operation		N	M	L	MT	R	R	U	N	N/A	M	
Final Closure		N	M	L	MT	O	I	U	N	N/A	M	
Change in Short-eared owl Habitat Availability – Mine + Winter Road Options												
Construction	Pre-clearing nest searches; no-disturbance buffers; reclamation	N	M	L	LT	S	I	U	N	N/A	M	No disturbance buffers around SAR breeding sites through to completion of breeding.
Operation		N	M	L	MT	R	R	U	N	N/A	M	
Final Closure		N	M	L	MT	O	I	U	N	N/A	M	

Table 2.1-19 Summary of Project Residual Environmental Effects for Short-eared Owl — Habitat Availability

KEY ***Direction:*** P Positive N Negative ***Magnitude:*** N Negligible: No anticipated effect on wildlife species. L Low: Observable effect on wildlife species but not likely to affect the species' sustainability in the LAA. M Moderate: Observable effect on wildlife species but not likely to affect the species' sustainability in the RAA. H High: Measurable effect on wildlife species that will likely affect the species' sustainability in the RAA. ***Geographic Extent:*** S Site-specific L Local: Effect confined to the LAA R Regional - Effect extends beyond the LAA but within the RAA T Territorial: Effect extends beyond the RAA but within Nunavut N National: Effect extends beyond Nunavut but within Canada	***Duration:*** ST Short term: Less than one year MT Medium term: More than one year, but not beyond the end of Project decommissioning LT Long term: Beyond the life of the Project ***Frequency:*** O Once: Effect occurs once S Sporadically: Effect occurs occasionally but not consistently throughout the life of the Project R Regularly: Effect occurs at regular intervals throughout the life of the Project C Continuous: Effect occurs continuously throughout the Project ***Reversibility:*** R Reversible: Will likely recover to baseline conditions after or before the end of Project decommissioning I Irreversible: Unlikely to recover to baseline conditions after the end of Project decommissioning	***Environmental Context:*** U Undisturbed: Area relatively or not adversely affected by human activity D Developed: Area has been substantially previously disturbed by human development or human development is still present **N/A** Not Applicable ***Significance:*** S Significant N Not significant ***Prediction Confidence:*** Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence	***Likelihood of Significant Effects:*** Based on professional judgment L Low probability of occurrence M Medium probability of occurrence H High probability of occurrence ***Other Projects, Activities and Actions:*** Human disturbance associated with Meadowbank Mine, various exploration operations, and various regional communities.

2.1.4 Marine

2.1.4.1 Marine Mammals

Table 2.1-20 Summary of Project Residual Environmental Effects: Marine Mammals

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Mortality: Project-related shipping has the potential to collide with marine mammals													
Construction:	See section 6.2.1.3 for a complete list	Y	A	L	R	ST	R	R	U	N	N/A	H	• MMOs on board vessels in the LAA • Record all incidents of vessel-mammal collisions
Operation:	See section 6.2.1.3 for a complete list	Y	A	L	R	ST	R	R	U				
Final Closure: Decommissioning and Abandonment	See section 6.2.1.3 for a complete list	Y	A	L	R	ST	R	R	U				
Residual environmental effects for all phases		Y	A	L	R	ST	R	R	U				
Change in Behaviour: Project-related underwater noise due to shipping has the potential to change behaviour of marine mammals													
Construction	See section 6.2.2.4 for a complete list	Y	A	M	R	ST	S	R	U	N	N/A	M	• MMOs on board vessels in the LAA • Follow up monitoring
Operation:	See section 6.2.2.4 for a complete list	Y	A	M	R	ST	S	R	U				

Table 2.1-20 Summary of Project Residual Environmental Effects: Marine Mammals

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Final Closure: Decommissioning	See section 6.2.2.4 for a complete list	Y	A	M	R	ST	S	R	U				program in the RAA
Residual environmental effects for all phases		Y	A	M	R	ST	S	R	U				

Table 2.1-20 Summary of Project Residual Environmental Effects: Marine Mammals

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				

KEY

Direction:

P Positive

A Adverse

Magnitude:

Use quantitative measure; or

L Low: effect is within the range of natural variance or less than reference criteria

M Moderate: effect is at or slightly above the range of natural variation or reference criteria

H High: effect exceeds upper limit of natural variation or reference criteria

Geographic Extent:

Use quantitative measure; or

S Site-specific: effect is limited to the Project footprint

L Local: effect is limited to the Local Assessment Area (LAA)

R Regional: effect is limited to the Regional Assessment Area (RAA)

Duration:

Use quantitative measure; or

ST Short term: Hours to days

MT Medium term: Months

LT Long term: Years

P Permanent: permanent

Frequency:

Use quantitative measure; or

O Occurs once.

S Occurs sporadically at irregular intervals.

R Occurs on a regular basis and at regular intervals.

C Continuous.

Reversibility:

R Reversible

I Irreversible

Environmental Context:

U Undisturbed: Area relatively or not adversely affected by human activity

D Developed: Area has been substantially previously disturbed by human development or human development is still present

N/A Not Applicable

Significance:

S Significant

N Not Significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood:

Of a significant effect occurring

N/A not applicable

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Cumulative Effects

Y Potential for effect to interact with other past, present or foreseeable projects or activities in RSA

N Effect will not or is not likely to interact with other past, present or foreseeable projects or activities in RSA

2.1.4.1 Marine Fish

Table 2.1-21 Summary of Project Residual Environmental Effects: Marine Fish

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Change in Behaviour: Project-related underwater noise due to shipping has the potential to change the behaviour of marine fish													
Construction:	See section 6.2.2.4 for a complete list	Y	A	L	S	ST	R	R	U	N	N/A	H	None
Operation:	See section 6.2.2.4 for a complete list	Y	A	L	S	ST	R	R	U				
Final Closure: Decommissioning	See section 6.2.2.4 for a complete list	Y	A	L	S	ST	R	R	U				
Residual environmental effects for all phases		Y	A	L	S	ST	R	R	U				

Table 2.1-21 Summary of Project Residual Environmental Effects: Marine Fish

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				

KEY

Direction:

P Positive

A Adverse

Magnitude:

Use quantitative measure; or

L Low: effect is within the range of natural variance or less than reference criteria

M Moderate: effect is at or slightly above the range of natural variation or reference criteria

H High: effect exceeds upper limit of natural variation or reference criteria

Geographic Extent:

Use quantitative measure; or

S Site-specific: effect is limited to the Project footprint

L Local: effect is limited to the Local Assessment Area (LAA)

R Regional: effect is limited to the Regional Assessment Area (RAA)

Duration:

Use quantitative measure; or

ST Short term: Hours to days

MT Medium term: Months

LT Long term: Years

P Permanent: permanent

Frequency:

Use quantitative measure; or

O Occurs once.

S Occurs sporadically at irregular intervals.

R Occurs on a regular basis and at regular intervals.

C Continuous.

Reversibility:

R Reversible

I Irreversible

Environmental Context:

U Undisturbed: Area relatively or not adversely affected by human activity

D Developed: Area has been substantially previously disturbed by human development or human development is still present

N/A Not Applicable

Significance:

S Significant

N Not Significant

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation

L Low level of confidence

M Moderate level of confidence

H High level of confidence

Likelihood:

Of a significant effect occurring

N/A Not applicable

L Low probability of occurrence

M Medium probability of occurrence

H High probability of occurrence

Cumulative Effects

Y Potential for effect to interact with other past, present or foreseeable projects or activities in RSA

N Effect will not or is not likely to interact with other past, present or foreseeable projects or activities in RSA

2.1.5 Human Health

Table 2.1-22 Summary of Project Residual Environmental Effects: Human Health (Members of the Public)

Project Phase	Mitigation/ Compensation Measures	Residual Environmental Effect (Y/N)	Direction	Residual Environmental Effects Characteristics						Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Exposure of Members of the Public to CAC: Levels of Criteria Air Contaminants may affect individuals that are residing at the Kiggavik camp													
Construction		N								N	L	M	Implement ambient air monitoring program as required
Operation	General mitigation (see atmospheric environment)	Y	N	M	S	MT	S	R	N/A				
Final Closure		N											
Post Closure		N											

Table 2.1-22 Summary of Project Residual Environmental Effects: Human Health (Members of the Public)

KEY **Direction:** P Positive N Negative **Magnitude:** N Negligible: The predicted exposures are at or below the selected threshold. L Low: The predicted exposures are within a factor of 2 of the selected threshold. M Moderate: The predicted exposures are within a factor of 5 of the selected threshold H High: The predicted exposures are greater than a factor of 5 of the selected threshold **Geographic Extent:** S Site-specific: Within Project Boundaries L Local: Within 10km from the site R Regional: Baker Lake	**Duration:** Use quantitative measure; or ST Short term: Less than one year MT Medium term: More than one year, but not beyond the end of project decommissioning LT Long term: Beyond the life of the project P Permanent **Frequency:** Use quantitative measure; or O Occurs once. S Occurs sporadically at irregular intervals. R Occurs on a regular basis and at regular intervals. C Continuous. **Reversibility:** R Reversible I Irreversible	**Environmental Context:** U Undisturbed: Area relatively or not adversely affected by human activity D Developed: Area has been substantially previously disturbed by human development or human development is still present N/A Not Applicable **Significance:** S Significant N Not Significant **Prediction Confidence:** Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence	**Likelihood:** Based on professional judgment L Low probability of occurrence M Medium probability of occurrence H High probability of occurrence **Cumulative Effects** Y Potential for effect to interact with other past, present or foreseeable projects or activities in RSA N Effect will not or is not likely to interact with other past, present or foreseeable projects or activities in RSA

2.1.6 Socio-Economic

2.1.6.1 Traditional Culture

Table 2.1-23 Summary Impact Matrix, Cumulative Effects on Traditional Culture

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Cumulative Project Effects, Traditional Culture													
Resource abundance	Harvesting, food security, values and knowledge	Negative	No	Yes	More negative, where a large number of projects starts to affect resource abundance	Mitigation for biological cumulative effects	Land use planning, mitigation for biological cumulative effects	Negative (more negative)	Not determined	Commun-ities	Long	Not determined	High

Table 2.1-23 Summary Impact Matrix, Cumulative Effects on Traditional Culture

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Access to caribou in western Kivalliq	Harvesting, food security, values and knowledge	Negative	Yes	Yes	More negative, where increased access starts to affect caribou abundance								
Increased access to harvested resources in western Kivalliq	Harvesting, food security, values and knowledge	Positive	Yes	Yes	No	n/a							
Facilitation of harvesting	Harvesting, food security, values and knowledge	Positive	Yes	Yes	No	n/a							

Table 2.1-23 Summary Impact Matrix, Cumulative Effects on Traditional Culture

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Demotivation for traditional harvesting and thus food security	Harvesting, food security, values and knowledge	Negative	Yes	Yes	More negative, where there is movement away from traditional culture as a result of increased exposure to English language large mining project environments	Workforce management measures to accommodate traditional culture, support for community wellbeing initiatives	Programs in support of traditional culture	Negative (more negative)	Not determined	Commun-ities	Long	Not determined	High
Reduction in shared harvest availability for the more vulnerable	Food security, values and knowledge	Negative	Yes	Yes									
Reduced use of Inuktitut	Language	Negative	Yes	Yes									
Loss of Inuktitut	Language	Negative	No	Yes									

Table 2.1-23 Summary Impact Matrix, Cumulative Effects on Traditional Culture

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Reduced traditional values and knowledge	Harvesting, food security, values and knowledge, language	Negative	Yes	Yes									
Loss of traditional values and knowledge	Harvesting, food security, values and knowledge, language	Negative	No	Yes									
Preservation and access to sites of cultural heritage	Values and knowledge, cultural heritage sites	Positive	Yes	No	No	n/a							

2.1.6.2 Individual, Family and Community Wellbeing

Table 2.1-24 Summary Impact Matrix, Cumulative Effects on Individual, Family and Community Wellbeing

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Cumulative Project Effects, Individual, Family and Community Wellbeing													
Overall health status	Health	Positive	Yes	Yes	No	n/a							
Infectious and chronic disease rates	Health	Positive	Yes	Yes	No	n/a							
Substance abuse and gambling)	Health, family function	Negative	No	Yes	No	n/a							
Diet	Health	Positive/ negative	No	Yes	No	n/a							
Inappropriate sexual behaviours	Health, family function	Negative	No	Yes	No	n/a							
Increases in STI rates	Health	Negative	Yes	Yes	No	n/a							

Table 2.1-24 Summary Impact Matrix, Cumulative Effects on Individual, Family and Community Wellbeing

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Overall better functioning families in response to economic security and personal self esteem	Family function	Positive	Yes	Yes	No	n/a							
Poor management of incomes and stressors, leading to domestic violence, divorce, children at risk, suicide etc.	Health, family function	Negative	No	Yes	No	n/a							
Increased household economic security with savings	Savings, family function	Positive	Yes	Yes	No	n/a							
Increased rates of crime and nuisance public behaviours	Public security, public health and safety	Negative	Yes	Yes	No	n/a							

Table 2.1-24 Summary Impact Matrix, Cumulative Effects on Individual, Family and Community Wellbeing

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Increased incidence of crime and nuisance public behaviours and consequent lower sense of wellbeing	Public security, public health and safety	Negative	Yes	Yes	No	n/a							
Worker and public health and safety related to mining	Public health and safety	Positve	Yes	Yes	No	n/a							
Public health and safety related to traffic	Public health and safety	Negative	No	Yes	No	n/a							
Safety on the land	Public health and safety	Positive	Yes	Yes	No	n/a							
Perceptions of harm	Public health and safety	Negative	Yes	Yes	No	n/a							
Social cohesion	Social cohesion and participation	Positive/ negative	Yes	Yes	No	n/a							

Table 2.1-24 Summary Impact Matrix, Cumulative Effects on Individual, Family and Community Wellbeing

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Participation	Social cohesion and participation	Positve	Yes	Yes	No	n/a							
Social conflict	Social cohesion and participation	Positive/ negative	Yes	Yes	No	n/a							

2.1.6.3 Public Infrastructure and Services

Table 2.1-25 Summary Impact Matrix, Cumulative Effects on Public Infrastructure and Services

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Cumulative Project Effects, Public Infrastructure and Services													
Increase in demand for health services	Social infrastructure and services	Positive	Yes	Yes	No	n/a							
Increase in demand for counseling services	Social infrastructure and services	Positive	No	Yes	No	n/a							
Decrease in demand for social assistance	Social infrastructure and services	Positive	Yes	Yes	No	n/a							
Increase in demand for policing	Policing	Positive	Yes	Yes	No	n/a							

Table 2.1-25 Summary Impact Matrix, Cumulative Effects on Public Infrastructure and Services

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Increase in demand for private housing	Housing	Positive	Yes	Yes	More positive, where the availability of many jobs with multiple mining projects gives people more confidence in security of employment	None	Project sequencing	Positive (more positive)	Not determined	Commun-ities	Long	Not determined	High
Increase in demand for social housing	Housing	Positive	Yes	Yes	No	n/a							
Increased costs for governments	Social infrastructure and services, policing, housing, other infrastructure and services	Negative	No	Yes	No	n/a							

Table 2.1-25 Summary Impact Matrix, Cumulative Effects on Public Infrastructure and Services

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Effects on increased demand for services on the more vulnerable		Negative	Yes	Yes	No	n/a							

2.1.6.4 Non-traditional Land Use and Land Use Planning

Table 2.1-26 Summary Impact Matrix, Cumulative Effects on Non-Traditional Land Use and Land Use Planning

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Cumulative Project Effects, Land Use and Planning													
Increase in uranium mining as a land use	Mining, tourism, commercial harvesting	Positive	Yes	Yes	No	n/a							
Disincentive to tourism as a result of expanded uranium mining	Tourism	Negative	Not determined	Yes	More negative	Mitigation for biological cumulative effects	Land use planning	Not determined	Not determined	Communities	Long	Not determined	High
Development of tourism as a result of shared use of infrastructure	Tourism	Positive	No	Yes	No	n/a							

Table 2.1-26 Summary Impact Matrix, Cumulative Effects on Non-Traditional Land Use and Land Use Planning

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Effects on land use in Baker Lake	Land use in Baker Lake	Positive	Yes	Yes	No	n/a							
Effects on shipping into Baker Lake	Landuse in Baker Lake	Negative	No	Yes	No	n/a							

2.1.6.1 Economy of Nunavut

Table 2.1-27 Summary Impact Matrix, Cumulative Effects on the Economy of Nunavut

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Cumulative Project Effects, Economy of Nunavut													
Contribution to GDP	Economic effects, fiscal effects	Positive	Yes	Yes	Less positive, where there is constrained ability in labour force to take advantage of employment opportunities	As for AREVA's mitigation and enhancement for the local study area	As for government mitigation and enhancement for the local study area	Negative (less positive)	Not determined	Nunavut	Long	Not determined	High
Contribution to employment and labour income	Economic effects, fiscal effects	Positive	Yes	Yes									
Contribution to revenues of GN and NTI	Fiscal effects	Positive	Yes	Yes									

Table 2.1-27 Summary Impact Matrix, Cumulative Effects on the Economy of Nunavut

Effect	Related VSEC	Potential for Project Effects		Potential for Significant Cumulative Effects		Mitigation/ Enhancement		Criteria for More than Additive Cumulative Effects					
		Direction	Significance	Additive	More, or Less, than Additive	AREVA	Governments	Direction	Magnitude	Geographic Extent	Duration	Likelihood	Significance Prediction Confidence
Reversal of economic effects in Nunavut	Economic effects, fiscal effects	Negative	Yes	Yes	Less negative, where there is increased availability of alternative employment			Positive (less negative)					
Economic effects in the rest of Canada	Economic effects, fiscal effects	Positive	Yes	Yes	No	n/a							

Table 2.1-28 Summary Impact Matrix

Valued Socio-Economic Component	Mitigation/ Enhancement Measures	Residual Effect	Direction	Residual Environmental Effects Characteristics					Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility				
Effects on Community Economies												
Employment	Preferential hiring and contracting, education and training, work force management	Yes	Positive	High	Communities	Long	Continuous	In part	Yes	Very likely	High	Operations, collaborative monitoring
Education and training		Yes	Positive	High								
Contracting		Yes	Positive	High								
Economic growth and diversification		Yes	Positive	Medium								
Incomes		Yes	Positive	High								
Population change		Yes	Positive	Medium								
Effects on Traditional Culture												
Harvesting	Work force management measures	Yes	Positive/ negative	Medium	Communities	Long	Continuous	No	Yes	Very likely	Medium	Collaborative monitoring
Food security		Yes	Positive/ negative	Medium								
Language		Yes	Negative	Medium								

Table 2.1-28 Summary Impact Matrix

Valued Socio-Economic Component	Mitigation/ Enhancement Measures	Residual Effect	Direction	Residual Environmental Effects Characteristics					Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility				
Values and knowledge		Yes	Negative	Medium								
Cultural heritage sites		No	n/a									
Effects on Individual, Family and Community Wellbeing												
Health	Work force management measures, contributions to communities	Yes	Positive	Medium	Communities	Long	Continuous	No	No	Likely	Medium	Collaborative monitoring
Family function		Yes	Positive	Medium								
Savings		Yes	Positive	Medium								
Public security		Yes	Negative	Medium								
Public health and safety		No	n/a									
Social cohesion and participation		Yes	Positive/ negative	Medium	Communities	Long	Continuous	No	Yes	Likely	Medium	

Table 2.1-28 Summary Impact Matrix

Valued Socio-Economic Component	Mitigation/ Enhancement Measures	Residual Effect	Direction	Residual Environmental Effects Characteristics					Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility				
Effects on Public Infrastructure and Services												
Social infrastructure and services	None practical	Yes	Positive	Medium	Communities	Long	Continuous	No	Yes	Likely	Medium	Collaborative monitoring
Policing		Yes	Positive	Medium								
Housing		Yes	Positive	Medium								
Other infrastructure and services		Yes	Positive	Medium								
Institutional capacity and governance		Yes	Positive	Medium								
Effects on Non-Traditional Land Use and Land Use Planning												
Mining	None required	Yes	Positive	Medium	Nunavut and Kivalliq	Long	Continuous	No	Yes	Likely	Medium	None
Commercial harvesting		No	n/a									
Tourism		Yes	Negative	Low	Nunavut and Kivalliq	Long	Continuous	No	Yes	Likely	Medium	
Land Use in Baker Lake		No	n/a									Collaborative monitoring

Table 2.1-28 Summary Impact Matrix

Valued Socio-Economic Component	Mitigation/ Enhancement Measures	Residual Effect	Direction	Residual Environmental Effects Characteristics					Significance	Likelihood	Prediction Confidence	Recommended Follow-up and Monitoring
				Magnitude	Geographic Extent	Duration	Frequency	Reversibility				
Effects on the Economy of Nunavut												
Economic effects	None required	Yes	Positive	High	Nunavut	Long	Continuous	In part	Yes	Very likely	High	None
Fiscal effects		Yes	Positive	High								

2.2 Assessment of Cumulative Environmental Effects

2.2.1 Screening for Potential Cumulative Effects

Cumulative environmental effects are only assessed if the following criteria are met for the residual Project effect under consideration:

- The Project will result in a measurable, demonstrable or reasonably-expected residual environmental effect on a component of the biophysical or socio-economic environment,
- The Project-specific residual environmental effect on the component will likely act in a cumulative fashion with the environmental effects of other past or future projects or activities that are likely to occur (i.e., Is there overlap of environmental effects?), and
- There is a reasonable expectation that the Project's contribution to cumulative environmental effects will be substantive, measurable or discernible such as that it will affect the viability or sustainability of the resource.

If, based on these criteria, there is potential for cumulative environmental effects, the effect is assessed further to determine if it is likely to shift the component to an unacceptable state. Where there is no potential for the environmental effect of the Project to spatially or temporally overlap with similar effects of other project and activities, justification for not carrying these environmental effects forward to the assessment of cumulative environmental effects is provided.

2.2.2 Significance of Residual Cumulative Environmental Effects

The significance of cumulative environmental effects is determined using standards or thresholds that are specific to the VC, KI and/or measurable parameters used to assess the Project environmental effect. Determinations of significance are made for:

- the significance of the total residual cumulative environmental effect; and
- the significance of the contribution of the Project to the total residual cumulative environmental effect.

The determination of residual cumulative environmental effects includes a discussion of the confidence of the prediction based on scientific certainty relative to:

- quantifying or estimating the environmental effect (i.e., quality and/or quantity of data, understanding of the effects mechanisms), and
- the effectiveness of the proposed mitigation measures.

As for residual Project environmental effects, prediction confidence for the cumulative environmental effect and the success of mitigation measures is ranked as low, moderate or high.

2.2.3 Air Quality

Table 2.2-1 Summary of Residual Cumulative Environmental Effects on Air Quality

Cumulative Environmental Effect	Case	Other Projects, Activities and Actions	Mitigation and Compensation Measures	Description of Residual Effects				Significance
				Magnitude	Geographic Extent	Frequency	Reversibility	
Change in Air Quality – Preferred Option								
Ambient 1-hour NO_2 Concentration	Cumulative Effect with Project (Project Case)	Meadowbank	General and activity-specific measures – Tier 2, Volume 4, part 1, Section 6.2.2.2	H	F*	I	R	NS
Ambient 24-hour NO_2 Concentration	Cumulative Effect with Project (Project Case)	Meadowbank	General and activity-specific measures – Tier 2, Volume 4, part 1, Section 6.2.2.2	M	F*	I	R	NS

KEY

Magnitude:
- L Low: The predicted COPC concentrations are less than 25% greater than the Indicator Threshold criterion.
- M Moderate: The predicted COPC concentrations are less than 100% greater than the Indicator Threshold.
- H High: The predicted COPC concentrations are more than 100% greater than the Indicator Threshold.

Geographic Extent:
- F Footprint: Effect confined to the project footprint
- F* Footprint: Effect confined to 2km from the project footprint
- L Local: Effect confined to the LAA
- R Regional: Effect extends beyond the LAA but within the RAA

Duration:
- ST Short term: Less than one year (growing season)
- MT Medium term: More than one year, but not beyond the end of project decommissioning
- LT Long term: Beyond the life of the project
- P Permanent

Frequency:
- I Infrequent: occurs less than 1% of the time (no more than 4 days per year or 88 hours per year)
- S Sporadic: Occurs less than 3.5% of the time (no more than 12 days per year or 305 hours per year)
- R Regular: Occurs less than 15% of the time (no more than 55 days per year or 1300 hours per year)
- C Continuous: the effect occurs more than 15% of the time.

Reversibility:
- R Reversible
- I Irreversible

Significance:
- S Significant
- N Not Significant

Likelihood:

Based on professional judgment
- L Low probability of occurrence
- M Medium probability of occurrence
- H High probability of occurrence

Prediction Confidence:

Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation
- L Low level of confidence
- M Moderate level of confidence
- H High level of confidence

N/A Not Applicable

2.2.4 Terrestrial

Table 2.2-2 Summary of Residual Cumulative Environmental Effects on Caribou and Muskox

Cumulative Environmental Effect	Case	Other Projects, Activities and Actions	Mitigation and Compensation Measures	Residual Cumulative Environmental Effects Characteristics							Significance	Prediction Confidence	Likelihood	Proposed Follow-up and Monitoring Programs
				Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Changes in Mortality Risk	Cumulative Effect with Project (Future Case)	Meadowbank Mine access road, harvesting activities across ranges		N	N	N	MT	R	R	D	N	M	N/A	Agency responsibility
	Project Contribution to Cumulative Effect	Unintended harvester access		N	N	N	MT	R	R	U	N	M	N/A	Private road, road closure, access management
Changes in Habitat Availability	Cumulative Effect with Project (Future Case)	Meadowbank Mine, various exploration operations, and various regional communities	Dust management; Minimize Project footprint; Progressive reclamation	N	L	N	LT	C	R	D	N	M	N/A	Contribution to collaring program
	Project Contribution to Cumulative Effect	NA	NA	N	L	N	LT	C	R	U	N	M	N/A	Quantify Project footprint on an annual basis

Table 2.2-2 Summary of Residual Cumulative Environmental Effects on Caribou and Muskox

KEY ***Direction:*** P Positive N Negative ***Magnitude:*** N Negligible: No anticipated effect on wildlife species. L Low: Observable effect on wildlife species but not likely to affect the species' sustainability in the LAA. M Moderate: Observable effect on wildlife species but not likely to affect the species' sustainability in the RAA. H High: Measurable effect on wildlife species that will likely affect the species' sustainability in the RAA. ***Geographic Extent:*** S Site specific L Local: Effect confined to the LAA R Regional - Effect extends beyond the LAA but within the RAA T Territorial: Effect extends beyond the RAA but within Nunavut N National: Effect extends beyond Nunavut but within Canada	***Duration:*** ST Short term: Less than one year MT Medium term: More than one year, but not beyond the end of Project decommissioning LT Long term: Beyond the life of the Project ***Frequency:*** O Once: Effect occurs once S Sporadically: Effect occurs occasionally but not consistently throughout the life of the Project R Regularly: Effect occurs at regular intervals throughout the life of the Project C Continuous: Effect occurs continuously throughout the Project ***Reversibility:*** R Reversible: Will likely recover to baseline conditions after or before the end of Project decommissioning I Irreversible: Unlikely to recover to baseline conditions after the end of Project decommissioning	***Environmental Context:*** U Undisturbed: Area relatively or not adversely affected by human activity D Developed: Area has been substantially previously disturbed by human development or human development is still present **N/A** Not Applicable ***Significance:*** S Significant N Not significant ***Prediction Confidence:*** Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence	***Likelihood of Significant Effects:*** Based on professional judgment L Low probability of occurrence M Medium probability of occurrence H High probability of occurrence ***Other Projects, Activities and Actions:*** Human disturbance associated with Meadowbank Mine, various exploration operations, and various regional communities.

Table 2.2-2 Summary of Residual Cumulative Environmental Effects on Migratory Birds

Cumulative Environmental Effect	Case	Other Projects, Activities and Actions	Mitigation and Compensation Measures	Residual Cumulative Environmental Effects Characteristics							Significance	Prediction Confidence	Likelihood	Proposed Follow-up and Monitoring Programs
				Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Changes in Habitat Availability	Cumulative Effect with Project (Future Case)	Meadowbank Mine, various exploration operations, and various regional communities	Dust management; Minimize Project footprint; Progressive reclamation	N	N	L	LT	C	R	D	N	H	N/A	None
	Project Contribution to Cumulative Effect	NA	NA	N	N	L	LT	C	R	D	N	H	N/A	NA

Table 2.2-2 Summary of Residual Cumulative Environmental Effects on Migratory Birds

KEY ***Direction:*** P Positive N Negative ***Magnitude:*** N Negligible: No anticipated effect on wildlife species. L Low: Observable effect on wildlife species but not likely to affect the species' sustainability in the LAA. M Moderate: Observable effect on wildlife species but not likely to affect the species' sustainability in the RAA. H High: Measurable effect on wildlife species that will likely affect the species' sustainability in the RAA. ***Geographic Extent:*** S Site specific L Local: Effect confined to the LAA R Regional - Effect extends beyond the LAA but within the RAA T Territorial: Effect extends beyond the RAA but within Nunavut N National: Effect extends beyond Nunavut but within Canada	***Duration:*** ST Short term: Less than one year MT Medium term: More than one year, but not beyond the end of Project decommissioning LT Long term: Beyond the life of the Project ***Frequency:*** O Once: Effect occurs once S Sporadically: Effect occurs occasionally but not consistently throughout the life of the Project R Regularly: Effect occurs at regular intervals throughout the life of the Project C Continuous: Effect occurs continuously throughout the Project ***Reversibility:*** R Reversible: Will likely recover to baseline conditions after or before the end of Project decommissioning I Irreversible: Unlikely to recover to baseline conditions after the end of Project decommissioning	***Environmental Context:*** U Undisturbed: Area relatively or not adversely affected by human activity D Developed: Area has been substantially previously disturbed by human development or human development is still present **N/A** Not Applicable ***Significance:*** S Significant N Not significant ***Prediction Confidence:*** Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence	***Likelihood of Significant Effects:*** Based on professional judgment L Low probability of occurrence M Medium probability of occurrence H High probability of occurrence ***Other Projects, Activities and Actions:*** Human disturbance associated with Meadowbank Mine, various exploration operations, and various regional communities.

Table 2.2-3 Summary of Residual Cumulative Environmental Effects on Species at Risk — Short-eared Owl Habitat Availability

Cumulative Environmental Effect	Case	Other Projects, Activities and Actions	Mitigation and Compensation Measures	Residual Cumulative Environmental Effects Characteristics							Significance	Prediction Confidence	Likelihood	Proposed Follow-up and Monitoring Programs
				Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental Context				
Changes in Habitat Availability	Cumulative Effect with Project (Future Case)	Meadowbank Mine, various exploration operations, and various regional communities	Dust management; Minimize Project footprint; Progressive reclamation	N	N	L	LT	C	R	D	N	H	N/A	None
	Project Contribution to Cumulative Effect	NA	NA	N	N	L	LT	C	R	D	N	H	N/A	NA

Table 2.2-3 Summary of Residual Cumulative Environmental Effects on Species at Risk — Short-eared Owl Habitat Availability

KEY ***Direction:*** P Positive N Negative ***Magnitude:*** N Negligible: No anticipated effect on wildlife species. L Low: Observable effect on wildlife species but not likely to affect the species' sustainability in the LAA. M Moderate: Observable effect on wildlife species but not likely to affect the species' sustainability in the RAA. H High: Measurable effect on wildlife species that will likely affect the species' sustainability in the RAA. ***Geographic Extent:*** S Site-specific L Local: Effect confined to the LAA R Regional - Effect extends beyond the LAA but within the RAA T Territorial: Effect extends beyond the RAA but within Nunavut N National: Effect extends beyond Nunavut but within Canada	***Duration:*** ST Short term: Less than one year MT Medium term: More than one year, but not beyond the end of Project decommissioning LT Long term: Beyond the life of the Project ***Frequency:*** O Once: Effect occurs once S Sporadically: Effect occurs occasionally but not consistently throughout the life of the Project R Regularly: Effect occurs at regular intervals throughout the life of the Project C Continuous: Effect occurs continuously throughout the Project ***Reversibility:*** R Reversible: Will likely recover to baseline conditions after or before the end of Project decommissioning I Irreversible: Unlikely to recover to baseline conditions after the end of Project decommissioning	***Environmental Context:*** U Undisturbed: Area relatively or not adversely affected by human activity D Developed: Area has been substantially previously disturbed by human development or human development is still present **N/A** Not Applicable ***Significance:*** S Significant N Not significant ***Prediction Confidence:*** Based on scientific information and statistical analysis, professional judgment and effectiveness of mitigation L Low level of confidence M Moderate level of confidence H High level of confidence	***Likelihood of Significant Effects:*** Based on professional judgment L Low probability of occurrence M Medium probability of occurrence H High probability of occurrence ***Other Projects, Activities and Actions:*** Human disturbance associated with Meadowbank Mine, various exploration operations, and various regional communities.